

Analysis of Invasive Meningococcal Diseases in the Moravian-Silesian Region in 2008 - 2017

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Abstract

Invasive meningococcal disease is one of the most serious diseases with a rapid course. Bacteria *Neisseria meningitidis* is the cause of the disease. It has 13 serotypes, of which only 6 (A, B, C, W, X, Y) causes the disease. Invasive meningococcal disease has a fulminant course. The diagnosis based on the patient's anamnestic data and physical exam, should be determined in timely matter and should be immediately followed by antibiotic therapy. In the Czech Republic vaccination is available and recommended. 628 patients were reported in the Czech Republic in 2008 - 2017. 171 patients were from the Moravian-Silesian Region. Group B meningococcus caused a disease in 65% of reported cases. Children and adolescents are the most endangered groups of the population. 60 people died in 2008 - 2017, 10% of patients were from the Moravian-Silesian Region.

Keywords: *Invasive Meningococcal Disease; Serotype; Czech Republic; Moravian-Silesian Region*

Occurrence in the world

Invasive meningococcal diseases (further only "IMD") rank among the diseases with a worldwide occurrence. Each year there are about 500 000 new meningococcal diseases reported and 50 000 of this number ends in death [1]. Individual serotypes occur by geographical areas. The highest incidence of meningococcal diseases is in the area of sub-saharan Africa, the serotype A was the pathogen of the epidemics to year 2010, then vaccination campaigns against this serotype aimed at persons aged 1 - 29 were started. The serotypes C and W became pathogens of the following epidemics. Occurrences of IMD caused by serotype X were also reported. The most common pathogens in Europe, America and Australia are the serotypes B, C, Y. An increasing number of diseases caused by serotype W was also observed [2]. There are between the states of Europe with high occurrence of IMD belong Ireland, Great Britain, Spain, France, Denmark and Lithuania. The occurrence is yearlong with higher occurrence in the spring and winter months. The most common pathogen in the Czech republic (further only "CR") in the last 10 years is the serotype C and B [4-13].

Occurrence in the Czech Republic and Moravian Silesian region

Over a period of years 2008 - 2017 overall 628 IMD diseases were recorded in the CR, Moravian Silesian Region (further only "MSR") participates by 27,2% on the total number, 171 persons got sick for the observed period. There were 93 men and 78 women. We reported in the MSR the highest number of diseases during 10 years in January (31), February (20), March (18), April (20) and October (21). The

occurrence trend of IMD is permanent in CR, the morbidity in the reported period did not exceed 0,8 persons on 100 000 residents. The trend in MSR is fluctuating, the highest occurrences of IMD were reported in years 2009, 2013, 2017, when the morbidity has reached a value 2 sick persons on 100 000 residents. The occurrence trend of IMD in the CR and the MSR in the reported period is clearly described in the chart 1.

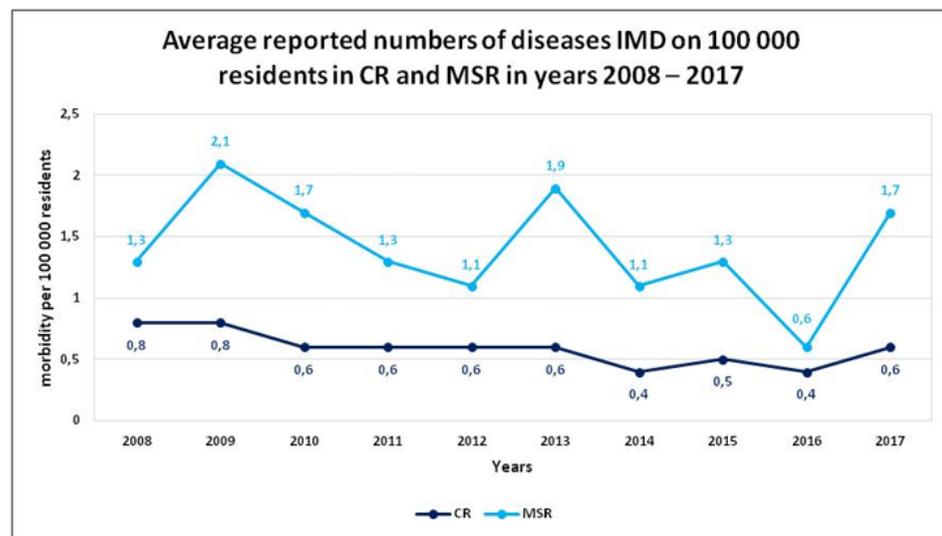


Chart 1: Average reported numbers of diseases IMD on 100 000 residents in CR and MSR in years 2008 – 2017.

The largest share of sick persons was in the district Ostrava from the point of view at the situation in MSR for the observed period in the individual districts, where the number of sick persons has reached 4 sick persons on 100 000 residents in years 2009, 2013 and 2017. The next highest occurrence of sick persons was recorded in 2010 in the district Karviná, where 3 persons got sick on 100 000 residents. Districts Nový Jičín and Frýdek-Místek reported 2 sick persons on 100 000 residents. The lowest number of sick persons has been reported from the districts Opava and Bruntál. The number of sick persons attacked the limit 1 sick person on 100 000 residents. The exact description of the situation in the individual districts of MSR is illustrated in the chart 2.

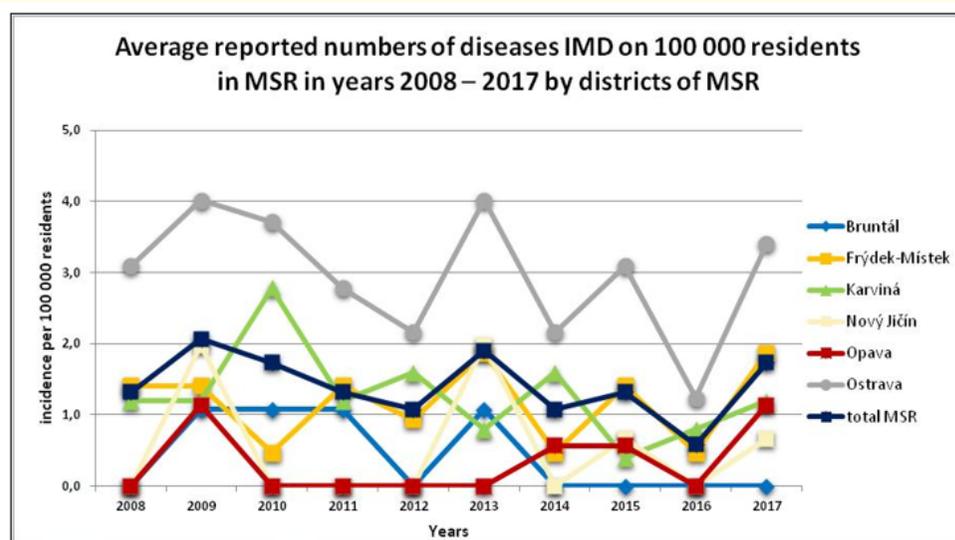


Chart 2: Average reported numbers of diseases IMD on 100 000 residents in MSR in years 2008 - 2017 by districts of MSR.

The occurrence trend of IMD is not changing while watching the occurrence IMD in the period 10 years in MSR compared to the situation in CR. 0,6 persons got sick on 100 000 residents in last 10 years in CR. 1,4 persons got sick on 100,000 residents in last 10 years in MSR. The situation was following compared to the situation in the individual districts: Ostrava registers 3 sick person IMD on 100 000 residents on average in 10 years, Karviná 1,3 sick person on 100 000 residents, Frýdek-Místek 1,2 sick person on 100 000 residents (Chart 3).

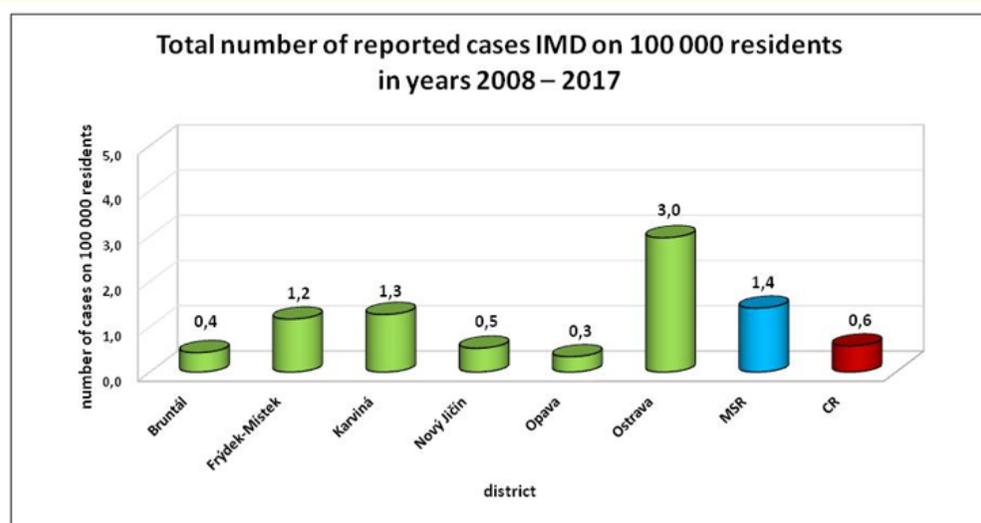


Chart 3: Total number of reported cases IMD on 100,000 residents in years 2008 - 2017.

Vaccination of patients in Moravian Silesian region

Within 10 years 628 sick person IMD on 100,000 residents were reported in CR, 171 cases in MSR. A total of 93 men became ill, 78 cases were women. 1 person is registered in MSR (district Ostrava), who has been vaccinated against IMD by conjugate vaccine Menjugate serotype C. She is a girl born in 1994, who got sick IMD in 2011, unfortunately the serotype of meningococcus that caused the sick could not be determined. The vaccination record was not found for 3 persons, 167 persons have not been vaccinated.

The occurrence divided by the serotype

The most common pathogen IMD in CR was intended serotype B in 64,5% of cases followed by serotype C, that was pathogen in 16,2% of cases. The individual numbers of designates species of serotypes are listed in the chart 4 and the table 1.

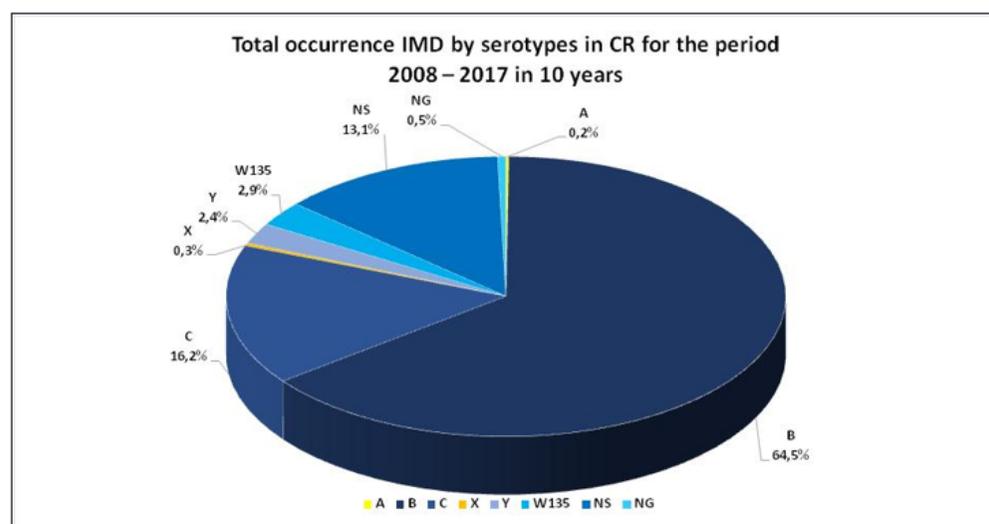


Chart 4: Total occurrence IMD by serotypes in CR for the period 2008 - 2017 in 10 years.

Serotypes	Total number of patients in the CR in 10 years	Percentage of individual serotypes in the CR in 10 years	Total number of patients in MSR in 10 years	Percentage share of serotypes in MSR from the total number in the CR
A	1	0,20%	0	0,00%
B	405	64,50%	139	22,10%
C	102	16,20%	11	1,80%
X	2	0,30%	0	0,00%
Y	15	2,40%	3	0,50%
W135	18	2,90%	2	0,30%
NS	82	13,10%	15	2,40%
NG	3	0,50%	0	0,00%

Table 1: Serotype, total sick in CR 10 years, percentage of individual serotypes, total sick MSR 10 years, percentage of serotypes from total number in CR.

The most common pathogen IMD in MSR was the bacteria *Neisseria meningitis* serotype B that caused 82% of diseases, the pathogen at 15 persons could not be determined. 6% of diseases were caused by serotype C. The percentage of individual serotypes is presented in the chart 5.

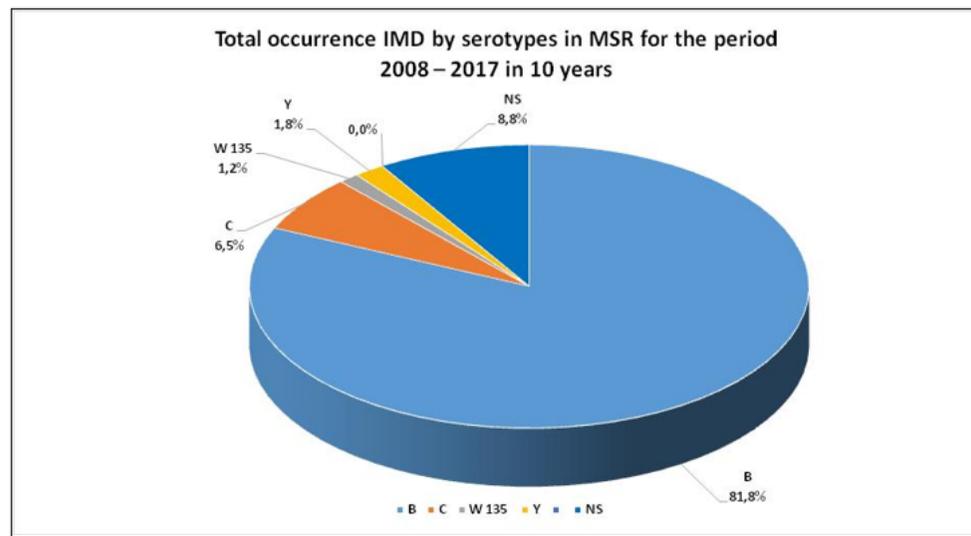


Chart 5: Total occurrence IMD by serotypes in MSR for the period 2008 - 2017 in 10 years.

The occurrence divided by the age groups

The highest number of diseases IMD in CR has been reported in age groups 0 - 11 months and 1 - 4 years, 15 persons in each age group. Higher occurrence of disease was also recorded in the age group 15 - 19 years. The occurrence trend of IMD in CR and MSR is almost iden-

tical. The morbidity in MSR in the age group 0 - 11 months has reached the value 25 persons on 100 000 residents on average within 10 years, 10 persons on 100 000 residents in CR in this age group. The morbidity in MSR in the age group 1 - 4 years has reached the value 7 persons on 100 000 residents on average, 3 persons on 100 000 residents in CR for the whole monitored period. The morbidity in MSR in the age group 15 - 19 years has reached the value 7 persons on 100 000 residents on average, 2 persons on 100 000 residents in CR within 10 years. The situation in the occurrence IMD divided by the age groups is clearly presented in the chart 6.

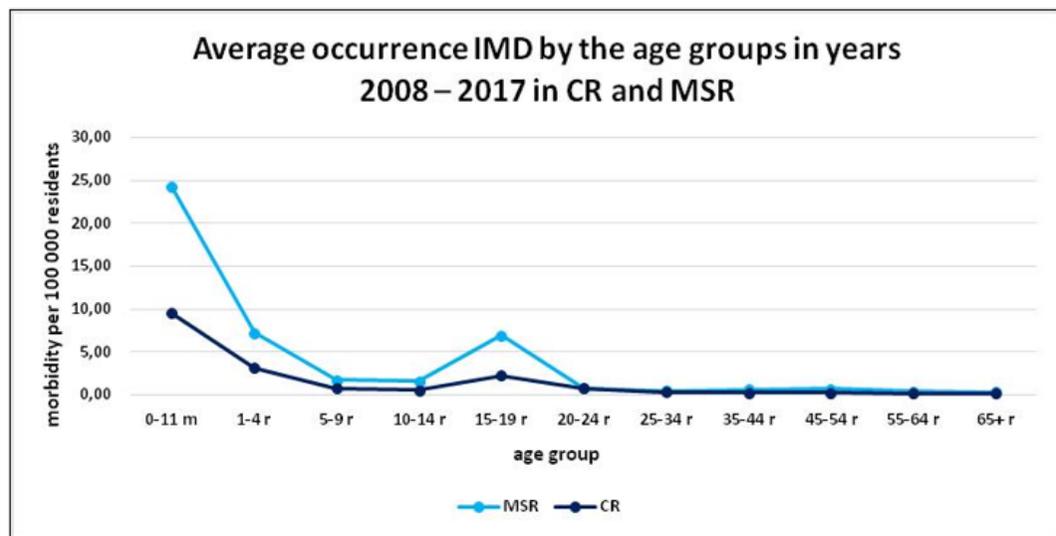


Chart 6: Average occurrence IMD by the age groups in years 2008 - 2017 in CR and MSR.

Deaths

60 deaths were recorded in CR in the same period, 10% of them were reported in MSR. There is the total of 6 persons who died for IMD (report from: 1 x Frýdek-Místek, 2 x Karviná and 3 x Ostrava). There were 2 men, 2 women and 2 girls. The death was caused by serotype B in 4 cases, serotype in 2 cases could not be determined. 15 deaths are registered in CR in last 10 years in age groups 0 - 11 months, 2 of them were reported from MSR (13,3%). 2 deaths are registered in MSR in each of age groups 35 - 44 years and 55 - 64 years, this is 66,7 percentage of the total number, CR reports 3 deaths in the indicated age groups. The highest number of deaths in the reported period is caused by serotype B, which caused the death of 32 persons in CR, 4 of them were reported from MSR (12,5%). The serotype was not determined in 2 other persons in MSR, who died for IMD. 15 deaths for IMD in persons were caused by serotype C and were reported in CR, 1 case serotype X, 3 cases serotype W 135. Serotype was not determined in 9 cases.

Prevention

Vaccination is a meaningful measure to avoid infection. 4 available vaccines against 5 types of meningococcus are in the Czech market - types A, B, C, W 135, Y. They are divided for administration for adults and children. There are vaccines:

- **Vaccine Bexsero:** Protects against *Neisseria meningitidis* serotype B, it can be administrated for children older than 2 months, teenagers and adults.

- **Vaccine Trumenba:** Protects against *Neisseria meningitidis* serotype B, it is intended for vaccination of children older than 10 years, teenagers and adults.
- **Vaccine Menveo:** Protects against *Neisseria meningitidis* serotype A, C, W 135, Y, it can be administrated for children older than 2 years and adults.
- **Vaccine Nimenrix:** Protects against *Neisseria meningitidis* serotype A, C, W 135, Y, it is intended for vaccination of children older than 1 year [14].

The next possibility is to act to reduce risk factors optionally to prevent them. The risk factors are stress, smoking, unhealthy lifestyle and stay in closed spaces with a huge cumulation of persons [15]. Vaccination is recommended not only to children and teenagers but also to travellers who visit the areas with the higher risk of meningococcal infection [14,16].

The source of disease can be an ill person or a carrier. It is stated 10 - 25% of world population are carriers of meningococcus. The transfer takes place by droplets optionally by direct contact with saliva and respiration secretion [1]. Meningococcus gets through the entrance gate on the nasopharyngeal mucosa. Mucosa without disruption coated with a layer of mucus forms a protective barrier. If a breach occurs for example by smoking, drying, stay in dusty environment or by respiration infection, the development of the invasive infection can appear that will manifest in the course following 7 days from overcoming the protective barrier [16].

Post-exposure prophylaxis

The task of workers of Health public authorities is searching and securing all the persons who have come into contact with sick with the IMD due to the increased risk of disease. Medical supervision is ordered to these persons for 7 days according to the decree no 473/2008 Collection of Laws, about the system of epidemiological vigilance for selected infection, Enclosure no 6, according to which the health status of these persons must be monitored [17]. Persons belonging to some risk group (children, teenagers, persons older than 65 years, persons with the respiratory infection, persons with known immunodeficiency, paramedics after resuscitation or face splash) are taking antibiotics for 7 days. Vaccination is offered to persons in contact after 1 week since the last contact with sick in the case that serotype of Meningococcus was determined and vaccine is available [16].

Conclusion

Our analysis shows the average morbidity on IMD was 1,4 persons on 100 000 residents in 10 years in MSR, while 0,6 persons on 100 000 residents in CR. 63 persons got sick on IMD on average each year in CR. It is necessary not to underestimate this disease due to its fast progress and possible consequences [16]. Vaccination against IMD offers the simplest and the best way of prevention IMD [18]. Available vaccines are on the market in CR against all serotypes of meningococcus they are capable to cause disease. Anyone of any age can be vaccinated. Vaccination is recommended not only to children and teenagers but also to travellers who visit areas with higher risk of meningococcal infection [14,16].

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