



EPIDEMIOLOGICAL STUDY OF PERTUSSIS IMMUNIZATION EFFECTIVENESS IN VARNA REGION (2009-2014)

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SUMMARY

Pertussis is an acute infectious disease, caused by *Bordetella pertussis*. Although an effective vaccination program exists in many countries, it is a wide-spread and highly contagious infection.

In Varna Region, *B. pertussis* infection affects different age groups, but the incidence rate is highest in infants under 1 year (12 cases in total), following the group of children at 0 - 9 years of age (9 cases in total). During the period 2009 - 2014, a significant decrease in the immunization covering was detected, mainly due on irregular vaccine supply and anti-vaccination movement among parents.

Key words: *Bordetella pertussis*, vaccination, epidemiology, immunization

BACKGROUND

Pertussis, or whooping cough, is an acute infectious disease of the respiratory tract, caused by the bacterium *Bordetella pertussis*. It can be found only in humans [1]. The disease spreads predominantly among children, but adults may also be affected [2]. The contagious index varies from 70-75% to 90%. Whooping cough is easily transmitted from person to person, mainly through air droplets [3].

The incubation period of pertussis usually lasts for 3-5 days. The clinical course of the illness is divided into three stages: catarrhal stage, paroxysmal stage and convalescent stage. Before pertussis vaccine became available in the 1940s, more than 200,000 cases of pertussis were reported annually. In spite of high vaccination coverage in western countries pertussis is still a major public health burden because of yearly incidences which continue to increase and the mortality in children under 6 months which reaches 0.2%. About 195,000 deaths in children per year are registered according to the World Health Organization in the developing countries. Most deaths occur among young babies who are either unvaccinated or incompletely vaccinated [4]. The spreading of the infection can be stopped only by achieving high immunization coverage in the population (>92%) [5].

In Bulgaria routine pertussis immunization was in-

troduced in 1960 with diphtheria, tetanus, whole cell pertussis (DTwP) vaccine in 3 dose schedule [6]. In addition to this between 1960 and 1981, two booster doses with whole cell pertussis vaccine were implemented among children at age of 18 months and 4 years respectively. This immunization schedule was used for the next 20 years [7].

Acellular pertussis vaccine (DTaP) has been applied as a booster dose at 6 years old children since 2008. Since 2010 acellular vaccine was included in the Bulgarian Immunization Calendar to perform the primary immunization and it replaced the whole cellular vaccine that had been used for 50 years [8]. According to the Bulgarian Immunization Calendar from 1 April 2010 the pentavalent vaccine Pentaxim was used for vaccination at 2-, 3-, 4-, 16-month-olds and Tetraxim was applied at 6-year-olds [9].

From 1 July to 31 December 2014 the primary immunization at 2-, 4-, 6-month-olds was carried out with the vaccine Hexacima; Pentaxim was applied at 18 month-olds and Tetraxim was used for booster dose at 6 year-olds [10]. Since 1 January 2015 immunization at 2-, 3-, 4-month-olds has been done with Pentaxim or Hexacima. Pentaxim has been applied at 16 month-olds and Tetraxim has been used for booster immunization at 6 year olds [11].

PURPOSE

In the current study we analyze the epidemiology and control of pertussis in Varna region from 2009 to 2014. We also try to assess the effectiveness of anti-pertussis immunization in the region.

MATERIAL AND METHODS

We performed a retrospective analysis (2009 - 2014) using epidemiological data from Regional Health Inspectorate - Varna.

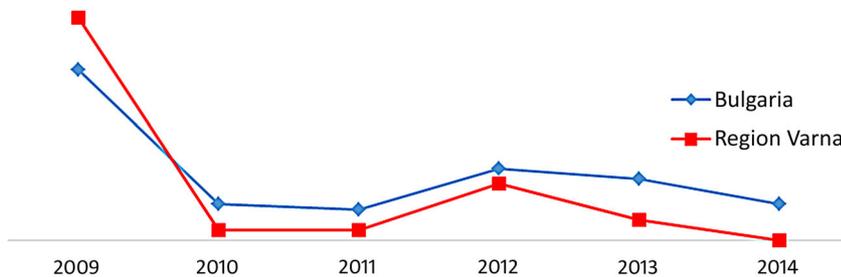
RESULTS AND DISCUSSION

From 2009 to 2014 the morbidity of pertussis in Bulgaria was between 3.3%000 (2009) and 0.3%000 (2014). During the analyzed period, 29 pertussis cases were reported in Varna region. However only 5 of them were confirmed by microbiology diagnosis and PCR typing. The incidence

of pertussis in Varna region has been steadily decreasing for the last six years: in 2009 its total value was 4,35‰ while in 2014 zero cases were registered (Fig. 1). The analy-

sis of data showed that from 2010 to 2014 the morbidity in Varna region was lower than the average incidence in Bulgaria.

Fig. 1. Morbidity of pertussis in Varna Region and in whole country



Due to the difficulty in the etiological confirmation of pertussis disease, the reported morbidity rate cannot be used to assume the real intensity of its epidemiological progress. Only those cases with typical clinical manifestation have been registered. The remaining ones are clas-

sified as acute respiratory diseases.

The disease has a clear seasonal pattern, as most of the notifications occur during the spring and summer (Fig. 2).

Fig. 2. Seasonal distribution of cases in the study region (on y-axis are presented the number of reported cases)

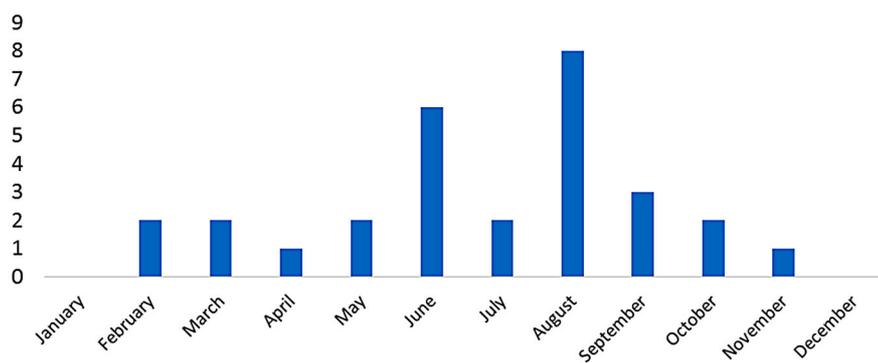


Table 1 shows the distribution of the patients infected with *B. pertussis* according to their age from 2009 to 2014. *B. pertussis* infection affects different age groups, but the incidence rate is highest in infants under 1 year (12 cases

in total), following the group of children at 0-9 years of age (9 cases in total). As mentioned above during 2014 there are not any pertussis cases.

Table 1. Age distribution of pertussis in Varna Region

Age	< 1	1-4	5-9	10-19	20+
2009	9	9	2	0	0
2010	1	0	0	0	0
2011	0	0	1	0	0
2012	1	0	3	0	1
2013	1	0	1	0	0
2014	0	0	0	0	0
Total	12	9	7	0	1

The main and most effective mean of pertussis's prevention is the specific immunization. During 2009 - 2014 vaccination coverage in infant population with 4 doses ranged between 54.6% and 100%. The lowest vaccination coverage (54.6%) was observed from 1 June 2014 to 31 August 2014, when the supply of vaccines was irregular (Table 2). Surpris-

ingly, during the same year the lowest pertussis incidence was also observed mainly due to better immunization coverage in the previous years. The result of the irregular vaccination during the last year of our study will be precisely observed in the near future when an increased number of pertussis cases are expected to appear in the region.

Table 2. Pertussis immunization in Varna region

	Vaccine	First dose	Second dose	Third dose	Booster dose	Vaccine	Booster dose
2009	DTwP	97.27%	95.25%	95.76%	93.69%	DTaP	81.01%
From 1 Jan to 31 Mar 2010	DTwP	100%	100%	100%	100%	DTaP	100%
From 1 Apr to 31 Dec 2010	Pentaxim	90.42%	87.91%	84.44%	84.26%	Tetraxim	90.97%
2011	Pentaxim	95.52%	93.93%	89.78%	91.76%	Tetraxim	92.83%
2012	Pentaxim	94.77%	93.59%	91.30%	94.22%	Tetraxim	94.38%
2013	Pentaxim	95.57%	92.86%	91.08%	92.92%	Tetraxim	93.05%
2014	Pentaxim	89.86%	87.14%	77.36%	67.03%	Tetraxim	54.97%
From 1 June to 31 Aug 2014	Tetraxim	89.49%	65.10%	54.60%			
From 1 Sept to 31 Dec 2014	Hexacima	78.72%	84.00%	44.26%			

CONCLUSION

In this study we show that during 2009-2014 *Bordetella pertussis* infection tends to decrease in Varna region. The reduction in vaccination coverage due to the irregular supply with vaccines and the increasing lack of vac-

cine confidence among parents is alarming. Therefore the range and quality of specific immunoprophylaxis should be improved. The health care professionals should have a central role in maintaining public trust in vaccination.

REFERENCES:

1. Amirthalingam G, Gupta S, Campbell H. Pertussis Immunisation and control in England and Wales, 1957 to 2012: A historical review. *Euro Surveill.* 2013 Sep;18(38): pii: 20587. [PubMed] [CrossRef]
2. Higg R, Higgins SC, Ross PJ, Mills KH. Immunity to the respiratory pathogen *Bordetella pertussis*. *Mucosal Immunol.* 2012 Sep;5(5):485-500. [PubMed] [CrossRef]
3. Doichinova V. Pertussis and paraptussis. In: Dimitrova T, (editor) Epidemiology of infectious diseases. *Medical Publishing ARSO*, Sofia, 2012. p. 127-8 [in Bulgarian]
4. Centers for Disease Control and Prevention. Pertussis. In: Hamborsky J, Kroger A, Wolfe S. (editors) *Epidemiology and Prevention of Vaccine-Preventable Diseases*. 13th edition. *The Public Health Foundation*; Oct 2015. p. 81-100.
5. Gabutti G, Rota MC. Pertussis: A review of disease epidemiology worldwide and in Italy. *Int J Environ Res Public Health.* 2012 Dec;9(12): 4626-38. [PubMed] [CrossRef]
6. Koguharova M, Gacheva N. Vaccines and immunizations. *Global cross centre*, Sofia, 2001. 44-49 p. [in Bulgarian]
7. Vladimirova N. Control of pertussis infection in Bulgaria: changes resulting from modern epidemiology of pertussis. *MedInfo.bg.* 2010 Aug;10(8): 41-3. [in Bulgarian]
8. Vinarova J, Tongova M. Vaccines and vaccination as a means and methods for health management. *Department Health and social sciences, Annual book.* 2014;1. [in Bulgarian]
9. Bulgarian Immunization Calendar in use from 1 April 2010.
10. Bulgarian Immunization calendar in use from 1 July 2014.
11. Bulgarian Immunization calendar in use from 7 November 2014.

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