

## Research Article

# The Cost Analysis of Uncomplicated Chickenpox Treatment in Slovakia

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**\*Corresponding author:** Viera Svihrova, Department of Public Health, Jessenius Faculty of Medicine in Martin, Comenius University Bratislava, Mala Hora 4B, 036 01 Martin, Slovakia**Received:** March 19, 2016; **Accepted:** May 05, 2016;**Published:** May 11, 2016**Abstract****Background:** Chickenpox is one of the most common infectious diseases globally. The aim of this work was to analyse direct and indirect costs for treatment of uncomplicated chickenpox in Slovakia in 2013 compared to 2007.**Methods:** Data of the infection incidence were obtained from the Epidemiological information system of the Slovak Republic. Direct costs included costs for outpatient treatment. Indirect costs included: costs used to care for a family member under home care for children 1 to 14 years (for a parent taking care of a sick child); wage compensation (calculated from minimum wage) from an employer for an employee within the first 10 sick leave days (age group 19 to 62 years); and losses of gross domestic product during 10 days (parents of children 1 to 14; employee in the age group 19 to 62 years).**Results:** Approximately 18,000 cases are reported annually in Slovakia. Average direct costs per case of uncomplicated chickenpox represented EUR 12.27 which means an increase of more than 107% compared to the year 2007 (EUR 5.91). Total indirect costs reached EUR 422 per case, which is more than 20% growth compared to the year 2007 (EUR 349). Total costs reached EUR 434 per case and increased by more than 22% compared to the year 2007 (EUR 355).**Conclusion:** Treatment costs for chickenpox rise each year, mainly because of increasing indirect costs. Indirect costs in Slovakia represent about 97% of total costs, which is the highest proportion in comparison with other countries.**Keywords:** Chickenpox; Uncomplicated chickenpox; Direct costs; Indirect costs

## Introduction

Chickenpox is one of the most common infectious diseases globally. The varicella zoster virus is the disease agent and belongs to the herpetic virus group. The disease is highly contagious. In the tropics, it affects mainly adults. In the temperate zone, it is most common in children aged 1 to 9. Globally, the incidence of chickenpox is estimated to be around 140 million cases per year [1,2]. Approximately 18,000 cases are reported annually in Slovakia [3]. The course of infection in children is usually uncomplicated, but it is more severe at a higher age, when often associated with complications such as pneumonia, encephalitis, pericarditis, and arthritis. Immunity after offset of the disease is long-term. However, the virus can dwell in the spinal ganglia in latent form for decades and can reactivate upon weakening of cellular immunity and manifest as a herpes zoster known as shingles. Therefore, many countries around the globe have vaccinated against chickenpox in a selected population or have provided nationwide vaccination of children.

The aim of this work was to analyse direct and indirect costs for treatment of uncomplicated chickenpox in Slovakia in 2013 compared to 2007.

## Materials and Methods

Data of the infection incidence were obtained from The

Epidemiological information system of the Slovak Republic. Introduction criteria for recording the disease were infectious diseases, varicella B01, uncomplicated varicella B01.9, and the time period 1994–2013. According to these criteria, morbidity per 100,000 inhabitants and absolute numbers of illness in particular age groups were assessed. We subsequently assessed the cost of outpatient care. The average direct and minimal indirect costs of uncomplicated chickenpox treatment in 2013 were calculated on the basis of existing legislation on health and social insurance. These data were compared with those previously published in 2007 [4].

Direct costs included costs for outpatient treatment: drug costs (antipyretics, general and local antihistaminic drugs paid for by health insurance or the child's parents) and the capitation payment in individual age groups according to the general practitioners. Treatment data were obtained by general practitioners in the Martin's district. The average patient's capitations for the three health insurances were received from the reports of the Health Care Surveillance Authority [5].

Indirect costs included costs used to care for a family member under home care (for a parent taking care of a sick child from 1 to 14 years) and an allowance paid to a family member for home care for a period of 10 days, representing 55% of the daily assessment base. Next indirect costs included wage compensation (calculated from

**Table 1:** The direct costs of uncomplicated chickenpox in Slovakia, years 2007 and 2013.

2007 (EUR)											
age group	0	1-4	5-14	15-18	19-50	51-60	61-62	63-80	81+		
drug costs	3.42	3.42	3.42	3.42	3.42	3.42	3.42	3.42	3.42		
capitation payment	4.38	3.09	2.19	1.69	1.69	1.69	1.69	1.69	1.69	total	
number of cases	403	5197	10 027	515	480	7	1	4	0	16,634	per case
total costs	3,143	33,832	56,251	2,632	2,453	36	5	20	0	98,373	5.91
2013 (EUR)											
age group	0	1-4	5-14	15-18	19-50	51-60	61-62	63-80	81+		
drug costs	9	9	9	9	9	9	9	9	9		
capitation payment	5.69	3.89	2.87	2.03	1.93	1.99	2.35	2.35	2.67	total	
number of cases	502	6,474	10,293	554	371	7	3	5	2	18,211	Per case
total costs	7,374	83,450	122,178	6,111	4,055	77	34	57	23	223,359	12.27

**Table 2:** The indirect costs of uncomplicated chickenpox in Slovakia, years 2007 and 2013.

ROK 2007 (EUR)				
age group		1-14	19-62	
number of cases		15,224	488	total
family member home care (50.06 EUR per case) costs		762,113	x	762,113
wage compensation (employer 54.28 EUR) costs		x	26,489	26,489
unformed GDP* (31.92 EUR per case / per day)		4,859,501	155,770	5,015,270
TOTAL COSTS		5,621,614	182,259	5,803,873
				348.92
				per case
ROK 2013 (EUR)				
age group		1-14	19-62	
number of cases		16,767	381	total
family member home care (50.06 EUR per case) costs		1,257,525	x	1,257,525
wage compensation (employer 54.28 EUR) costs		x	27,214	27,214
unformed GDP* (31.92 EUR per case / per day)		6,247,384	141,961	6,389,345
TOTAL COSTS		7,504,909	169,175	7,674,084
				421.40 EUR

minimum wage) from an employer for an employee within the first 10 sick leave days (age group 19–62 years) and losses of gross domestic product (unformed GDP) during 10 days (parents of children aged 1–14; employee in the age group 19–62 years). For the age group 15–18 years, we did not expect a loss of GDP, because, as a rule, young people are still in training. We used data from the Statistical Office of the Slovak Republic (value gross national product per capita in a given year) by calculating the loss of productivity (i.e. absence from work for family member care) [6]. For the age group 15–18 years, we did not expect a loss of GDP, because, as a rule, young people are still in training. We used data from the Statistical Office of the Slovak Republic (value gross national product per capita in a given year) by calculating the loss of productivity (i.e. absence from work for family member care) [7].

## Results and Discussion

Approximately 18,000 cases are reported annually in Slovakia. The number of reported cases is highest in the age group from 5 to 9 years (44.2% of all reported cases in 2013) and from 1 to 4 years (35.3% of all reported cases in 2013). Average direct costs per case of uncomplicated chickenpox represented EUR 12.27, which means an increase of more than 107% compared to the year 2007 (EUR 5.91)

(Table 1,3). Loss of GDP was EUR 373 per case. Total indirect costs reached EUR 422 per case, which is more than 20% growth compared to the year 2007 (EUR 349) (Table 2,3). Total costs reached EUR 434 per case and increased by more than 22% compared to the year 2007 (EUR 355) (Table 3).

Chickenpox is considered to be a disease with a mild course, particularly in children. A complicated course of the disease may occur, for example, in immuno deficient children. The global incidence of chickenpox is approximately 140 million cases per year (i.e. approximately 2% of the world's population). Hospital stay and serious complications are reported in approximately 3% of cases, accounting for 4.2 million cases annually. Reported deaths represent about 0.1% of complicated cases (i.e. about 4,200 cases per year) [2]. On average, 18,000 chickenpox cases have been reported annually in Slovakia for the last 20 years [3]. This means that the disease affects approximately 0.4% of the entire population. Hospital stay and serious complications are reported by approximately 150 patients annually, which represent about 1% of all chickenpox cases. For an uncomplicated course of the disease, treatment is prescribed by isolation of the infected person at home and symptomatic measures such as adequate fluid intake, reduction of body temperature, and

**Table 3:** Compare the total cost of outpatient treatment of chickenpox in Slovakia, years 2007 and 2013.

costs (EUR)	2007 (% of total costs)	2013 (% of total costs)	Change 2007 compared to 2013 (%)
Direct costs per case	5.91 (1.7)	12.27 (2.8)	107.6
Indirect costs per case (family member home care)	50.06 (14.1)	75.00 (17.3)	49.8
Indirect costs per case (unformed GDP)	319.20 (90.0)	372.60 (85.9)	17
Indirect costs per case	348.92 (98.3)	421.70 (97.2)	21
TOTAL COSTS	354.83 (100.0)	433.67 (100.0)	22

reduction of itching by drug administration. The aim of chickenpox treatment is to prevent the spread of the infection to the child's eyes, nose, and genital area and to prevent secondary infections of rashes. The acute phase of the disease lasts about 7 days, and the duration of treatment and recovery in an uncomplicated course lasts for about 14 days [2].

Outpatient treatment of the complicated disease causes direct and indirect national costs. For example, in 1999 direct costs represented about 10% of the total cost of outpatient care of children with chickenpox in Canada, corresponding to EUR 34 per case [8]. The direct cost of prescribed drugs was EUR 11 per patient in 2005 in Germany and EUR 13 in France [9]. According to our Slovak data, we found direct costs of approximately EUR 3 per patient in 2007 and EUR 9 in 2013. In Australia, total direct costs for a child's outpatient chickenpox treatment were on average EUR 23 in 1998 and EUR 34 in 2007 [10,11]. The total direct costs for outpatient treatment reached EUR 36, according to the most recent available data in Belgium [12]. Whereas in 2007, according to our findings, the total direct cost of treatment for an uncomplicated chickenpox case reached an average of EUR 5.91, it increased to EUR 12.27 in 2013. We can find differences in direct as well as indirect costs when compared to other countries, because treatment costs are associated with a different method of financing health care. In our case, direct costs include the costs of prescribed drugs and capitation payment per patient per month. In the available references, direct costs included the cost of drugs and the cost of the medical examination. The average number of examinations during an uncomplicated course of the disease ranged from one to two examinations.

Total indirect costs were EUR 349 per case in 2007 and EUR 422 per case in 2013. It represents more than 20% increasing of the indirect costs. The majority of authors have concluded that the greater parts of the total costs for the treatment of chickenpox are indirect costs [8,9,13,14,15]. In Canada, indirect costs accounted for 90% of the total costs in 1999, and in Germany, indirect costs accounted for 82% of the total costs in 2004 [8,13,15]. In Slovakia, indirect costs accounted for about 98% of the total cost of outpatient treatment of uncomplicated chickenpox in 2007 and about 97% of total costs in 2013.

Chickenpox is currently a vaccine-preventable disease [16]. The World Health Organization has recommended mass vaccination in countries in which the disease is a public-health and socio-economic problem and in which it is possible in financial terms in order to achieve and maintain a high vaccination rate of 80 to 95% of the population [2]. In Europe, recommendations vary by country. Some countries such as Austria, the Czech Republic, the United Kingdom, Slovenia, France, and Belgium have joined the model vaccination of high-risk groups. Mandatory vaccination has been implemented since

2008 in Latvia. Vaccination is recommended in Germany, Greece and Luxembourg [17,18]. Slovakia currently registers several vaccines, but no determination of payment exists. Vaccination is possible at the individual request of parents.

## Conclusion

Treatment costs for chickenpox rise each year, mainly because of increasing indirect costs. Indirect costs in Slovakia represent about 97% of total costs, which is the highest proportion in comparison with other countries. Loss of labour productivity (i.e. loss of GDP during a 10-day work absence to care for a sick child) amounted to 6 million EUR in 2013, representing an increase of more than 1.191 million EUR compared to 2007. It would be appropriate and necessary to deal with primary prevention of the disease (i.e. vaccination, defining a cohort of persons for whom vaccination is preferred, and determining what sources will be financed in Slovakia).

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## References

1. CDC. Epidemiology and Prevention of Vaccine-Preventable Diseases. The Pink Book: Course Textbook - 13th Edition. 2015.
2. [No authors listed]. Varicella and herpes zoster vaccines: WHO position paper. *Wkly Epidemiol Rec.* 2014; 89: 265-287.
3. Public Health Authority of the Slovak Republic. Annual report Regional Public Health Authorities in the Slovak Republic by expert departments in 2014.
4. Svihrova V, Hudeckova H, Rusnakova S. Varicella as a Social and Economic Problem. *Zdravotnicke studied.* 2009; 2: 19-22.
5. Health care Surveillance Authority SR. Sprava o stave vykonavania verejného zdravotného poistenia za rok 2012. (Report on the status of implementation of public health insurance in 2013). Publisher: UDZS. 2014.
6. Act Collection. Zakon o socialnom poistení (Social Insurance Act) Nr. 461/2003.
7. Statistical Office of the Slovak Republic. Statistical Yearbook of the SR 2014. Publisher: VEDA. 2015.
8. Law B, Fitzsimon C, Ford-Jones L, MacDonald N, Dry P, Vaudry W, et al. Cost of chickenpox in Canada: part I. Cost of uncomplicated cases. *Pediatrics.* 1999; 104: 1-6.
9. Coudeville L, Brunot A, Szucs TD, Dervaux B. The economic value of childhood varicella vaccination in France and Germany. *Value Health.* 2005; 8: 209-222.
10. Ferson MJ, Shen WL, Stark A. Direct and indirect costs of chickenpox in young children. *J Paediatr Child Health.* 1998; 34: 18-21.
11. Vally H, Dowse GK, Eastwood K, Cameron S. An outbreak of chickenpox at a child care centre in Western Australia. Costs to the community and

- implications for vaccination policy. *Aust N Z J Public Health*. 2007; 31: 113-119.
12. Bilcke J, Van Hoek AJ, Beutels P. Childhood varicella-zoster virus vaccination in Belgium: cost-effective only in the long run or without exogenous boosting? *Hum Vaccin Immunother*. 2013; 9: 812-822.
  13. Banz K, Wagenpfeil S, Neiss A, Hammerschmidt T, Wutzler P. The burden of varicella in Germany. Potential risks and economic impact. *Eur J Health Econ*. 2004; 5: 46-53.
  14. Fornaro P, Gandini F, Marin M, Pedrazzi C, Piccoli P, Tognetti D, et al. Epidemiology and cost analysis of varicella in Italy: results of a sentinel study in the pediatric practice. *Italian Sentinel Group on Pediatric Infectious Diseases. Pediatr Infect Dis J*. 1999; 18: 414-419.
  15. Law B, Fitzsimon C, Ford-Jones L, McCormick J, Riviere M. Cost of chickenpox in Canada: part II. Cost of complicated cases and total economic impact. The Immunization Monitoring Program-Active (IMPACT). *Pediatrics*. 1999; 104: 7-14.
  16. Urbancikova I. Vaccination option for preventing chickenpox. *Pediatrics (Bratisl.)*. 2010; 5: 263-268.
  17. Haverkate M, D Ancona F, Giambi C, Johansen K, Lopalco PL, Cozza V et al. On behalf of the VENICE project gatekeepers and contact points. Mandatory and recommended vaccination in the EU, Iceland and Norway: results of the VENICE 2010 survey on the ways of implementing national vaccination programmes. *Euro Surveill*. 2012; 17: 20183.
  18. Helmuth IG, Poulsen A, Suppli CH, Molbak K. Varicella in Europe-A review of the epidemiology and experience with vaccination. *Vaccine*. 2015; 33: 2406-2413.