

**WORK-RELATED UPPER LIMB DISORDERS IN SLOVAKIA:
A THIRTY-YEAR RETROSPECTIVE STUDY
OCHORENIA HORNÝCH KONČATÍN SÚVISIACE S PRÁCOU NA SLOVENSKU:
TRIDSAŤROČNÁ RETROSPEKTÍVNA ŠTÚDIA**

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ABSTRACT

Introduction: Physical dynamic overload is over time being replaced by static overload with an emphasis on small muscle groups of hands and forearms. This phenomenon is caused by change in the character of work as a result of constant automatization, modernization, and robotization.

Methods: The research for our study was conducted between 1988 and 2018 in the Slovak Republic. This retrospective study was based on the data from the National Health Information Centre, focusing on total occupational diseases, and upper limb disorders by gender.

Results: Diseases due to the long-term excessive unilateral load of upper extremities have been at the first place of all admitted occupational diseases in the Slovak Republic since 1998. The total number of notified occupational diseases in respective years shows a declining trend. Between 1988 and 2018 a total of 19,231 new cases were recorded, of which 4,828 (25.1 %) were the diseases due to the long-term excessive unilateral load of upper extremities. Since 2008, females have been affected by the diseases due to the long-term excessive unilateral load of upper extremities more often than males.

Conclusions: Quantity of occupational diseases is associated with the quality of healthcare, working environment, and also with the change in the character of work and the supply of labor in the market.

Key words: Upper limb disorder. Gender. Occupational diseases. Carpal tunnel syndrome.

ABSTRAKT

Úvod: Fyzické dynamické preťaženie je v priebehu času nahrádzané statickým preťažením so zvýšenými nárokmi na malé svalové skupiny rúk a predlaktia. Tento fenomén je spôsobený zmenou charakteru práce v dôsledku neustálej automatizácie, modernizácie a robotizácie.

Metódy: Výskum našej štúdie sa uskutočnil v Slovenskej republike v rokoch 1988 až 2018. Retrospektívna štúdia bola založená na údajoch z Národného centra zdravotníckych informácií. Zamerali sme na porovnanie celkového počtu chorôb z povolania a ochorenia horných končatín podľa pohlavia.

Výsledky: Ochorenia z dlhodobého, nadmerného a jednostranného zaťaženia horných končatín sú od roku 1998 na prvom mieste všetkých chorôb z povolania v Slovenskej republike. Celkový počet hlásených chorôb z povolania v jednotlivých rokoch vykazuje klesajúci trend. V rokoch 1988 až 2018 bolo zaznamenaných celkom 19 231 nových prípadov, z toho 4 828 (25,1 %) boli ochorenia z dlhodobého, nadmerného a jednostranného zaťaženia horných končatín. Od roku 2008 sú ženy častejšie postihnuté ochorením z dlhodobého, nadmerného a jednostranného zaťaženia horných končatín ako muži.

Záver: Množstvo chorôb z povolania súvisí s kvalitou zdravotnej starostlivosti, pracovným prostredím, a tiež so zmenou charakteru práce a ponukou práce na trhu.

Kľúčové slová: Ochorenie horných končatín. Pohlavie. Choroby z povolania. Syndróm karpálneho tunela.

INTRODUCTION

Automatization, modernization, and robotization has caused a decline in physically demanding work. While the number of works in which small muscle groups of hands and forearms are loaded is increasing. In 2018, the number of average annual hours actually worked per worker in the Slovak Republic was 1,698 [1]. The retirement age is prolonged every year. Therefore, the person spends a lot more time in the working environment, being exposed to risk factors [2]. Health condition of the workers is the result of independent influence of the working, non-occupational, and personal predispositions. This requires a multidisciplinary approach and a comprehensive assessment of the factors of work and the working environment [3, 4].

In 1975, the disease due to the long-term excessive unilateral load of upper extremities was included in the list of occupational diseases (OD) as item no. 29 (disorders of bones, joints, tendons and nerves due to the long-term excessive unilateral load of upper extremities). The list of OD contains of 47 items [5].

Apart from the Slovak Republic and the Czech Republic, we will not encounter the definition “diseases due to the long-term excessive unilateral load of upper extremities“. In the literature is this term being used and known as: work-related upper limb disorders, repetitive strain injury, overuse syndrome, cumulative trauma disorder, and others. Work-related upper limb disorder is a general and non-specific term referring to a range of musculoskeletal conditions affecting the upper limb, caused or made worse by work. The most common

upper limb disorders are carpal tunnel syndrome (CTS), shoulder tendinitis, lateral epicondylitis and wrist tendinitis. The work-related upper limb disorder is a frequent cause of prolonged sick leave, disability and related financial costs. For example, in the United States the costs associated with limb diseases are estimated at 0.5–2 % of the gross domestic product (GDP) [6]. According to German authors the most frequent occurrence of professional CTS is among workers such as the following professions: gardeners, assembly workers, upholsterers [7]. Buchanová et al. mention the most frequent occurrence of the long-term excessive unilateral load of upper extremities mainly in the sawmill related professions, assembly workers, in the work related to cutting, sewing, and in a variety of other stereotypically performed manual activities [3]. Physical dynamic overload is over time being replaced by static overload. This phenomenon is caused by changes in the character of work and the supply of labor in the market.

The aim of our study was to compare trends of total cases of OD and upper limb disorders by gender during the period 1988–2018 in the Slovak Republic.

METHODS

In this retrospective study the development of specific OD in the Slovak Republic was analyzed from 1988 to 2018. We focused on total cases of OD (47 items), and upper limb disorders, especially diseases due to the long-term excessive unilateral load of upper extremities (item no. 29) according to gender. We compared them with the noise-related diseases (item no. 38). Data for the thirty-year observation period were processed in the Microsoft Office Excel 2016 and were evaluated graphically. Analyzed results are displayed in graphs in percentages together with appropriate 95 % confidence intervals. We considered statistically significant differences in which the respective confidence intervals did not overlap. Data were retrieved from the National Health Information Centre of the Slovak Republic.

RESULTS

In 1988, there were 1,129 (698 males, 431 females) OD reported. The noise-related diseases were reported in 175 cases. On the other hand, only 43 diseases due to the long-term excessive unilateral load of upper extremities were reported. Until 1991,

noise-related diseases were more reported than the diseases due to the long-term excessive unilateral load of upper extremities. However, the incidence of OD changed in 1992. There were 1,056 OD reported (634 males, 422 females). The highest amount of all admitted OD were diseases due to the long-term excessive unilateral load of upper extremities (80 males, 57 females). 5,423 OD were reported in the period from 1992 to 1998. More than half (60.5 %) of all these cases were males.

During the years 1994–1998, most OD were reported in 1998 (740 cases of which 459 were males, 281 females). The most frequent OD were diseases due to the long-term excessive unilateral load of upper extremities (191 cases). Since that year, we have noticed trend in the total number of OD. Diseases due to the long-term excessive unilateral load of upper extremities also represented the first place of all admitted OD in 1999 (174 cases). There were 1,577 OD due to the long-term excessive unilateral load of upper extremities reported in years 1998–2006 (of which 546 were females) [8–10].

In the period from 2005 to 2014, 4,220 OD were notified and 36.8 % of them affected females (1,552), mostly diseases due to the long-term excessive unilateral load of upper extremities and occupational infectious diseases occurred. The number of OD decreased between 2005 and 2014 by 9.7 % [10–14].

In the period of 2007–2018 had been reported 4,609 OD (2,163 diseases due to the long-term excessive unilateral load of upper extremities and only 374 noise-related diseases) [11–17].

In 2012, there were 344 OD, the incidence was 13.7 OD per 100,000 working females and 15.6 OD per 100,000 working males. The first place of all admitted OD was represented by diseases due to the long-term excessive unilateral load of upper extremities, especially CTS.

In 2014, the incidence of OD was 1.8 per 100,000 all working persons. Diseases due to the long-term excessive unilateral load of upper extremities caused (2,701 notifications altogether) were most frequently notified, with 64 % incidence. In 2015, there was reported 156 OD due to the long-term excessive unilateral load of upper extremities, i.e. 46 % of all reported OD [14].

In 2016 the annual incidence rose to 173 diseases due to the long-term excessive unilateral load of upper extremities (more than 50 % of all reported OD). Diseases due to the long-term excessive unilateral load

of extremities occurred more frequently in females than in males (99 females compared with 74 males) [15].

In 2017, 354 OD were reported (147 females, 207 males). The most frequent OD were the diseases due to the long-term excessive unilateral load of upper extremities (50.3 %, 178 cases), diseases of upper limb caused by vibration (16.7 %, 59 cases), and infectious and parasitic diseases (8.5 %, 30 cases). On the fourth place there were diseases caused by noise (7.3 %). According to the classification of jobs 42 OD were reported in the assembly workers, of which the disease due to the long-term excessive unilateral load of upper extremities was reported up to 28 times [16].

In 2018 were reported 308 OD (121 females, 187 males). The most frequent OD were the diseases due to the long-term excessive unilateral load of upper extremities (47.7 %, 147 cases), diseases of upper limb caused by vibration (17.8 %, 55 cases) and diseases caused by noise (9.1 %, 28 cases). According to the classification of jobs 90 OD were reported in the assembly workers in 2018 [17] (Tab.1).

The differences in the number of diseases due to the long-term excessive unilateral load of upper extremities among males and females in the period 1992-2018 are shown in Fig. 1. Until 1992, data of the number of diseases among males and females are unknown. The higher number of newly diagnosed diseases due to the long-term excessive unilateral load of upper extremities among females compared to males was recorded for the first time in 2008 (82 males, 113 females). The trend has not changed since this year (except 2014). Statistical analysis revealed significant differences between males and females in 2008, 2009, 2010, 2012, 2013, 2016, 2018 (females more often than males).

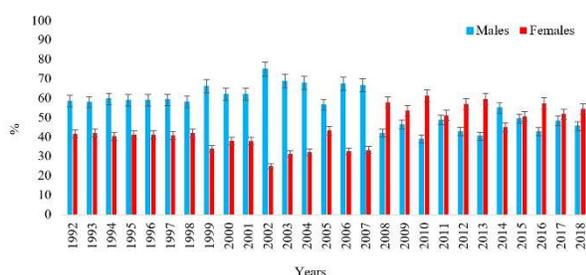


Figure 1 Diseases due to the long-term excessive unilateral load of upper extremities in the period years from 1992 to 2018 [8–17]

Table 1 Number of occupational diseases in the Slovak Republic from 1988 to 2018 [8–17]

Year	Total OD (N)	Item n. 29 (N)	Item n. 38 (N)
1988	1129	43	175
1989	1041	44	170
1990	1142	84	191
1991	1287	142	207
1992	1056	137	145
1993	939	121	107
1994	722	151	49
1995	601	95	74
1996	726	107	67
1997	639	164	80
1998	740	191	56
1999	673	174	64
2000	660	158	47
2001	577	145	47
2002	609	188	26
2003	551	154	39
2004	613	215	31
2005	413	122	26
2006	504	230	26
2007	575	261	27
2008	429	195	17
2009	483	209	36
2010	425	193	36
2011	373	162	45
2012	344	168	37
2013	301	141	33
2014	373	180	40
2015	328	156	30
2016	316	173	19
2017	354	178	26
2018	308	147	28

Notes: OD, occupational diseases (47 items); Item no. 29 Diseases due to the long-term excessive unilateral load of upper extremities; Item no. 38 Noise-related diseases

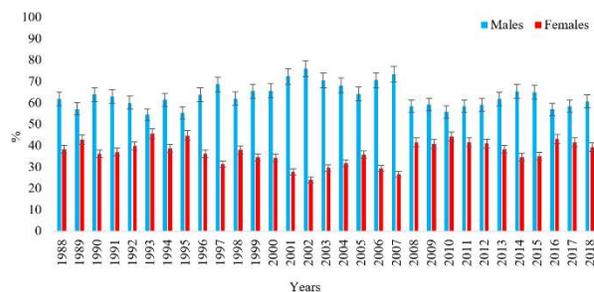


Figure 2 Trends of total number of occupational diseases in the Slovak Republic in the period of years from 1988 to 2018 [8–17]

Within the observed period, the most reported OD were in 1991 (1,287 diseases). On the other hand, least OD were reported in 2013 (301 OD) and in 2018 (308 OD). In the total number of OD males predominate every year. Statistical analysis revealed significant differences between males and females every observed year [8–17] (Fig.2).

DISCUSSION

Not only in the Slovak Republic, but also in all the surrounding countries are the most common OD diseases due to the long-term excessive unilateral load of upper extremities. The most common diagnosis was CTS. In these countries (the Czech Republic, Slovenia, Hungary, Austria, Spain), the automobile industry has the largest presence, and thus contributes most to the morbidity of the working population [17–20].

The most important risk factor in the onset of the work-related upper limb disorders is repetitive, monotonous work with load of the same muscle groups of the upper extremities, especially associated with numerous movements of small muscle groups of the hands. Automotive industry offers a lot of job opportunities. On the other hand, it is characterized by a type of work activity that signifies a considerable risk to employees. Work is associated with stretched fingers associated with flexion and extension of the wrist and movements performed at high frequency. This type of work is characteristic especially for automobile industry-assembly workers (females). The result of these impacts is that after 2008 females have been affected by the disease due to the long-term excessive unilateral load of upper extremities more often than males (except 2014). Nevertheless, by the total number of OD, males are still more often to be affected than females [8–17].

The current trend-the boom of automotive industry may affect the increasing number of diseases due to the long-term excessive unilateral load of upper extremities. Diseases due to the long-term excessive unilateral load of upper extremities have been at the first of all admitted OD in the Slovak Republic since 1998. It can be attributed to the change of industry after 1991, when Volkswagen came to Slovakia, which actually started the fast development of the automotive industry. At present this sector has an irreplaceable place in our economy [21, 22]. In the Slovak Republic the automotive industry employs (directly and indirectly) more than 270,000 people in total, with more than 350 companies operating in

it. Since 2007 the Slovak Republic has been the world's largest producer of cars per capita with a total of 1,100,000 cars manufactured in 2019 alone in a country with 5 million people. Automotive is the largest industry with a share of 13 % on the Slovak GDP in 2019, which was 50 % of industrial production [22].

The significant is the fact that 1,054 OD cases were reported in the automotive industry in the Czech Republic during the period 2001–2014. The most frequent diagnosis was CTS. While the 2001 percentage share of the OD cases in the automotive industry was only 1.7 %, it rose to 11.4 % by 2014. In the Slovak Republic, the trend of OD reported in automotive industry was the same [8–14, 20].

The increasing number of diseases due to the long-term excessive unilateral load of upper extremities does not reflect the increased number of workers at risk. A clear example is the fact, that the most OD (especially disease due to the long-term excessive unilateral load of upper extremities) are reported in the second category of work, which is non-hazardous [14–17].

According to the Occupational Safety and Health Administration the local muscular burden is the most frequently occurring and most costly occupational health problem affecting hundreds of thousands of people in the European Union. The United States government has to invest annually to compensate employees for diseases caused by local overloading of limbs over \$100 billion [23].

According to the United States Bureau of Labor Statistics 45 % of all reported OD were due to exposure to the re-loading of the upper limbs (wrists, elbow, or shoulders) [24, 25].

Economic losses related to health damage in the European Union are estimated at 3–5 % of GDP, with only the loss of professional health damage, but 10–15 % GDP, including the reduction of working age for trained productive persons [24].

According to EODS - data EUROSTAT (data from 17 European countries) the most common OD of all (27.9 %) was CTS already in 2007, while it dominated in women (up to 67.6 %) [19]. Diseases due to the long-term excessive unilateral load of upper extremities have represented the first place of all admitted OD in the Slovak Republic since 1998. For the first time in 2008 were diseases due to long-term excessive unilateral load of extremities more frequent among females than among males, especially CTS [8–18].

CONCLUSION

Our study points out that the higher number of newly diagnosed diseases due to the long-term excessive unilateral load of upper extremities among females compared to males was in the Slovak Republic recorded for the first time in 2008. The current trend—the boom of automotive industry may affect the increasing number of diseases due to the long-term excessive unilateral load of upper extremities, especially among females. The limitation of our study was that there are not freely available data of the number of exposed workers (both employees and tradesmen) in the working process by each risk factors. OD are preventable and their decrease is associated with increasing quality of healthcare, especially primary prevention.

Ethical Approval

The study protocol was approved by the Ethics Committee at the Jessenius Faculty of Medicine in Martin, Comenius University in Bratislava, reference number EK 138/2018, and was performed in accordance with the guidelines proposed in Declaration of Helsinki (2000) of the World Medical Association.

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