COMPARISON OF OCCUPATIONAL DISEASES DEVELOPMENT DURING ONE DECADE IN THE SLOVAK AND CZECH REPUBLIC

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SUMMARY

Objectives: An occupational disease (OD) is a disorder or health condition which arises due to work related activities and tasks or is caused by work environment. The impact of ODs on medical and social system may be considered as a very important in relation to mortality, morbidity, and invalidity. The most common ODs in the European Union are musculoskeletal disorders (58% of all ODs in 2015). The aim of the study was to determine the differences in the incidence of occupational diseases between the Slovak Republic (SK) and the Czech Republic (CZ).

Methods: Data were obtained from the Health Statistics Yearbooks of the National Health Information Centre of the Slovak Republic and in CZ from the Institute of Health Information and Statistics of the Czech Republic. We worked with records from 2009 to 2019. The average incidence rates (aIR) per 100,000 labourers were calculated based on the number of workers in a given year. All data were calculated separately for SK and CZ, and for males and females. $P < 0.05$ was considered a significant value.

Results: In SK, the number of ODs diagnosed from 2009 to 2019 amounted to 2,351 cases in males and 1,605 cases in females. In CZ, the amount of ODs diagnosed from 2009 to 2019 reached 6,616 cases in males and 5,513 cases in females. In SK, from 2009 to 2019, the incidence of ODs decreased significantly from 7.3 to 4.8 cases per 100,000 labourers ($rs = -0.76$; $p = 0.006$). Diseases from one-sided excessive load were the most common ODs in SK (aIR = 7.6 ± 2.2) and in CZ (aIR = 8.2 ± 3.5), followed by ODs caused by vibration. Occupational diseases due to noise, vibrations and SiO_2 inhalation were considerably more common among males. Diseases due to long-term excessive one-sided load, skin and infectious diseases were more prevalent in females. Occupational hearing damage due to noise was more frequent in SK and silicosis, asthma bronchiale, respiratory allergies, dermatoses, and infectious diseases were remarkably more frequent in CZ.

Conclusion: Regarding the main goal, we found a significantly higher aIR of ODs caused by noise in SK than in CZ. In CZ, there was a markedly higher presence of ODs caused by SiO_2 inhalation, asthma and respiratory allergy, ODs of skin and infectious and parasitic ODs when compared to SK. In both countries different principles for discontinuance in work are applied when a risk factor occurs. It is necessary to enhance surveillance data and reporting of ODs and increase investments in occupational safety, health education and research for the future.

Key words: occupational diseases, incidence, Slovak Republic, Czech Republic

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INTRODUCTION

An occupational disease (OD) is a disorder or health condition (e.g., poisonings, musculoskeletal disorders, infectious diseases, etc.) which arises due to work related activities and tasks or is caused by work environment. All health conditions or disorders that occur in a group of people with similar occupational exposure more often than in the rest of the population can be considered ODs provided that they are included in the List of Occupational Diseases (1). The impact of ODs on medical and social system may be considered very important in relation to mortality, morbidity and invalidity (2).

Improvement of work procedures, development of new protective work equipment and their appropriate use is associated with better health protection at work. But the relative high dynamics of changes in work environment leads to the occurrence of new OD types (1). Effective protection of workers represents approximately 1/10 of financial loss caused by occupational accidents and occupational diseases (3). Most ODs have difficult and long-term treatment, but they are preventable (4).

The most common ODs in the European Union are musculoskeletal disorders (58% of all ODs in 2015) (2). Occupational skin diseases (contact dermatitis accounts for 90–95% of them) are the second most common OD in the USA after musculoskeletal ODs with the incidence rate of 23 per 100,000 workers. Occupational asthma is accounting for approximately 15% of all asthma cases (5, 6). Occupational asthma has a decreasing trend in Europe but is the most common occupational lung disease in industrialized countries (7).

Global estimated incidence of new silicosis cases also increased in 2017 (23.7) compared with 1990 (15.0) (1). The rates of fatal occupational diseases per 100,000 workers in Africa and Asia are 4 to 5 times higher than in Europe (8).

The aim of the study was to determine the differences in the incidence of occupational diseases between the Slovak Republic (SK) and the Czech Republic (CZ). The goal was also to compare development trends during this period for individual countries and genders.

MATERIALS AND METHODS

Data on newly notified ODs were obtained from the Health Statistics Yearbooks of the National Health Information Centre of the Slovak Republic, and in the Czech Republic from the Institute of Health Information and Statistics of the Czech Republic. We work with records from 2009 to 2019. Before working with the data, it was necessary to unify the data due to different way of recording in these countries. In SK the yearbooks consist of the total number of cases during one year for both sexes, in CZ also a number of cases per 100,000 persons insured is included. Therefore, the incidence of ODs was based on the number of employers per each year.

ODs (marked with numbers according to the Slovak "List of Occupational Diseases" from Codex No. 461/2003 Supplement No. 1) were divided to categories according to the risk factors and the location of the adverse effect as follows:

- poisonings and diseases caused by chemicals (1–18),
- disorders of ears due to noise (38),
- diseases due to vibration (28),
- diseases due to long-term excessive one-sided load (29),
- pneumoconiosis caused by SiO_2 (33),
- asthma bronchiale and allergy diseases of upper respiratory tract (37, 44, 45),
- diseases of skin (21, 22),
- infectious and parasitic diseases (24–26).

Occupational diseases due to asbestos, lung cancer from ionizing radiation, neoplasms, and diseases caused by other factors were excluded from the study due to their low incidence.

From the data obtained we calculated an average incidence rate (aIR) of newly notified ODs per 100,000 working males and females. Employment status data were acquired from Eurostat dataset (9). Furthermore, the ratio of the number of ODs to the number of workers was calculated for each year separately. All data were calculated separately for Slovak males (SK-M) and females (SK-F) and for Czech males (CZ-M) and females (CZ-F).

The effect size of the t-tests and U-tests is expressed by Rosenthal's r (r). T-tests or U-tests were used according to the normality of the distribution. Correlation dependence is expressed by Spearman's rank correlation coefficient (r_s) and Pearson correlation coefficient (r_{xy}). $P < 0.05$ was considered a significant value.

RESULTS

In SK, the number of ODs diagnosed from 2009 to 2019 amounted to 2,351 cases in males and 1,605 cases in females. Male to female ratio was approximately 3:2. Diseases due to long-term excessive one-sided load were diagnosed most often: in males (37.4% of all ODs in males) and in females (66.8% of all ODs in females).

In CZ, the amount of ODs diagnosed from 2009 to 2019 reached 6,616 cases in males and 5,513 cases in females. Male to female ratio was 6:5. Diseases caused by vibration were the most frequent in males (28.1%). Females were most affected by long-term excessive one-sided load (48.4%). Details are shown in Table 1 and Figure 1.

In SK, from 2009 to 2019, the incidence of ODs decreased significantly from 7.3 to 4.8 cases per 100,000 labourers ($r_s = -0.76$, $p = 0.006$). In CZ, the incidence of OD increased from 4.1 in 2009 to 4.7 in 2019, but the development was insignificant, and the trend line has an isolinear character ($r_s = 0.018$, $p = 0.958$).

Poisonings and Diseases Caused by Chemicals

The least frequent ODs occur only in 1.2% cases in SK and in 0.8% cases in CZ. Incidence rate in both countries is similar without significant differences. The harmful effect of chemicals is significantly more frequent in SK-M (aIR = 0.3 ± 0.2) than

Table 1. *Number of cases and average incidence rate of ODs in SK and CZ*

Occupational diseases (codes)	Number of cases n (%)		Average incidence rate aIR (SD)		p-value
	SK	CZ	SK	CZ	
Caused by chemicals (1–18)	47 (1.2)	94 (0.8)	0.17 (0.18)	0.17 (0.12)	0.930
Caused by noise (38)	360 (9.1)	160 (1.3)	1.3 (1.1)	0.3 (0.2)	**0.002**
Caused by vibration (28)	648 (16.4)	1,956 (16.1)	2.2 (2.2)	3.2 (3.3)	0.059
From one-sided long-term load (29)	1,915 (49.3)	4,254 (35.1)	7.6 (2.2)	8.2 (3.5)	0.492
Caused by SiO_2 inhalation (33)	110 (2.8)	1,163 (9.6)	0.4 (0.4)	1.9 (2.1)	**0.002**
Asthma and respiratory allergy (37, 44, 45)	169 (4.3)	724 (6.0)	0.7 (0.3)	1.4 (0.5)	**< 0.001**
Diseases of skin (21, 22)	190 (4.8)	1,729 (14.3)	0.7 (0.4)	3.2 (1.1)	**< 0.001**
Infectious and parasitic OD (24–26)	279 (7.0)	1,937 (16.0)	1.5 (0.9)	3.2 (2.3)	**< 0.001**
Total	3,956	12,129			

OD codes – numbers according to the Slovak "List of Occupational Diseases" from Codex No. 461/2003 Supplement No. 1; SK – Slovak Republic; CZ – Czech Republic; aIR – average incidence rate; SD – standard deviation
Numbers in bold indicate statistically significant values.

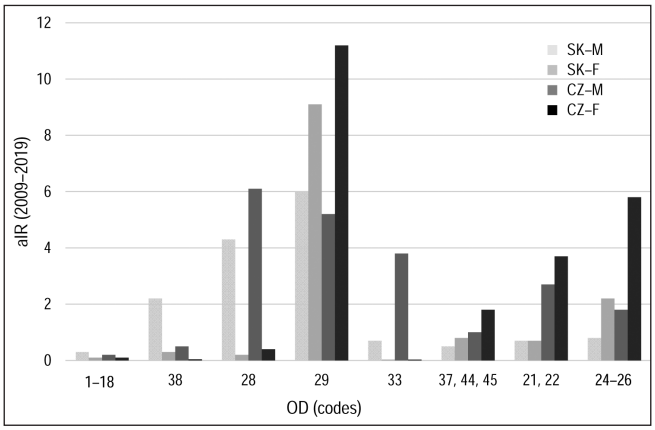

Fig. 1. *Average incidence rate of ODs in Slovak and Czech males and females.*

OD codes – numbers according to the Slovak "List of Occupational Diseases" from Codex No. 461/2003 Supplement No. 1

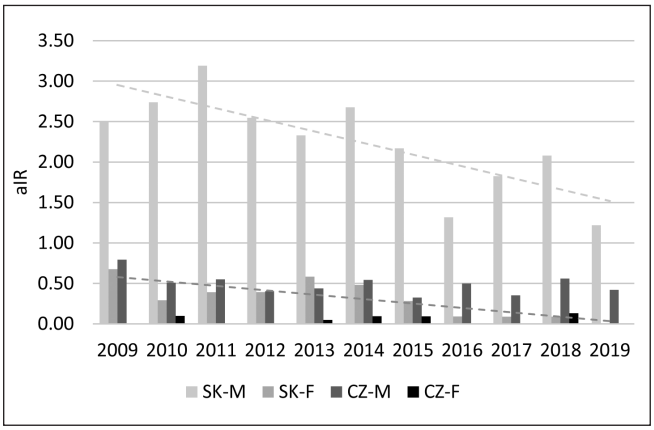

Fig. 2. *Incidence development for disorders of ears due to noise.*

in SK-F (aIR = 0.1 ± 0.1) (r = 0.61, p = 0.013). It is also more frequent in CZ-M (aIR = 0.2 ± 0.1) than in CZ-F (aIR = 0.1 ± 0.1) (r = 0.64, p = 0.003). The incidence rate for SK-M and CZ-M is without significant difference with the same relationship between females' groups.

In SK, these ODs are caused by warfare agents or chemicals with the same effect (organophosphates, organic sulphides and organochlorine pesticides) (n = 14, 29.8%). Less represented chemicals include benzene (n = 6, 12.8%) lead (n = 5, 10.6%), carbon disulphide (n = 5, 10.6%), halogenated hydrocarbons (n = 5, 10.6%), and others (n = 12, 25.6%). In the CZ, these ODs are not further specified. In both countries descending trends for males are observed. For SK-M is weaker and insignificant (r_{xy} = 0.54, p = 0.88), for CZ-M is significant (r_{xy} = 0.67, p = 0.024). There is no significant development for SK-F and CZ-F through years.

Disorders of Ears Due to Noise

Hearing disorders are more frequent in SK than in CZ at a significant level (r = 0.47, p = 0.002). SK-M (aIR = 2.2 ± 0.6) have impaired inner ear more often than SK-F (aIR = 0.3 ± 0.2) (r = 0.85, p < 0.001), and equal ratio between CZ-M (aIR = 0.5 ± 0.1) and CZ-F (aIR = 0.04 ± 0.05) is detected (r = 0.86, p < 0.001). Their incidence is considerably higher in SK-M than in CZ-M (r = 0.85, p < 0.001) and in SK-F than in CZ-F (r = 0.62, p = 0.003).

As shown in Figure 2, the development trend of IR for SK-M (r_s = 0.83, p = 0.002) and SK-F (r_s = 0.82, p = 0.002) is clearly descending. In CZ-M and CZ-F there is no significant change in incidence through years. The trend line is shown only for significant developments.

Diseases Due to Vibrations

The second most common disorders with insignificant aIR in CZ are significantly more frequent in SK-M (aIR = 4.3 ± 1) than in SK-F (aIR = 0.2 ± 0.2) (r = 0.85, p < 0.001), and more frequent in CZ-M (aIR = 6.1 ± 2.1) than in CZ-F (aIR = 0.4 ± 0.2) (r = 0.78; p < 0.001). The incidence is significantly lower in SK-M in comparison to CZ-M (r = 0.6, p = 0.004) and lower in SK-F than in CZ-F (r = 0.55, p = 0.010). Diseases due to vibration are the most common ODs in the group of CZ-M. There are no significant trends in any group.

Diseases Due to Long-term Excessive One-sided Load

Diseases due to long-term one-sided excessive load are the most common in SK (49.3% cases) and in CZ (35.1% cases). Difference between the countries incidence rate is not significant. In SK, the incidence is considerably lower in SK-M (aIR = 6.0 ± 1.1) than in SK-F (aIR = 9.1 ± 1.8) (r = 0.8, p < 0.001). In CZ, the same analogy among males (aIR = 5.2 ± 0.7) and females (aIR = 11.2 ± 2.4) is detected (r = 0.85, p < 0.001). When comparing sexes, a significantly higher incidence is observed in SK-M than in CZ-M (r = 0.47, p = 0.039) and in CZ-F than in SK-F (r = 0.49, p = 0.034). The development trend is significantly decreasing only in SK-F (r_{xy} = 0.68, p = 0.021). For other groups, there is no significant development. Details are shown in Figure 3.

Pneumoconiosis Caused by SiO_2

Pneumoconiosis caused by SiO_2 (silicosis) is the most common respiratory OD in CZ and second most common respiratory OD in SK (Table 1). Inhalation of SiO_2 caused fewer ODs in SK than in CZ (r = 0.51, p = 0.002). Silicosis occurs more often in SK-M (aIR = 0.7 ± 0.2) than in SK-F (aIR = 0.03 ± 0.05) (r = 0.87, p < 0.001), and more often in CZ-M (aIR = 3.8 ± 1.1) than in CZ-F (aIR = 0.03 ± 0.04) (r = 0.86, p < 0.001). The incidence of silicosis

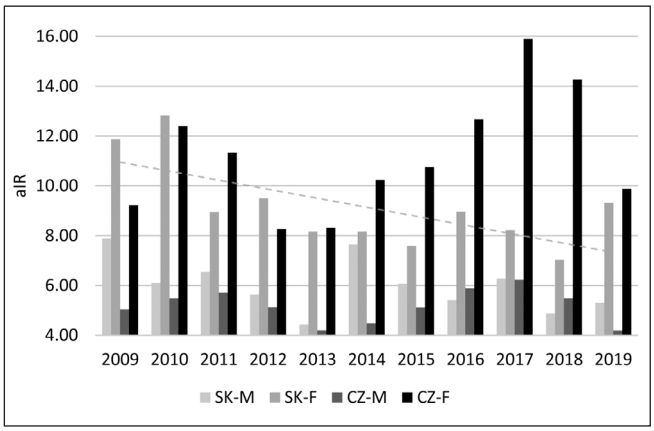

Fig. 3. *Development of diseases due to long-term excessive one-sided load incidence.*

is remarkably higher in CZ-M in comparison with SK-M ($r = 0.85$, $p < 0.001$). There are no differences between females and there are no changing trends for any measured group.

Asthma Bronchiale and Allergy Diseases of Upper Respiratory Tract

Asthma and allergy diseases are the most common respiratory ODs in SK and second most common respiratory OD in CZ (behind silicosis). Asthma bronchiale and allergies are more frequent in CZ than in SK ($r = 0.69$, $p < 0.001$). The average incidence is significantly higher in SK-F ($aIR = 0.8 \pm 0.2$) than in SK-M ($aIR = 0.5 \pm 0.2$) ($r = 0.64$, $p = 0.001$), and also higher in CZ-F ($aIR = 1.8 \pm 0.5$) than in CZ-M ($aIR = 1.0 \pm 0.2$) ($r = 0.74$, $p < 0.001$). When comparing males a higher aIR was found in CZ-M than in SK-M ($r = 0.79$, $p < 0.001$). In females' group aIR was also higher in CZ-F than in SK-F ($r = 0.76$, $p < 0.001$). A significantly changing trend was recorded only in CZ-M group; it is increasing ($r_s = 0.69$, $p = 0.018$). The development of these ODs and the trend line for CZ-M is shown in Figure 4.

Diseases of Skin

Skin disorders in relation to work occur more often in CZ than in SK population group ($r = 0.78$, $p < 0.001$). In SK, the incidence is the same in males and females, in CZ aIR is significantly higher in females ($aIR = 3.7 \pm 1.3$) than in males ($aIR = 2.7 \pm 0.4$) ($r = 0.61$, $p = 0.003$). When comparing aIR for males, it is considerably higher in CZ-M group than in SK-M group ($aIR = 0.7 \pm 0.3$) ($r = 0.85$, $p < 0.001$). The remarkably higher aIR is observed in CZ-F in comparison with SK-F ($aIR = 0.7 \pm 0.5$) ($r = 0.71$, $p < 0.001$). No significant changes in development trends for skin ODs are observed.

Infectious and Parasitic Diseases

Communicable diseases are more common in CZ than in SK ($r = 0.55$, $p < 0.001$), more common in SK-F ($aIR = 2.2 \pm 0.8$) than in SK-M ($aIR = 0.8 \pm 0.4$) ($r = 0.71$, $p < 0.001$) and more frequent in CZ-F ($aIR = 5.8 \pm 1.4$) than in CZ-M ($aIR = 1.8 \pm 0.3$) ($r = 0.85$, $p < 0.001$). In CZ-M higher aIR is observed in comparison with SK-M ($r = 0.82$, $p < 0.001$). CZ-F also have higher aIR than SK-F ($r = 085$, $p < 0.001$). The development trend is significantly decreasing only in SK-M group ($r_s = 0.91$, $p < 0.001$). There are no significant changes in other groups.

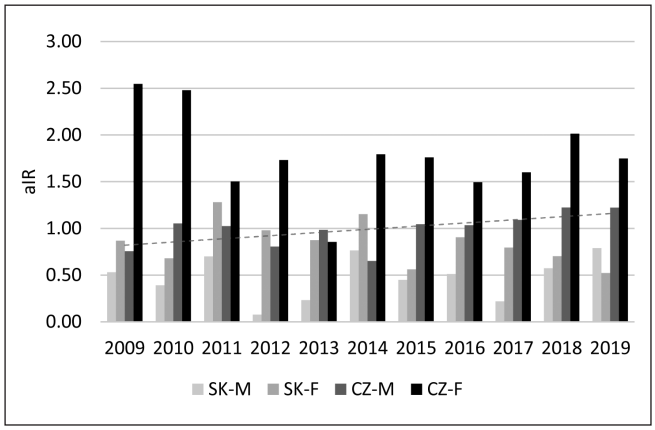

Fig. 4. Development of aIR of asthma bronchiale and allergy diseases of upper respiratory tract.

DISCUSSION

The decrease in the incidence of occupational poisonings in SK is a continuation of the trend that began in 1994. In the period from 1994 to 1998 there were 203 cases, from 1999 to 2003 there were 184 cases, and from 2004 to 2008 there were 76 cases. This development is related to the improving preventive supervision of occupational medicine and to the reduction of the employees in risky industries (10).

Noise-induced hearing impairment has long been the third most common OD in SK, and its downward trend agrees with the results of Andrejiová et al. and Piňosová et al. (11, 12). According to Piňosová and Lumnitzer, with a higher frequency of noise and a longer exposure time, the probability of total hearing loss increases (13). The lower incidence in SK-F is related to the lower number of females exposed to noise (14). However, we think that the aIR does not correspond to the real situation, as the total number of long-term noise-exposed workers in SK is very high. Noise is the most frequent occupational risk factor in the long term (15).

According to the fact that vibrations are the most common physical risk factor contributing to the formation of OD, aIR of ODs caused by vibrations is the second highest. Dominance of aIR in males in both countries is related to more frequent work with machines that are the source of vibration (16). The second position of vibration causing ODs in this study agrees with the statement of Piňosová et al., who reported the same position among all ODs in the last two decades (17). According to Buchancová et al., aIR in SK is lower compared to CZ due to the different way of reporting these ODs (15).

Since 1999, diseases due to long-term one-sided excessive load are the most common diseases in SK. Their incidence is difficult to reduce because they mostly arise in jobs that are not classified as risky (16–18). Within this group, damage of the upper extremities (the most common disease is carpal tunnel syndrome) predominates. This syndrome occurs most often in SK and CZ in workers employed in the automotive industry due to stereotypic hand movements during the completion of various components (14, 19). Damage to upper extremities due to long-term one-sided excessive load also dominates in CZ (20). According to Stocks et al. the increasing incidence of the carpal tunnel syndrome in CZ was due to higher financial compensation for labourers in comparison with the past (21). Stocks et al. also shows the same development trend for diseases due to long-term one-sided excessive load in CZ (21).

The decrease in aIR of silicosis is a continuation of the trend that has been developing since 1991, when the aIR reached its peak (17, 22). The occurrence of silicosis in SK and CZ is related to work in lignite mines, the construction of railway tunnels, and to the work in metallurgy and glass industry. The lower incidence in SK compared to CZ is related to the lower SiO_2 content in lignite from Handlová region compared to black coal from the Ostrava and Karviná region (22, 23). Brhel also confirms the higher incidence of silicosis compared to asthma in CZ (23).

The aIR of asthma has fluctuated over the decades. The main risk factor is the presence of allergens in the work environment. According to Perečinský et al., the most common allergens are chemicals and food (7). Allergies are diseases where the factor of individual susceptibility is also applied (24). Perečinský et al. claims that the number of allergens from agriculture has decreased and there is an increase in allergens originating from disinfectants and cleaning agents (7). We attribute the higher aIR in SK-F to more frequent contact with these substances during cleaning. Brhel adds that workers in the automotive industry and in the production of plastics are often exposed (23).

As in this study, Piňosová et al. also report a decreasing trend in the aIR of skin diseases in SK (17). Buchancová et al. attribute this to the growing rate of self-medication and low financial compensation upon dismissal from work (15). Urbanček et al. attribute the lower incidence in SK to the modernization of work procedures that limit the worker's contact with the harmful substance (25). The higher incidence in CZ is attributed to a more systematic search for dermatoses (25). According to Novák (26) and Pelclová et al. (27), dermatoses and allergic eczemas account for up to 2/3 of all skin diseases.

Infectious and parasitic ODs are the third most common and predominate in women. These results correspond with the results of Piňosová and Králiková, who have observed this development since 1987 (18). Healthcare workers who come into contact with such pathogens are most often affected by infectious diseases. Parasitic diseases are most common in forest workers bitten by a tick (15). Zatloukalová et al. state that scabies is the most common infectious OD among healthcare workers in CZ (28).

CONCLUSIONS

Regarding our main goal, we found a significantly higher aIR of ODs caused by noise in SK than in CZ. In CZ, there was a markedly higher presence of ODs caused by SiO2 inhalation, asthma and respiratory allergy ODs, ODs of skin and infectious and parasitic ODs when compared to SK.

In both countries different principles for discontinuance in work are applied when a risk factor occurs. In SK, stopping work is recommended after prevention failure. In CZ, the interruption is recommended if there is any possibility to avoid the contact with the risk factor (29, 30).

A consistent adherence to effective preventive measures at work can significantly decrease medical and social impact. It is necessary to enhance surveillance data and reporting of ODs and increase investments in occupational safety, health education and research in the future.

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Conflicts of Interest

None declared

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