

EPIDEMIJE ŠARLAHA U VRTIĆIMA U BEOGRADU

Sonja Giljača^{1*}, Slavica Maris¹, Nataša Rančić², Milutin Mrvaljević³, Zorica Mrvaljević³

¹ Gradski zavod za javno zdravlje Beograd, Beograd, Republika Srbija

² Institut za javno zdravlje Niš, Niš, Republika Srbija

³ Urgentni Centar – Klinički Centar Srbije, Privatna ordinacija "IVAL", Beograd, Republika Srbija

* Korespondencija: sonja.giljaca@zdravlje.org.rs

SAŽETAK

Uvod/Cilj: Šarlah je uglavnom dečija bolest i u oko 90% slučajeva se javlja kod dece mlađe od 10 godina. Epidemije šarlaha uvek se javljaju u dečijim kolektivima (vrtićima, školama i ustanovama za decu). Cilj ovoga rada je da se analiziraju epidemiološke karakteristike epidemija šarlaha u vrtićima u Beogradu tokom petogodišnjeg perioda (2016-2020. godine).

Metode: Podaci o obolevanju od šarlaha prikupljeni su, za posmatrani period, iz Gradskog zavoda za javno zdravlje Beograd. Korišćeni izvori podataka su: epidemiološki upitnik, medicinska dokumentacija i laboratorijski rezultati. Prisustvo β -hemolitičkog streptokoka grupe A kod obolele dece dokazano je bakteriološkim pregledom briseva grla i nosa. U analizi podataka korišćene su opšte i specifične stope incidencije.

Rezultati: Tokom petogodišnjeg perioda registrovano je 30 epidemija šarlaha u kojima je ukupno obolelo 114 dece iz 23 beogradska vrtića. U 2017. godini bilo je 12 epidemija sa ukupno 49 obolelih, što predstavlja najveći ukupan broj obolelih u jednoj godini. U periodu 2016-2020. godine, najveći broj obolelih među svim obolevima od šarlaha je bio među decom uzrasta 4 godine (33,3%), a najmanji među decom uzrasta od 2 godine (1,7%). Nešto je više bilo novoobolelih dečaka (57,9%) nego devojčica (42,1%). Najveće prosečne petogodišnje stope incidencije za šarlah zabeležene su u uzrastu 1-4 godine (383,7 na 100.000) i u uzrastu 5-9 godina (262,8 na 100.000), a najniže su bile kod osoba starosti 15 i više godina. Oko 1/3 obolele dece registrovan je u opštini Novi Beograd, a oko 1/3 obolelih registrovan je u periodu ranog proleća (mart-april).

Zaključak: Poštovanje i blagovremena primena protivepidemijskih mera doprinose uspešnom zaustavljanju daljeg širenja infekcije (prijava oboljenja, izolacija, lečenje obolele dece, kao i pooštrene mere higijene i tekuća dezinfekcija).

Ključne reči: šarlah, β -hemolitički streptokok grupe A, epidemija, vrtić

Uvod

Šarlah (lat. *Scarlatina*) je oblik streptokokne bolesti karakterističan po ospi, koja nastaje kada soj streptokoka koji je izazvao infekciju produkuje pirogeni egzotoksin. Uzročnik šarlaha je β -hemolitički streptokok grupe A (1). Klinička slika oboljenja se manifestuje iznenadnom febrilnošću, bolovima u grlu, eksudativnim tonzilitisom ili faringitisom, malinastim jezikom i specifičnom ospom u vidu tačkastog egzantema (kao šmirgl papir). Ospa se najčešće javlja po vratu, grudima, u predelu potpazušnih jama, laktovima i preponama, kao

i na unutrašnjim stranama butina. Karakteristično je da šarlahna ospa ne zahvata lice, ali su na licu karakteristični zajapurenost obraza i bledilo koje okružuje usne (1).

Rezervoar infekcije je čovek. Najčešće se prenosi kapljičnim putem ili direktnim kontaktom sa obolevima ili kliconošama, ređe indirektnim kontaktom preko predmeta (1). Period inkubacije najčešće iznosi 2-5 dana (minimalna jedan dan, a maksimalna 7 dana). Dijagnoza šarlaha najčešće se postavlja na osnovu kliničke slike, a potvrđu-

OUTBREAKS OF SCARLET FEVER IN KINDERGARTENS IN BELGRADE

Sonja Giljaca^{1*}, Slavica Maris¹, Natasa Rancic², Milutin Mrvaljevic³, Zorica Mrvaljevic³

¹ Institute of Public Health of Belgrade, Belgrade, Republic of Serbia

² Institute of Public Health of Nis, Nis, Republic of Serbia

³ Emergency Centre – Clinical Centre of Serbia, Private ordination "IVAL", Belgrade, Republic of Serbia

* Correspondance: sonja.giljaca@zdravlje.org.rs

SUMMARY

Introduction/Aim: Scarlet fever is mostly a childhood disease and in about 90% of cases it occurs in children younger than 10 years. Outbreaks of scarlet fever always occur in children's collectives (kindergartens, schools and institutions for children). The aim of this paper is to analyze the epidemiological characteristics of scarlet fever epidemics in kindergartens in Belgrade during the five-year period (2016-2020).

Methods: Data about new cases of scarlet fever were collected for the observed period from the City Institute for Public Health Belgrade. The data sources used are: epidemiological questionnaire, medical documentation and laboratory results. The presence of β -hemolytic streptococcus group A in diseased children was proven by bacteriological analysis of throat and nose swabs. General and specific incidence rates were used in the data analysis.

Results: During the observed five-year period, 30 epidemics of scarlet fever were registered, in which a total of 114 children from 23 Belgrade kindergartens became ill. In 2017, there were 12 epidemics with a total of 49 cases, which represents the largest total number of cases in one year. In the period from 2016 to 2020, the highest number of patients among all patients with scarlet fever was among children aged 4 years (33.3%), and the lowest among children aged 2 years (1.7%). There were slightly more sick boys (57.9%) than girls (42.1%). The highest average five-year incidence rates for scarlet fever were recorded at the age 1-4 (383.7 per 100,000) and 5-9 years (262.8 per 100,000), and the lowest were in persons aged 15 and over. About $\frac{1}{3}$ of sick children were registered in the municipality of New Belgrade, and about $\frac{1}{3}$ of sick children were registered in the period of early spring (March-April).

Conclusion: Respect and timely application of anti-epidemic measures contribute to the successful cessation of further spread of infection (disease reporting, isolation, treatment of sick children, as well as stricter hygiene measures and ongoing disinfection).

Key words: scarlet fever, β -hemolytic streptococcus group A, epidemic, kindergarten

Introduction

Scarlet fever (Latin: *Scarlatina*) is a streptococcal illness characterized by a rash, which appears when a streptococcal strain that caused the infection produces pyrogenic exotoxins. Group A β -hemolytic streptococcus is the causative agent of scarlet fever (1). Clinical manifestations of this disease are sudden fever, sore throat, exudative tonsillitis or pharyngitis, "the strawberry tongue," and a distinctive rash that appears as papular exanthema (as sandpaper). The rash usually appears on the neck, chest, underarms, elbows,

and groin, as well as on the inner thighs. It is characteristic that scarlet rash does not spread to the face, but the cheeks become flushed, and the area around the mouth stays pale (1).

Humans are the primary reservoir of infection. It is typically transmitted through respiratory droplets or direct contact with infected persons or reservoirs, and more rarely, indirectly by contact with objects used by infected persons (1). The incubation period is most frequently 2 to 5 days (minimum 1 day, maximum 7 days). Scarlet fever

je izolacijom β -hemolitičkog streptokoka grupe A brisa grla (2).

Terapija je antibiotska, a lekovi izbora su penicilin ili amoksicilin (3). Ukoliko se šarlach ne leči osoba može biti zarazna 2 do 3 nedelje nakon pojave simptoma. Uz adekvatnu terapiju penicilinom zaraznost prestaje u roku od 24 sata (1).

Šarlach je uglavnom dečija bolest i u oko 90% slučajeva se javlja kod dece mlađe od 10 godina. Najveća učestalost ovog oboljenja je među decom uzrasta od 4 godine, a često se javlja u uzrastu od 2 do 8 godine (2). Streptokokna angina-faringitis i šarlach su uobičajni u zoni sa umerenom klimom, ređi u subtropskim predelima i još ređi u tropskim predelima. Oboljenje se javlja u toku cele godine, ali je vrh obolevanja krajem zime i u rano proleće (1). Epidemije šarlaha uvek se javljaju u dečijim kolektivima (vrtićima, školama i ustanovama za decu) (4). Tokom 17. i 18. veka epidemije šarlaha prijavljene su širom Evrope i Severne Amerike (5). Od početka 20. veka ova bolest nije među vodećim ozbiljnim bolestima dece zbog povećanja broja antibiotika kojim se leči i poboljšanja životnog standarda (6).

Poštovanje i blagovremena primena protiv-epidemijskih mera doprinose uspešnom zaustavljanju daljeg širenja infekcije (rano otkrivanje izvora, rezervoara i puteva prenošenja zaraznih bolesti, epidemiološko ispitivanje i istraživanje, postavljanje dijagnoze, prijavljivanje obolelih, izolacija, lečenje obolele dece, lična zaštita od infekcije, tekuća dezinfekcija, zdravstveno vaspitanje i edukacija zdravstvenih radnika) (1,4).

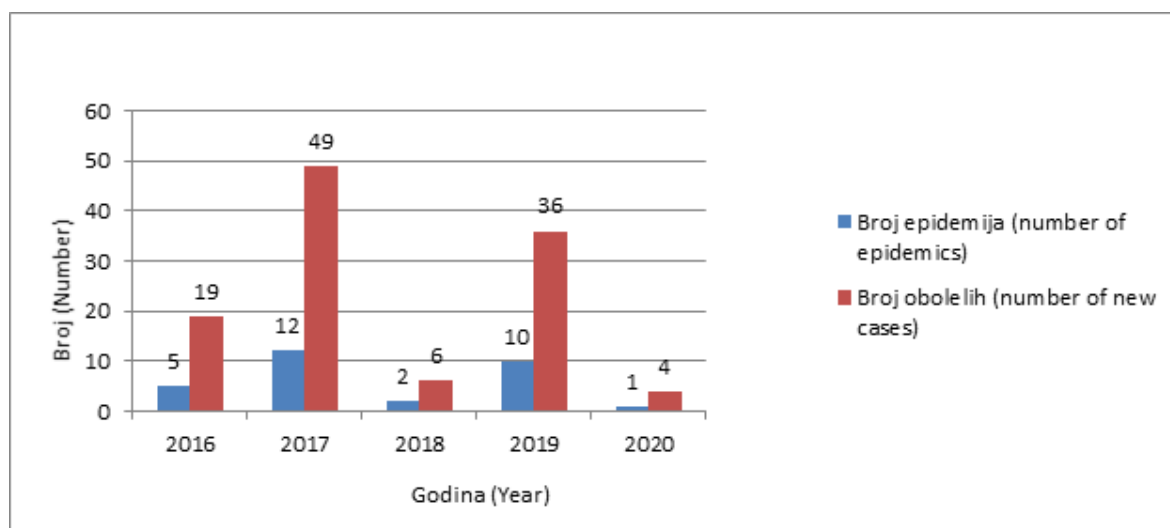
Cilj ovoga rada je da se analiziraju epidemiološke karakteristike epidemija šarlaha koje su se javile u vrtićima u Beogradu tokom perioda od 2016. do 2020. godine.

Metode

U cilju analize epidemioloških karakteristika epidemija šarlaha u vrtićima Beograda prikupljeni su podaci iz Gradskog zavoda za javno zdravlje Beograd za petogodišnji period (2016-2020. godine). Korišćeni izvori podataka su: epidemiološki upitnici, medicinska dokumentacija i rezultati bakterioloških analiza obavljene u laboratoriji Gradskog zavoda za javno zdravlje Beograd. Prisustvo β -hemolitičkog streptokoka grupe A kod obolele dece dokazano je bakteriološkim pregledom briseva grla i nosa. Statistička obrada podataka urađena je primenom SPSS programa (IBM SPSS Statistics 22). U analizi podataka korišćen je apsolutan broj obolelih, kao i opšte i specifične stope incidencije. Specifične stope incidencije računane su kao količnik broja novoobolelih od šarlaha za određen uzrast i broja stanovnika za dati uzrast. Sve stope su iskazane na 100.000. Podaci o broju stanovnika preuzeti su iz popisa stanovništva za 2011. godinu.

Rezultati

U periodu od 2016. do 2020. godine registrovano je 30 epidemija šarlaha u kojima je ukupno obolelo 114 dece iz 23 beogradska vrtića. Godišnji broj epidemija kretao se od jedne do 12, a broj obolelih od 4 do 49 (grafikon 1). U 2017. godini bilo je 12 epidemija sa ukupno 49 obolelih, što



Grafikon 1. Broj epidemija i novoobolelih od šarlaha, Beograd, 2016 – 2020. godine

diagnosis is usually made according to the clinical presentation, and it is confirmed by the isolation of Group A β -hemolytic streptococcus in throat swabs (2).

The treatment includes antibiotics, and the drug of choice is penicillin or amoxicillin (3). If scarlet fever is not treated, it can be infectious 2 to 3 weeks after the symptoms appear. When penicillin is used in the treatment, contagiousness stops within 24 hours (1).

Scarlet fever is mainly a childhood disease, and in 90% of cases, it affects children younger than 10 years. The highest incidence of this disease is among children aged 4, and it is often seen between the ages 2 to 8 years (9). Streptococcal tonsillitis-pharyngitis and scarlet fever are common in moderate climates, while they are rarely seen in subtropical and very rarely in tropical climates. The disease appears at any time of year, but it peaks in late winter and early spring (1). Scarlet fever outbreaks always appear in children's collective institutions (kindergartens, schools, and institutions for children) (4). During the 17th and 18th centuries, epidemics of scarlet fever were reported throughout Europe and North America. Since the beginning of the 20th century, this disease has not been among the leading serious children's diseases due to the increase in the number of antibiotics used for the treatment and due to the improvement of standards of living (6).

Respect and timely application of anti-epidemic measures contribute to the successful cessation of further spread of infection (early detection of cause, reservoirs, and ways of transmission of

contagious disease, epidemiological investigation and examination, early diagnosis, disease reporting, isolation, treatment of ill children, personal protection from infection, ongoing disinfection, health education and education of health care workers) (1,4).

The aim of this paper is to analyze the epidemiological characteristics of scarlet fever epidemics in kindergartens in Belgrade in the period 2016 to 2020.

Methods

In order to analyze the epidemiological characteristics of scarlet fever epidemics in kindergartens in Belgrade, data were collected from the City Institute of Public Health Belgrade for the five-year period (2016-2020). The data sources used are: epidemiological questionnaires, medical documentation, and the results of bacteriological analyzes performed in the laboratory of the City Institute of Public Health in Belgrade. The presence of Group A β -hemolytic streptococcus in ill children was proved by bacteriological examination of nose and throat swabs. The statistical analysis of data was done with the help of the SPSS program (IBM SPSS Statistics 22). The total number of cases was used for the analysis of data, as well as crude and specific incidence rates. Specific incidence rates were calculated as the total number of new cases of scarlet fever for the specific age group divided by the total population in that age group. All rates were calculated per 100,000. Population data were taken from the 2011 census.

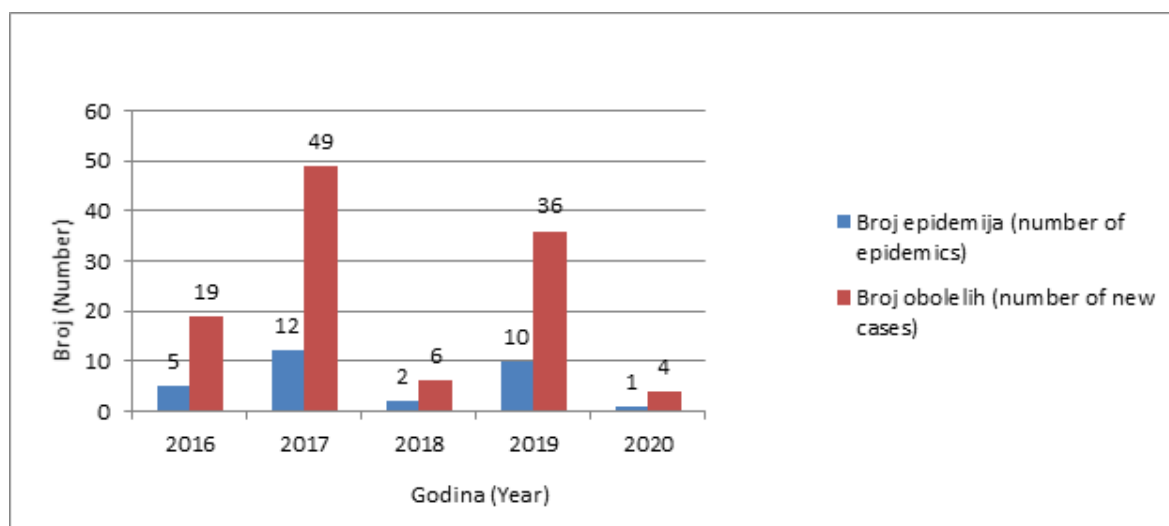


Figure 1. Number of epidemics and new cases of scarlatina fever, Belgrade, 2016 - 2020

Tabela 1. Distribucija novoobolelih od šarlaha i uzrasno specifične stope incidencije (na 100.000) prema polu i uzrastu, Beograd, 2016 – 2020. godine

Uzrast (godine)	Dečaci Broj (%) n=66	Dečaci (Stopa*)	Devojčice Broj (%) n=48	Devojčice (Stopa*)	Ukupno Broj (%) n=114	Ukupno (Stopa*)
1	0	0	0	0	0	0
2	1 (1,5)	11,7	1 (2,0)	12,5	2 (1,7)	12,3
3	17 (25,7)	207,3	18 (37,5)	232,5	35 (30,7)	219,6
4	17 (25,7)	214,4	21 (43,7)	276,2	38 (33,3)	244,6
5	13 (19,6)	163,7	4 (8,3)	53,0	17 (14,9)	109,7
6	12 (18,1)	152,2	2 (4,1)	26,2	14 (12,2)	90,4
7-9	6 (9,0)	25,0	2 (4,1)	8,8	8 (7,0)	17,2

predstavlja najveći ukupan broj obolelih u jednoj godini. Najmanji broj epidemija (i to samo jedna), kao i najmanji broj obolelih u epidemijama (samo četvero obolelih), registrovani su 2020. godine. U ovom petogodišnjem periodu, prosečan broj prijavljenih epidemija je iznosio 6, a prosečan broj obolelih u epidemijama 22.

Tokom posmatranog petogodišnjeg perioda, najveći broj obolelih među svim obolelima od šarlaha je bio među decom uzrasta 4 godine (33,3%), a najmanji među decom uzrasta od dve godine (1,7%) (tabela 1). Nešto je veći broj obolelih dečaka (57,9%) nego devojčice (42,1%). Najviša uzrasno specifična stopa kod dečaka bila je u uzrastu od četiri godine (214,4/100.000), a najmanja u uzrastu od dve godine (11,7/100.000). Dok kod devojčica najviša uzrasno specifična stopa takođe bila u uzrastu od 4 godine (276,2/100.000), a najmanja u uzrasnoj grupi od 7-9 godina (8,8/100.000) (tabela 1).

U svakoj posmatranoj godini najviša uzras-

na specifična stopa incidencije je bila u uzrastu 1-4 godine, a zatim u uzrastu 5-9 godina, a najmanje kod osoba starijih od 15 godina (tabela 2). Prosečna petogodišnja stopa incidencije je iznosila 383,7 na 100.000 za uzrast 1-4 godine, a 262,8 na 100.000 za uzrast 5-9 godina (tabela 2).

Najveći broj novoobolele dece registrovan je u gradskim opštinama Novi Beograd – 38 (33,3%), Palilula-24 (21,1%), Čukarica – 22 (19,3%), Vračar-12 (10,5%) i Zvezdara-11 (9,64%), a najmanji u prigradskoj opštini Obrenovac – 7 (6,14%). U ostalim opštinama Beograda nije registrovano obolevanje.

Sezonska distribucija ukazuje da je najveći broj novoobolelih registrovan u rano proleće (mart-april) – 35 (30,7%) i na kraju zime (januar-februar) – 28 (24,6%), što odgovara sezonskoj distribuciji ovoga oboljenja (grafikon 2).

Kod svih obolelih klinička slika se manifestovala povišenom telesnom temperaturom, bolom u grlu, hiperemijom ždrela i ospom po koži. Od 114 obolele dece od šarlaha tokom posmatranog peri-

Tabela 2. Broj novoobolelih i uzrasno specifične stope incidencije (na 100.000) za šarlaha, Beograd, 2016 – 2020. godine

Uzrasne grupe Godine	< 1 Broj (Stopa*)	1-4 Broj (Stopa*)	5-9 Broj (Stopa*)	10-14 Broj (Stopa*)	15-19 Broj (Stopa*)	20-29 Broj (Stopa*)	60+ Broj (Stopa*)	Ukupno Broj (Stopa*)
2016	5 (29,4)	304 (466,9)	290 (374,3)	32 (43,7)	3 (3,5)	6 (2,6)	0	640 (38,35)
2017	2 (11,7)	464 (712,7)	347 (447,8)	37 (50,5)	4 (4,7)	9 (4,0)	1 (0,2)	864 (52,07)
2018	0	182 (279,5)	173 (265,7)	23 (31,4)	1 (1,1)	7 (3,1)	2 (0,5)	388 (23,38)
2019	3 (17,6)	229 (351,7)	176 (227,1)	15 (20,4)	0	6 (2,6)	0	429 (25,85)
2020	0	70 (107,5)	32 (41,3)	10 (13,6)	1 (1,1)	8 (3,5)	0	121 (7,14)
2016-2020	10 (11,7)	1249 (383,7)	1018 (262,8)	117 (31,9)	9 (2,1)	36 (3,22)	3 (0,1)	2442 (29,4)

*U svakoj posmatranoj godini najviša uzrasna specifična stopa incidencije je bila u uzrastu 1-4 godine, a zatim u uzrastu 5-9 godina, a najmanje kod osoba starijih od 15 godina (tabela 2). Prosečna petogodišnja stopa incidencije je iznosila 383,7 na 100.000 za uzrast 1-4 godine, a 262,8 na 100.000 za uzrast 5-9 godina.

Table 1. Distribution of new cases of scarlet fever and age-specific incidence rates (per 100,000) by gender and age, Belgrade, 2016 - 2020

Age (years)	Boys Number (%) n=66	Boys (Rate*)	Girls Number (%) n=48	Girls (Rate*)	Total Number (%) n=114	Total (Rate*)
1	0	0	0	0	0	0
2	1 (1.5)	11.7	1 (2.0)	12.5	2 (1.7)	12.3
3	17 (25.7)	207.3	18 (37.5)	232.5	35 (30.7)	219.6
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6	12 (18.1)	152.2	2 (4.1)	26.2	14 (12.2)	90.4
7-9	6 (9.0)	25.0	2 (4.1)	8.8	8 (7.0)	17.2

Results

In the period from 2016 to 2020, 30 scarlet fever epidemics were registered, with a total of 114 ill children from 23 Belgrade kindergartens. The annual number of epidemics ranged from 1 to 12, while the number of new cases ranged from 4 to 49 (Graph 1). In 2017, there were 12 epidemics with 49 affected persons, which is the largest total number of new cases in one year. The smallest number of epidemics (only one) and the smallest number of new cases in epidemics (only 4 new cases) were registered in 2020. In this five-year period, the average number of reported epidemics was 6, while the average number of new cases was 22.

During the observed five-year period, the highest number of patients among all patients with scarlet fever was among children aged 4 years (33.3%), while the lowest number was among children aged 2 years (1.7%) (Table 1). There were slightly more sick boys (57.9%) than girls (42.1%).

The highest age-specific rate in boys was in the age group 4 years (214.4/100,000), while the lowest was in the age group 2 years (11.7/100,000). In girls, the highest age-specific rate was also in the age group 4 years (276.2/100,000), while the lowest was in the age group 7-9 years (8.8/100,000) (Table 1).

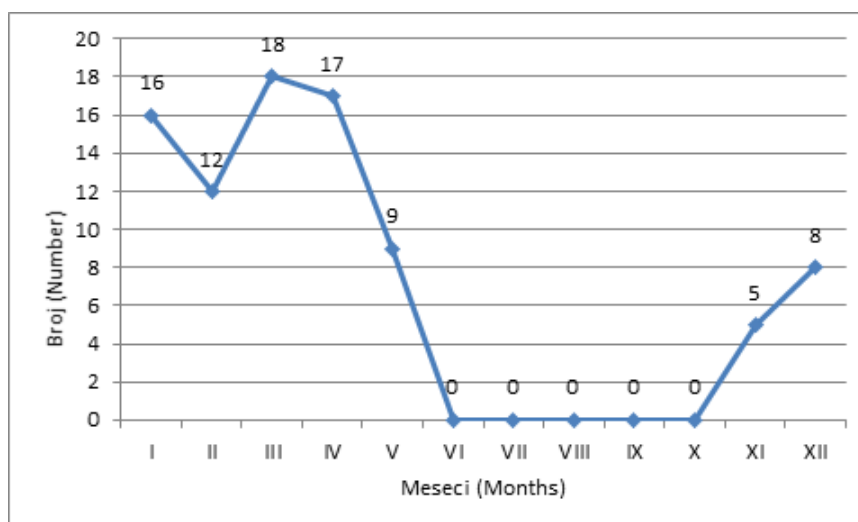
In each observed year, the highest age-specific incidence rate was in the age group 1-4 years, then in the age group 5-9 years, whereas the lowest rate was in persons older than 15 years (Table 2). The average five-year incidence rate was 383.7 per 100,000 in the age group 1-4 years and 262.8 per 100,000 in the age group 5-9 years (Table 2).

The largest number of ill children was registered in the following municipalities: Novi Beograd – 38 (33.3%), Palilula – 24 (21.1%), Cukarica – 22 (19.3%), Vracar – 12 (10.5%), and Zvezdara - 11 (9.64%), while the smallest number was in the suburban municipality Obrenovac – 7 (6.14%). The

Table 2. Number of new cases and age-specific incidence rates (per 100,000) for scarlatina, Belgrade, 2016-2020

Age groups Years	< 1 Number (Rate*)	1-4 Number (Stopa*)	5-9 Broj (Rate*)	10-14 Number (Rate*)	15-19 Number (Rate*)	20-29 Number (Rate*)	60+ Number (Rate*)	Total Number (Rate*)
2016	5 (29.4)	304 (466.9)	290 (374.3)	32 (43.7)	3 (3.5)	6 (2.6)	0	640 (38.35)
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2019	3 (17.6)	229 (351.7)	176 (227.1)	15 (20.4)	0	6 (2.6)	0	429 (25.85)
2020	0	70 (107.5)	32 (41.3)	10 (13.6)	1 (1.1)	8 (3.5)	0	121 (7.14)
2016-2020	10 (11.7)	1249 (383.7)	1018 (262.8)	117 (31.9)	9 (2.1)	36 (3.22)	3 (0.1)	2442 (29.4)

*In each observed year, the highest age-specific incidence rate was at the age of 1-4 years, followed by 5-9 years, and the lowest in persons older than 15 years (Table 2). The average five-year incidence rate was 383.7 per 100,000 for ages 1-4, and 262.8 per 100,000 for ages 5-9.



Grafikon 2. Distribucija novoobolelih od šarlaha po mesecima, Beograd, 2016 – 2020. godine

oda, kod 66 (57,9%) obolele dece dijagnoza šarlaha je postavljena na osnovu laboratorijske potvrde prisustva β -hemolitičkog streptokoka grupe A u brisu grla i/ili nosa, a kod 48 (42,1%) prema kliničkoj slici (grafikon 3).

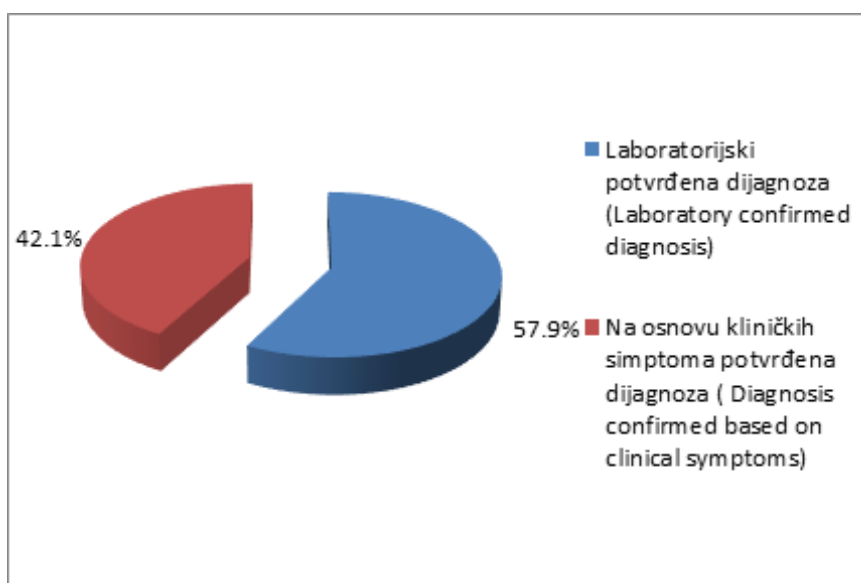
U cilju utvrđivanja prisustva beta hemolitičkog streptokoka grupe "A" kod dece i zaposlenih u vrtićima, u okviru epidemioloških istraživanja u posmatranom petogodišnjem periodu uzorkovana su ukupno 1.393 brisa grla i nosa i to od dece – 151 i zaposlenih – 243. Bakteriološkim pregledom briseva grla i nosa od dece i zaposlenih iz kontakta sa obolelom decom, kod 349 (30,3%) dece i 13 (5,3%) zaposlenih dokazano je prisustvo beta hemolitičkog

og streptokoka grupe "A".

Najveći broj novoobolele dece od šarlaha je bio prvog dana – 45 (39,4%), a nešto manje drugog – 18 (15,7%) i trećeg dana – 14 (12,2%) od pojave prvog slučaja ovog oboljenja u kolektivu (tabela 3).

Diskusija

U našoj studiji, u periodu od 2016. do 2020. godine, registrovano je 30 epidemija šarlaha i 114 novoobolele dece iz 23 beogradska vrtića. U Srbiji, u periodu od 2015. do 2019. godine registrovano je 45 epidemija šarlaha u kojima je obolelo 286 dece (7). U Nemačkoj, u okrugu Rojtligen samo u 2017. godini registrovano je 57 epidemija šarlaha,



Grafikon 3. Distribucija obolele dece od šarlaha na osnovu načina postavljene dijagnoze, Beograd, 2016 – 2020. godine

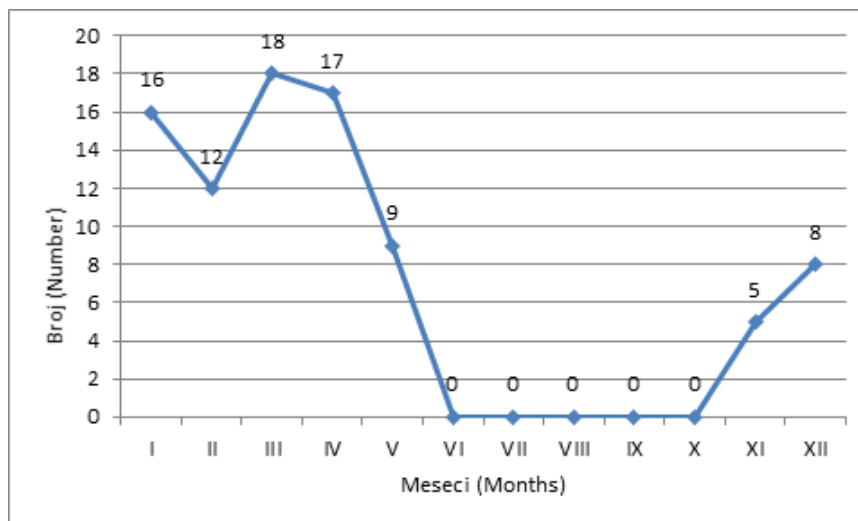


Figure 2. Distribution of new cases of scarlet fever by months, Belgrade, 2016 – 2020.

disease was not registered in other municipalities of the city of Belgrade.

Seasonal distribution pointed to the fact that the largest number of new cases was registered in early spring (March-April) – 35 (30.7%) and in late winter (January-February) – 28 (24.6%), which corresponds to the seasonal distribution of this disease (Graph 2).

In all patients, the disease was clinically manifested as fever, sore throat, throat hyperemia, and skin rash. Of 114 children affected by scarlet fever during the observed period, in 66 (57.9%) ill children, the diagnosis was made according to the laboratory confirmation of group A β -hemolytic streptococcus in the throat and/or nose swabs,

while in 48 children (42.1%) the diagnosis was made according to the clinical presentation (Graph 3).

In order to determine the presence of Group A β -hemolytic streptococci in children and employees in kindergartens, within the scope of epidemiological investigations, in the observed time period, the total of 1393 throat and nose swabs were sampled, that is, from children – 151 and employees – 243. Bacteriological examination of the nose and throat swabs taken from children and employees who had contact with ill children, in 349 children (30.3%) and 13 employees (5.34%), the presence of Group A β -hemolytic streptococci was confirmed.

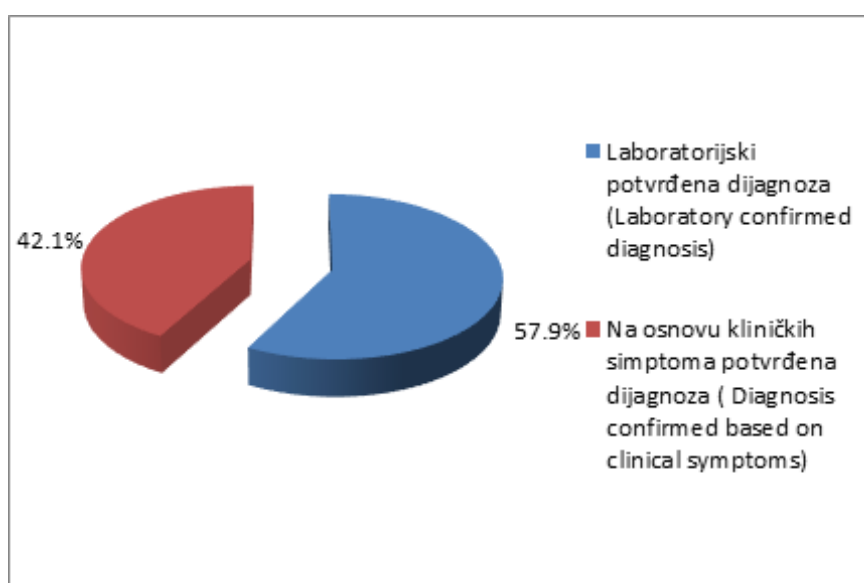


Figure 3. Distribution of children with scarlet fever based on the method of diagnosis, Belgrade, 2016 – 2020.

Tabela 3. Distribucija obolevanja od šarlaha po danima u odnosu na pojavu prvog slučaja ovog oboljenja u vrtiću, Beograd, 2016 – 2020. godine

Dan od pojave prvog slučaja obolelog od šarlaha u kolektivu	Dečaci Broj (%) n=66	Devojčice Broj (%) n=48	Ukupno Broj (%) n=114
1	28 (42,4)	17 (35,4)	45 (39,4)
2	10 (15,1)	8 (16,6)	18 (15,7)
3	8 (12,1)	6 (12,5)	14 (12,2)
4	3 (4,5)	4 (8,3)	7 (6,1)
5	3 (4,5)	6 (12,5)	9 (7,8)
6	5 (7,5)	4 (8,3)	9 (7,8)
7	1 (1,5)	1 (2,0)	2 (1,7)
8	5 (7,5)	0	5 (4,3)
9	3 (4,5)	2 (4,1)	5 (4,3)

što je činilo 55% svih prijavljenih slučajeva obolelih od šarlaha u okrugu (8).

Šarlah uzrokovan streptokokom grupe A (*Streptococcus pyogenes*), bio je uobičajna zarazna bolest kod dece pre početka 20. veka i glavni uzrok smrti, sa rizikom od smrtnog ishoda > 30%. Različiti faktori, uključujući poboljšanje higijene i uvođenje efikasnih antibiotika, doveli su do nestanka šarlaha kao glavnog uzrok smrti kod dece do sredine 20. veka. Međutim, tokom protekle decenije velike epidemije su prijavljene u Vijetnamu (< 23.000 slučajeva u 2009), Kini (>100.000 slučajeva koje je prijavilo Ministarstvo zdravlja) i Hong Kongu (> 1.000 slučajeva, dok su pre 2011. godine prijavljeni samo sporadični slučajevi). Manje epidemije prijavljene su u Kanadi (>100 slučajeva, 2012), Kansasu, SAD 2012, Meksiku 2000. i Valenciji, Španiji (40 slučajeva 2011.). Razlog ove nove epidemije šarlaha u svetu ostaje nejasan. Pretpostavlja se da je ovaj fenomen posledica mikrobnih determinanti (novi sojevi sa većim kapacitetom virulencije). Verovatno je da su uključeni i faktori životne sredine i domaćina, kao i višestruki kombinovani faktori kao što su meteorološke promene (9).

Prema rezultatima naše studije, tokom posmatranog petogodišnjeg perioda u Beogradu su registrovane ukupno 2442 obolele osobe od šarlaha. Najviša uzrasno specifična stopa incidencije zabeležena je u uzrasnoj grupi od 1 do 4 godine (383,7/100.000), a najniža u najstarijem uzrastu (60 i više godina) (0,1/100.000). Tokom posmatranog petogodišnjeg perioda, najčešće su obolevale deca uzrasta 4 godine (244,6/100.000), a najređe uzrasta od 2 godine (12,3/100.000). Epidemiološ-

ka istraživanja sprovedena u Hong Kongu u periodu 2012-2015. godine, ukazuju da je najveća incidencija obolevanja bila registrovana kod dece mlađe od pet godina (18,1/100.000) (10). Takođe, prema podacima epidemiološkog nadzora sprovedenog u Poljskoj 2013. godine, najviša incidencija obolelih od šarlaha registrovana je među decom uzrasta pet godina (949/100.000) i četiri godina (916,6/100.000), što je slično rezultatima naše studije (11). Rezultati studije sprovedene u provinciji Džedžu u Koreji (2002-2016), ukazuju da je najviše obolelih od šarlaha bilo u starosnoj grupi 0-2 godine, što je suprotno našim rezultatima (12).

U našoj studiji dečaci su nešto više obolevali od šarlaha nego devojčice. Proporcija obolelih dečaka prema devojčicama iznosi 1,37:1. Slično našim rezultatima, studija sprovedena u provinciji Džedžijang u Kini, u period 2004-2018 godine, pokazuje da proporcija obolelih osoba muškog pola je nešto veća nego kod žena (1,62:1) (13). Tokom perioda 01.07.2016. – 30.06.2018. godine sprovedena je studija u sedam pedijatrijskih centara u Australiji, koja je pratila decu obolelu od oboljenja izazvanih težom formom beta hemolitičkog streptokoka grupe "A". Kod svih obolelih (181) laboratorijski je potvrđen izolat streptokoka. Češće su obolevali dečaci (107; 59,1%). Većina pacijenata je bilo mlađe od 5 godina (115; 63,5%), uključujući 32 (17,7%) osobe mlađe od godinu dana. Ozbiljnu formu oboljenja je imalo 74 (40,9%) pacijenta, a 26 (14,4%) je imalo sindrom toksičnog šoka. Iako se većina pacijenata oporavila (122, 67,4%), kod 5 (2,8%) je došlo do smrtnog ishoda (14). U poređenju sa navedenom epidemijom, naše epidemije su

Tabela 3. Distribution of disease by days in relation to the occurrence of the first case of the disease in kindergartens, Belgrade, 2016 - 2020

The day since the appearance of the first case of a scarlet fever in the time	Boys No (%) n=66	Boys No (%) n=48	Boys No (%) n=114
1	28 (42.4)	17 (35.4)	45 (39.4)
2	10 (15.1)	8 (16.6)	18 (15.7)
3	8 (12.1)	6 (12.5)	14 (12.2)
4	3 (4.5)	4 (8.3)	7 (6.1)
5	3 (4.5)	6 (12.5)	9 (7.8)
6	5 (7.5)	4 (8.3)	9 (7.8)
7	1 (1.5)	1 (2.0)	2 (1.7)
8	5 (7.5)	0	5 (4.3)
9	3 (4.5)	2 (4.1)	5 (4.3)

The largest number of newly diagnosed children with scarlet fever was on the first day – 45 (39.4%), and slightly less on the second – 18 (15.7%) and the third day – 14 (12.2%) since the first case of this disease in the collective (Table 3).

Discussion

In our study, in the period from 2016 to 2020, 30 scarlet fever epidemics and 114 newly diseased children from 23 Belgrade kindergartens were registered. In Serbia, in the period from 2015 to 2019, 46 scarlet fever epidemics were registered, with 286 affected children (7). In Germany, in Reutlingen, 57 scarlet fever epidemics were registered in 2017, which made up 55% of all reported cases of scarlet fever in that region (8).

Scarlet fever caused by Group A streptococcus (*Streptococcus pyogenes*) was a common contagious disease in children before the 20th century and the main cause of death, with a risk of deathly outcome > 30%. Different factors, including better hygiene and the introduction of efficient antibiotics, led to the reduction in mortality caused by scarlet fever by the 1950s. However, during the last decade, great epidemics were reported in Vietnam (<23,000 cases in 2009), in China (>100,000 cases were reported by the Ministry of Health), and in Hong Kong (>1,000 cases, while before 2011, only sporadic cases were reported). Smaller epidemics were reported in Canada (>100 cases, 2012), Kansas, USA 2012, Mexico 2000, and in Valencia, Spain (40 cases, 2011). The reason for this new scarlet fever epidemic in the world remains unclear. It is assumed that this phenomenon is the consequence of microbial determinants (new

strains with greater virulence capacity). It is possible that environmental factors are included, as well as factors relating to the host and multiple combined factors such as meteorological changes (9).

According to our results, during the observed five-year period, a total of 2442 persons affected by scarlet fever was registered in Belgrade. The highest age-specific incidence rate was registered in the age group 1 to 4 years (383.7/100,000), while the lowest rate was in the oldest age group (60 years and older) (0.1/100,000). During the observed five-year period, children aged 4 became ill most frequently (244.6/100,000), while children aged 2 became ill most rarely 12.3/100,000). Epidemiological investigations conducted in Hong Kong in the period 2012-2015 indicated that the highest incidence was registered in children younger than 5 years (18.1/100,000) (10). Also, according to the data of one epidemiological investigation conducted in Poland in 2013, the highest incidence of new cases of scarlet fever was registered in children aged 5 (949/100,000) and 4 years (916.6/100,000), which is similar to the results of our study (11). The results of one study conducted in the province Jeju in Korea (2002-2016) indicated that the highest number of new cases of scarlet fever was in the age group 0-2 years, which is contrary to our results (12).

In our study, boys became ill slightly more frequently than girls. The ratio of boys to girls is 1.37:1. Similar to our results, a study which was conducted in Zhejiang in China, in the period 2004-2018, showed that the proportion of new cases in men was slightly higher than in women (1.62:1) (13). From the 1st of July 2016 to the 30th of June

prošle bez komplikacija, sa brzim i potpunim oporavkom dece u kratkom vremenskom periodu.

Najveći broj novoobolele dece od šarlaha je bilo u gradskoj opštini Novi Beograd 38 (33,3%), a najmanji u prigradskoj opštini Obrenovac 7 (6,14%). Prema podacima epidemiološke studije sprovedene u gradu Hefei u Kini, u periodu 2004-2008. godine, broj obolelih od šarlaha u urbanim sredinama bio je veći nego u ruralnim, što odgovara našim rezultatima (15). Mogući razlog većeg broja obolelih od šarlaha u navedenom gradu u Kini može biti i mogućnost dostupnosti većem broju laboratorija u gradskim opštinama u odnosu na ruralna područja. Takođe, razlog većeg broja obolelih u gradskim opštinama može biti dostupnost većeg broja zdravstvenih ustanova i samim time veća mogućnost pružanja zdravstvenih usluga stanovnicima ovih opština.

U našoj studiji, šarlaha je zadržalo sezonski karakter, sa najvećim brojem obolelih u martu i aprilu (30,7%) i zimskim mesecima januaru i februaru (24,6%), a najmanjim u novembru mesecu (4,3%). Suprotno našoj studiji, epidemiološko ispitivanje sprovedeno u mestu Šenjog u Kini 2018. godine, pokazuje da je najveći broj obolelih bio tokom leta u junu mesecu i u zimskom periodu u decembru (16).

Kod svih novoobolelih od šarlaha u našoj studiji klinička slika se manifestovala povišenom telesnom temperaturom, bolom u grlu, hiperemijom ždrela i ospom po koži. Od 114 obolele dece od šarlaha tokom posmatranog petogodišnjeg perioda, kod 57,9% dijagnoza šarlaha je postavljena na osnovu brisa grla i nosa, a kod 42,1% prema kliničkoj slici. U epidemiološkoj studiji sprovedenoj 2017. godine u jednoj osnovnoj i srednjoj školi Berlina, od 16 obolele dece od šarlaha kod većeg broja dece 7 (44%) dijagnoza šarlaha je postavljena prema kliničkoj slici, a kod 5 (31%) na osnovu brisa grla i nosa, suprotno rezultatima naše studije (17).

Rezultati našeg istraživanja pokazuju da su se u beogradskim vrtićima svi oboleli od šarlaha javili do devetog dana od pojave prvog slučaja bolesti u kolektivu, što ukazuje na uspešno sprovedene protiepidemijske mere. Suprotno našim rezultatima, studija sprovedena 2017. godine u vrtiću provincije Gjongi, mestu Suvon u Koreji, ukazuje da je epidemija šarlaha u tom kolektivu u odnosu na prvi slučaj oboljenja 28.03.2017. godine trajala čak 16 dana (18). Sve ovo govori o važnosti pravovremene primene protiepidemijskih mera.

Ograničenja ove studije odnose se na analizu podataka samo za jedan kratak vremenski period od pet godina, nedovoljno informacija o svakoj epidemiji posebno, kao i ne postojanju informacija o izolovanim sojeva *Streptococcus pyogenes* potvrđenih kod novoobolelih slučajeva.

Zaključak

Poštovanje i blagovremena primena protiepidemijskih mera doprinose uspešnom zaustavljanju daljeg širenja infekcije (prijava oboljenja, izolacija, lečenje obolele dece, kao i pooštrene mere higijene i tekuća dezinfekcija). Neophodna su dalja istraživanja u ovoj oblasti u cilju identifikacije modela koji bi pratili i razumeli vremenske karakteristike zaraznih bolesti, odnosno kojima je bi bilo moguće predviđanje pojave epidemije.

Konflikt interesa

Autori su izjavili da nema konflikta interesa.

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2018, a study was conducted in seven pediatric centers in Australia, and the children with the disease caused by the severe form of Group A beta-hemolytic streptococcus were monitored in this study. The isolate of streptococcus was confirmed by laboratory analyses for all new cases (181). Boys were more frequently ill (107; 59.1%). The majority of patients were younger than 5 years (115; 63.5%), including 32 (17.7%) persons younger than 1 year. Seventy-four patients (40.9%) had a severe form of the disease, while 26 (14.4%) had toxic shock syndrome. Although the majority of patients recovered (122, 67.4%), there came to the deathly outcome in 5 of them (2.8%) (14). In comparison to the mentioned epidemics, our epidemics passed without complications, with rapid and complete recovery for a short period of time.

The largest number of newly diseased children from Scarlet fever was in the city municipality of Novi Beograd 38 (33.3%), while the smallest number was in the suburban municipality Obrenovac – 7 (6.14%). According to the data of the epidemiological study conducted in the city of Hefei in China, in the period 2004-2008, the number of cases of scarlet fever was higher in urban than in rural areas, which corresponds to our results (15). A possible reason for a higher number of cases in the mentioned city in China may be the availability of a greater number of laboratories in city municipalities in comparison to rural regions. Also, a reason for the greater number of cases in city municipalities may be the availability of a greater number of health care institutions and, therefore, greater possibility of providing health care to the residents of these municipalities.

In our study, scarlet fever had seasonal character, with the largest number of cases in March and April (30.7%) and winter months January and February (24.6%), while the smallest number of cases was registered in November (4.3%). Contrary to the results of our study, one epidemiological investigation conducted in Shenyang in China in 2018 showed that the largest number of cases was in June and winter, in December (16).

In all new cases of scarlet fever in our study, the disease was manifested as fever, sore throat, hyperemia of the pharynx, and rash. Of 114 children affected by scarlet fever during the observed five-year period, in 57.9%, the diagnosis was made according to the nose and throat swabs, and 42.1% according to the clinical manifestation. In an

epidemiological study conducted in 2017, in one primary and middle school in Berlin, of 16 children affected by scarlet fever, the diagnosis was made according to the clinical manifestation in 7 of them (44%), while in 5 (31%) of them, the disease was diagnosed according to the nose and throat swabs, contrary to the results of our study (17).

The results of our study indicate that in Belgrade kindergartens, all new cases of scarlet fever appeared till the ninth day of the appearance of the first case in the group, which points to the successful implementation of prevention measures. Contrary to our results, a study conducted in one kindergarten in the province of Gyeonggi in Suwon, Korea, in 2017 showed that the epidemics of scarlet fever in that collective institution lasted 16 days, in relation to the first case, which was registered on the 28th of March, 2017 (18). All this speaks in favor of the significance of timely implementation of prevention measures.

The limitations of this study refer to the analysis of data relating to the short period of time, that is, a five-year period, the insufficient information about each separate outbreak, as well as the lack of information regarding the isolation of strains streptococcus pyogenes confirmed in new cases.

Conclusion

Respect and timely application of anti-epidemic measures contribute to the successful cessation of further spread of disease (disease reporting, isolation, treatment of sick children, as well as stricter hygiene measures and ongoing disinfection). Further research is necessary in this field to identify models with which it would be possible to monitor and understand the time characteristics of contagious diseases, which would enable us to predict possible outbreaks.

Competing interests

The authors declare no competing interests.

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