

# OBOLEVANJE I UMIRANJE OD ZARAZNIH BOLESTI, U PERIODU OD 2015. DO 2019. GODINE, NA TERITORIJI BEOGRADA

PO IZBORU UREDNIKA

EDITOR'S CHOICE

## COMMUNICABLE DISEASES INCIDENCE AND MORTALITY IN THE BELGRADE POPULATION, FROM 2015 TO 2019

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### SAŽETAK

**Uvod:** Zarazne bolesti još uvek značajno opterećuju društvo, kako u svetu, tako i kod nas. Cilj rada je bio da se analizira kretanje ukupnog broja obolelih i umrlih od zaraznih bolesti u beogradskoj populaciji, u periodu od 2015. do 2019. godine.

**Materijali i metode:** U radu je korišćena deskriptivna epidemiološka metoda. Podaci o obolevanju i umiranju od zaraznih bolesti dobijeni su iz Statističkih prikaza zdravstvene delatnosti u Beogradu Gradskog zavoda za javno zdravlje Beograd, za period od 2015. do 2019. godine. Korišćeni su podaci o broju novoobolelih i umrlih od zaraznih bolesti, kao i o broju novoobolelih po grupama zaraznih bolesti. Za procenu trendova obolevanja i umiranja od zaraznih bolesti tokom posmatranog perioda, korišćena je linearna regresiona analiza za trendove (*curve estimation*).

**Rezultati:** U periodu od 2015. do 2019. godine, na teritoriji Beograda je registrovano ukupno 144.215 lica obolelih od zaraznih bolesti. Obolevanje od zaraznih bolesti se, u posmatranom periodu, u beogradskoj populaciji smanjilo, a umiranje od zaraznih bolesti se povećalo. Tokom posmatranog perioda, nije zapažen statistički značajan trend u stopama incidencije i stopama mortaliteta od zaraznih bolesti (incidencija:  $y = 2.158,120 - 134,000 x, p = 0,073$ ; mortalitet:  $y = 4,930 + 0,250 x, p = 0,369$ ).

**Zaključak:** Zarazne bolesti, iako visoko preventabilne, i dalje su prisutne, kako u nerazvijenim, tako i u razvijenim zemljama. Pored mera opšte i lične higijene, nošenja zaštitnih maski, izbegavanja rizičnog ponašanja i zaštite od seksualno prenosivih bolesti, neophodno je javnozdravstvene mere usmeriti na zaštitu životne sredine i prevenciju širenja infektivnih agenasa van njihovih staništa, kao i na prevenciju nastanka novih infektivnih agenasa.

**Ključne reči:** zarazne bolesti, obolevanje, umiranje, trend, javno zdravlje

### ABSTRACT

**Introduction:** Communicable diseases remain a significant burden to society, both worldwide and in Serbia. This study aims to analyze the trend of the total number of patients and deaths from communicable diseases in the Belgrade population, in the period 2015 to 2019.

**Method:** A descriptive epidemiological method was used in this study. Morbidity and mortality data related to communicable diseases, taken from the Statistical Reviews of Health Activities in Belgrade issued by the City Institute of Public Health of Belgrade, for the period 2015 – 2019, were used in this study. Data on the number of new patients and deaths from communicable diseases were used, as well as data on the number of new patients, by groups of infectious diseases. Linear regression analysis for trends (*curve estimation*) was used to estimate trends in morbidity and mortality from infectious diseases during the observed period.

**Results:** A total of 144,215 persons suffering from communicable diseases was registered in Belgrade, from 2015 to 2019. Communicable disease morbidity in the observed period decreased in Belgrade, while communicable disease mortality increased. During that period, there was no statistically significant trend in incidence rates and mortality rates related to communicable diseases (incidence:  $y = 2,158.120 - 134.000 x, p = 0.073$ ; mortality:  $y = 4.930 + 0.250 x, p = 0.369$ ).

**Conclusion:** Although highly preventable, communicable diseases are still present in underdeveloped and developed countries. In addition to general and personal hygiene measures, wearing protective masks, avoiding risky behavior and using protection against sexually transmitted diseases, it is also necessary to focus public health measures on environmental protection and the prevention of the spread of infectious agents outside their habitats, as well as on the prevention of the emergence of new infectious agents.

**Key words:** communicable diseases, incidence, mortality, trend, public health

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## UVOD

Zarazne bolesti, izazvane specifičnim uzročnim agensom, nastaju kao posledica prenosa agensa ili njegovih toksičnih produkata, sa zaražene osobe ili drugog rezervoara na osetljivog domaćina, bilo direktno ili indirektno, preko zagađene hrane, vode, predmeta opšte upotrebe, prelaznog domaćina, vektora ili nežive sredine, te razmenom tečnosti koja je kontaminirana uzročnikom zaraze [1].

U svetu, od zaraznih bolesti, svake godine umre oko petnaest miliona osoba, i to najčešće od respiratornih infekcija i dijarealnih oboljenja, side (franc. *Syndrome d'immunodéficience acquise – SIDA*), tuberkuloze i malarije. U zemljama u razvoju, zarazne bolesti čine više od 40% svih uzroka smrti, a u razvijenim zemljama čine oko 1% uzroka smrti [2].

U Srbiji, zarazne bolesti su odgovorne za 0,7% ukupnog umiranja. Tokom 2019. godine, u Srbiji su od posledica zaraznih bolesti umrle 184 osobe, a najveći broj umrlih može se dovesti u vezu sa gripom, sidom i tuberkulozom [3].

Zarazne bolesti još uvek značajno opterećuju društvo, kako u svetu tako i kod nas. One su vekovima bile među vodećim uzrocima smrti i invalidnosti i predstavljale su izazov za zdravstvenu sigurnost i ljudski napredak. Pretnja, koju predstavljaju zarazne bolesti, dodatno se produbljuje stalnim pojavljivanjem novih, neprepoznatih i starih epidemija zaraznih bolesti globalnog uticaja. Tokom poslednje tri i po decenije pojavilo se najmanje trideset novih infektivnih agenasa, koji pogađaju ljude, a pokazalo se da njihovo poreklo značajno korelira sa socioekonomskim i ekološkim faktorima. Ako se stanje uzrokovano ovim faktorima bude pogoršavalo, stavljajući ljude u povećani kontakt sa patogenima koji uzrokuju bolest, postoji zabrinutost da zarazne bolesti mogu i dalje predstavljati strahoviti izazov. Stalna svest i sprovođenje efikasnih strategija za kontrolu zaraznih bolesti i pojave bolesti, i dalje su od presudnog značaja [4].

Hipokrat je, još 400 godina pre nove ere, opisao određeni broj zaraznih bolesti, a one su ostale u središtu pažnje razvoja nauke i prakse javnog zdravlja, sve do današnjih dana. U dvadesetom veku, zarazne bolesti su smatrane ključem u rešavanju zdravstvenih problema stanovništva, zahvaljujući uspostavljanju kontrole nad mikroorganizmima i poboljšanju rezultata prevencije zaraznih bolesti. Svedoci smo novonastalih zaraznih bolesti sa novim patogenim pretnjama (SARS, MERS, KOVID-19), koje predstavljaju globalni izazov za javno zdravlje u 21. veku [5].

Na osnovu glavnog ulaznog mesta prouzrokovala, najznačajnije zarazne bolesti mogu se svrstati u sledeće grupe: respiratorne, crevne, parazitarne, zoonoze, vektorske i polne.

## INTRODUCTION

Communicable diseases, caused by a specific causative agent, occur as the result of the transmission of the agent or its toxic products from an infected person or other reservoir to a susceptible host, either directly or indirectly, through contaminated food, water, objects in general use, an intermediate host, a vector or inanimate objects/mater in the environment, or through the exchange of fluid contaminated by the infectious agent [1].

Every year, around fifteen million people die worldwide from communicable diseases, most commonly from respiratory infections and diarrheal diseases, AIDS, tuberculosis and malaria. In developing countries, communicable diseases make up more than 40% of all causes of death, while in developed countries they make up 1% of causes of death [2].

In Serbia, infectious diseases make up 0.7% of overall mortality. There were 184 infectious disease-related deaths in Serbia, in 2019, and the greatest number of the deaths can be connected to the flu, AIDS, and tuberculosis [3].

Infectious diseases remain a significant burden on society, both in Serbia and worldwide. These diseases have been amongst the leading causes of death and invalidity for centuries and have posed a challenge to health safety and human progress. The threat of infectious diseases deepens with the constant appearance of new, unrecognized, and old epidemics of infectious diseases of global significance. During the past three and a half decades, at least thirty new infectious agents which affect humans have emerged, and it has transpired that their origin significantly correlates with socioeconomic and ecological factors. If the situation, caused by these factors, continues to worsen, placing humans in increased contact with disease causing pathogens, there is a concern that communicable diseases may continue to be a formidable challenge. Constant awareness and the implementation of efficient strategies for controlling communicable diseases and the occurrence of disease, remain crucial [4].

As early as 400 years BC, Hippocrates described a certain number of communicable diseases, and they have remained the focus of scientific development and public health practice to this day. In the 20<sup>th</sup> century, infectious diseases were considered the key in resolving the health problems of the population, due to the establishing of control of microorganisms and the improvement of results in preventing communicable diseases. We are all witness of the emergence of new communicable diseases which carry new pathogenic threats (SARS, MERS, COVID-19), and which represent a global challenge for public health in the 21<sup>st</sup> century [5].

Based on the main entry point of the causative agent, the most important communicable diseases

## Respiratorne zarazne bolesti

Respiratorne zarazne bolesti su dominantno najzastupljenije u ukupnom obolevanju od zaraznih bolesti, pa samim tim imaju veliki javnozdravstveni značaj. Za većinu respiratornih zaraznih bolesti, podaci se prate na osnovu pasivno prikupljenih podataka iz nadzora, izuzev za sezonsku influencu i pojedina vakcinama prevantabilna oboljenja. Najznačajnije respiratorne zarazne bolesti su: grip, akutne respiratorne infekcije, tuberkuloza, morbilli.

Grip (influenza) je visoko zarazno virusno oboljenje respiratornog trakta, koje se javlja svake sezone od oktobra do maja. Prema procenama Svetske zdravstvene organizacije (SZO), godišnje, preko 100 miliona ljudi u svetu oboli od gripa, a oko pola miliona umre zbog komplikacija. Grip je veliki javnozdravstveni i socioekonomski izazov jer može da dovede do smanjenja radne sposobnosti i opterećenosti zdravstvenog sistema. Sve zemlje sveta održavaju i unapređuju sisteme nadzora nad gripom, na osnovu preporuka Svetske zdravstvene organizacije i Evropskog centra za kontrolu bolesti (engl. *European Centre for Disease Prevention and Control – ECDC*) [6].

Opterećenje tuberkulozom u Srbiji je u poslednjih petnaest godina značajno smanjeno, zahvaljujući doslednoj primeni Nacionalnog programa, koji je zasnovan na strategijama Svetske zdravstvene organizacije, što je rezultiralo smanjenjem notifikacione stope tuberkuloze za 80%, u 2019. godini. Rezistentni oblici bolesti i dalje predstavljaju veliku javnozdravstvenu opasnost [6].

## Creвне zarazne bolesti

Creвне zarazne bolesti predstavljaju grupu bolesti koje se najčešće prenose kontaminiranom hranom, vodom, preko predmeta (indirektnim prenosom) i direktnim kontaktom, prljavim rukama. Značajne su, jer se njihova pojava može sprečiti primenom vrlo jednostavnih mera (higijena ruku, adekvatna primena mera za bezbednost hrane), ali uprkos tome, od ovih bolesti godišnje oboli oko milion ljudi širom sveta. Za grupu crevnih zaraznih bolesti podaci se prate na osnovu pasivno prikupljenih podataka iz nadzora. Zarazne bolesti iz ove grupe su: salmoneloze, šigeloze, kampilobakterioze, jersinioze, lamblijaze, hepatitis A, botulizam [6].

## Parazitarne zarazne bolesti

Parazitarne zarazne bolesti, odnosno parazitoze uzrokuju ili prenose paraziti. Od parazitarne bolesti, od 2015. godine, obaveznom prijavljivanju podleže samo šuga. Šuga je česti uzročnik epidemija u socijalnim ustanovama, kao i česti uzročnik infekcija među osobama sa imunodeficijencijom. Za prenošenje uzročnika

can be categorized into the following groups: respiratory, bowel, parasitic, zoonoses, vector-borne, and sexually transmitted diseases.

## Communicable respiratory diseases

Communicable respiratory diseases are predominant in the overall morbidity caused by infectious diseases, and therefore they are of great significance for public health. For most infectious respiratory diseases data are monitored on the basis of passively collected surveillance data, with the exception of seasonal influenza and certain diseases that are preventable with vaccines. The most important infectious respiratory diseases are the following: influenza, acute respiratory infections, tuberculosis, morbilli.

Influenza is a highly infectious viral disease of the respiratory system, which occurs in the population each season, from October until May. According to the estimates of the World Health Organization (WHO), over 100 million people become sick with the flu worldwide, while half a million die as the result of complications related to this disease. Influenza is a great public health and socio-economic challenge, as it can lead to a decrease in work ability and overburdening of the healthcare system. All countries in the world maintain and improve flu surveillance systems, on the basis of recommendations issued by the World Health Organization and the European Centre for Disease Prevention and Control (ECDC) [6].

The burden of tuberculosis infection in Serbia has been significantly reduced in the past fifteen years, owing to the consistent implementation of the National Program, which is based on WHO strategies. As a result, there has been a decrease in the tuberculosis case notification rate by 80%, in 2019. Resistant forms of the disease remain a great public health threat [6].

## Communicable bowel diseases

Communicable bowel diseases (bowel infections) are a group of diseases most commonly transmitted through contaminated food, water, objects (indirect transmission), and through direct contact, with dirty hands. They are significant as their incidence can be prevented through the application of very simple measures (hand hygiene, appropriate application of food safety measures). Nevertheless, around a million people all over the world contract these diseases every year. Data for the group of communicable bowel diseases are monitored through passively collected surveillance data. The communicable diseases belonging to this group are the following: salmonellosis, shigellosis, campylobacteriosis, yersiniosis, lamblia, hepatitis A, botulism [6].

šuge neophodan je direktni kontakt. Povećanoj učestalosti obolevanja doprinose siromaštvo, neuhranjenost, te gust kolektivni smeštaj [6].

### Zoonoze

Zoonoze su bolesti životinja od kojih mogu da obole i ljudi, a koje mogu da imaju jedno ili više ulaznih mesta. Većina oboljenja iz ove grupe se odlikuju blažom kliničkom slikom sa povoljnim ishodom. Registruju se i invazivne forme, koje mogu dovesti do smrtnog ishoda, naročito u vulnerabilnim grupama stanovništva, kao što su novorođenčad, starije osobe, trudnice, imunokompromitovane osobe. Bolesti kod kojih postoji efikasna vakcina (tetanus, besnilo) ili sistematski preventivni programi, koje preduzima veterinarska služba (antraks, trihineloz, bruceloza, Kju groznica ili besnilo) su ili eliminisane (besnilo), ili se javljaju sporadično. Podaci o obolevanju iz grupe zoonoza prikupljaju se u okviru pasivnog nadzora nad ovim oboljenjima u humanoj populaciji [6].

### Vektorske (transmisivne) zarazne bolesti

Vektorske (transmisivne) zarazne bolesti prenose vektori, među kojima su najznačajniji: vaši, komarci, buve i krpelji. Distribucija ovih bolesti zavisi, kako od faktora životne sredine, tako i od socioekonomskih faktora. Tokom poslednjih godina, značajan uticaj na transmisiju ovih bolesti imaju globalizacija i klimatske promene. Tako se neke bolesti, kao što su denga, čikungunja virusna infekcija, groznica Zapadnog Nila, pojavljuju u zemljama u kojima ranije nisu registrovane. Za većinu vektorskih zaraznih bolesti, podaci se prate na osnovu pasivno prikupljenih podataka iz nadzora. Pored vektorskih zaraznih bolesti, koje podležu obaveznom prijavljivanju prema važećoj zakonskoj regulativi – malaria, lajmska bolest, krpeljski encefalitis, lajšmanijaza, od 2012. godine, uspostavljen je sezonski nadzor nad groznicom Zapadnog Nila u humanoj populaciji [6].

### Polne zarazne bolesti

Polne zarazne bolesti se prenose polnim putem, a one koje se obavezno prijavljuju su: sifilis, gonoreja, polne infekcije izazvane hlamidijama, bolest uzrokovana HIV virusom [6].

### Ostale zarazne bolesti

Ostale zarazne bolesti obuhvataju uglavnom septikemije, izazvane različitim infektivnim agensima. Porast incidencije sepse danas predstavlja globalni problem javnog zdravlja [6].

U svetu, u većini zemalja, postoji zakonski regulisano prijavljivanje zaraznih bolesti. Prema trenutno važećoj zakonskoj regulativi, u Srbiji se prijavljuje četrdeset devet zaraznih bolesti [7,8].

### Communicable parasitic diseases

Communicable parasitic diseases, i.e., parasitoses, are caused or transmitted by parasites. As of 2015, amongst parasitic diseases, mandatory reporting applies only to scabies. Scabies is a frequent cause of epidemics in social welfare institutions, as well as a frequent cause of infection amongst immunodeficient persons. Direct contact is necessary for the transmission of the scabies infectious agent. Poverty, malnutrition, and densely populated collective accommodation contribute to increased incidence of scabies [6].

### Zoonoses

Zoonoses are diseases of animals which can also affect people, and which can have one or more entry points. Most diseases in this group have mild clinical presentation and a favorable outcome. However, invasive forms are also registered, which may lead to the lethal outcome, especially in vulnerable population groups, such as newborn babies, aged persons, pregnant women, immunocompromised individuals. Diseases for which there are efficient vaccines (tetanus, rabies) or systematic preventive programs in place, carried out by veterinary services (anthrax, trichinellosis, brucellosis, Q fever, or rabies), have either been eradicated (rabies), or occur sporadically. Data on people contracting zoonoses are collected within passive surveillance of these diseases in the human population [6].

### Communicable vector-borne diseases

Communicable vector-borne diseases are transmitted by vectors, amongst which the most important are the following: lice, mosquitos, fleas, and ticks. The distribution of these diseases depends on both environmental factors and socioeconomic factors. In recent years, globalization and climate change have had a significant impact on the transmission of these diseases. Thus, some diseases, such as dengue, the chikungunya viral infection, West Nile fever, have started to occur in countries where they had previously not been registered. Data for most vector-borne diseases are monitored on the basis of passively collected surveillance data. In addition to vector-borne diseases for which reporting is mandatory, in keeping with the current laws and regulations – malaria, Lyme disease, tick-borne encephalitis, and leishmaniasis, as of 2012, seasonal surveillance has been established for West Nile fever, in the human population [6].

### Sexually transmitted diseases

Sexually transmitted diseases are transmitted via sexual intercourse, and reporting is mandatory for the following: syphilis, gonorrhoea, sexually transmitted infections caused by chlamydia, disease caused by the HIV virus [6].

## CILJ RADA

Cilj rada jeste analiza podataka o kretanju ukupnog broja obolevanja i umiranja, kao i analiza stopa obolevanja i umiranja od zaraznih bolesti, na teritoriji Beograda, u periodu od 2015. do 2019. godine.

## MATERIJALI I METODE

Ovo je deskriptivna epidemiološka studija, u okviru koje je vršena sekundarna analiza podataka iz Statističkih prikaza zdravstvene delatnosti u Beogradu Gradskog zavoda za javno zdravlje Beograd, za period od 2015. do 2019. godine, o obolevanju i umiranju od zaraznih bolesti. Korišćeni su podaci o broju novoobolelih i umrlih od zaraznih bolesti, kao i broj novoobolelih po grupama zaraznih bolesti, u Beogradu, za posmatrani period od 2015. do 2019. godine

Put podataka o zaraznim bolestima u Statističkim prikazima zdravstvene delatnosti u Beogradu, baziran je na podacima iz izveštaja (prijava oboljenja ili smrti od zaraznih bolesti), koje su zdravstvene ustanove na teritoriji Beograda obavezne da dostave Gradskom zavodu za javno zdravlje Beograd, prema Pravilniku o prijavljivanju zaraznih bolesti u Republici Srbiji.

Kao pokazatelj obolevanja korišćena je stopa incidencije, koja se izračunava na sledeći način:

*stopa incidencije od zaraznih bolesti = broj novoobolelih od zaraznih bolesti u Beogradu u posmatranoj godini/ broj stanovnika na teritoriji Beograda x 100.000*

Kao pokazatelj umiranja korišćena je stopa mortaliteta, koja se izračunava na osnovu sledeće formule:

*stopa mortaliteta od zaraznih bolesti = broj umrlih od zaraznih bolesti u Beogradu u posmatranoj godini/ broj stanovnika na teritoriji Beograda x 100.000*

Podaci o broju stanovnika na teritoriji Beograda uzeti su iz Statističkog godišnjaka Republičkog zavoda za statistiku.

U skladu sa postavljenim ciljem rada, podaci su prikazani tabelarno i grafički. Za procenu trendova obolevanja i umiranja od zaraznih bolesti tokom posmatranog perioda, korišćena je linearna regresiona analiza za trendove (engl. *curve estimation*), kojom je iskazana veza između dve promenljive, koje procenjuju vrednost zavisne promenljive Y, na osnovu izabrane vrednosti nezavisne promenljive X.

Izračunate su jednačine linearnih trendova ( $Y = a + bX$ ), koje definišu vezu između dve promenljive koje imaju linearnu vezu, kao i njihova statistička značajnost. Pri čemu je  $a$  procenjena vrednost zavisne promenljive Y gde regresiona linija seče y-osu kada je X nula.

Regresioni koeficijent ( $b$ ) je nagib linije, ili prosečna promena Y za svaku jediničnu promenu (povećanje ili smanjenje) nezavisne promenljive X.

## Other communicable diseases

Other communicable diseases mostly include septiciemias caused by different infectious agents. The rise in the incidence of sepsis today represents a global public health problem [6].

In most countries in the world, reporting infectious diseases is regulated by law. According to the laws and regulations that are currently in force, forty-nine different communicable diseases are reported on in Serbia [7,8].

## STUDY AIM

The aim of this study is to analyze data on the fluctuation of the overall number of morbidity and mortality, as well as of the morbidity and mortality rates, related to communicable diseases, in the territory of Belgrade, in the period 2015 – 2019.

## MATERIALS AND METHODS

This is a descriptive epidemiological study wherein a secondary analysis of data from the Statistical Reviews of Health Activities in Belgrade issued by the City Institute of Public Health of Belgrade, for the period 2015 – 2019, regarding the morbidity and mortality related to infectious diseases, was performed. Data on the number of newly diseased and deceased persons from communicable diseases, as well as the number of newly diseased persons by groups of infectious diseases, in Belgrade, for the observed period (2015 – 2019), were used.

The data flow on communicable diseases in the Statistical Reviews of Health Activities in Belgrade is based on the data from reports (report of disease or death from communicable disease), which health institutions in the territory of Belgrade are obliged to submit to the City Institute of Public Health of Belgrade, according to the Rulebook on Reporting Communicable Diseases in the Republic of Serbia.

The incidence rate was used as an indicator of morbidity. It is calculated in the following way:

*communicable diseases incidence rate = number of newly diseased persons from communicable diseases in Belgrade in the observed year/population in the territory of Belgrade x 100.000*

As an indicator of mortality, the mortality rate was used. It is calculated on the basis of the following formula:

*communicable diseases mortality rate = number of deceased persons from communicable diseases in Belgrade in the observed year/population in the territory of Belgrade x 100.000*

Data on the Belgrade population were taken from the Statistical Yearbook of the Statistical Office of the Republic of Serbia.

Vrednosti  $p < 0,05$  su smatrane statistički značajnim. Pozitivna vrednost regresionog koeficijenta ukazuje na rastući trend, a negativna vrednost na opadajući trend.

Podaci su analizirani uz pomoć statističkog paketa SPSS Version 20.0 for Windows (SPSS Inc. Chicago, IL, USA) i pomoću programa Microsoft Office Excel.

## REZULTATI

Na teritoriji Beograda, u posmatranom periodu od 2015. do 2019. godine, prijavljeno je ukupno 144.215 osoba novoinficiranih zaraznim bolestima. U Tabeli 1, prikazani su broj novoinficiranih osoba i stope incidencije zaraznih bolesti na 100.000 stanovnika, u Beogradu, od 2015. do 2019. godine.

**Tabela 1.** Broj novoinficiranih lica i stope incidencije zaraznih bolesti, u Beogradu, u periodu 2015 - 2019

Godina / Year	Broj osoba novoinficiranih zaraznim bolestima / Number of persons newly infected with communicable diseases	Stope incidencije zaraznih bolesti (na 100.000) / Incidence rates of communicable diseases (per 100,000)
2015.	31.420	1.893,4
2016.	32.994	1.988,2
2017.	28.351	1.798,5
2018.	29.305	1.766,0
2019.	22.145	1.334,5

U posmatranom petogodišnjem periodu (2015 – 2019), uočava se opadajući trend broja osoba novoinficiranih zaraznim bolestima. Najveći broj osoba novoinficiranih zaraznim bolestima je bio 2016. godine, a najmanji broj je bio u 2019. godini (Tabela 1).

Trend je opadajući za stope incidencije zaraznih bolesti u Beogradu, ali nije statistički značajan (jednačina:  $y = 2.158,120 - 134,000 x$ ,  $p = 0,073$ ) (Grafikon 1).

Najveći broj osoba novoinficiranih zaraznim bolestima, u Beogradu, u posmatranom periodu, odnosio

In keeping with the defined aim of the study, data are presented in tables and graphs. For assessing morbidity and mortality trends related to communicable diseases, in the observed period, linear trend estimation (curve estimation) was used, whereby the relationship between the two variables was expressed, estimating the value of the dependent variable Y, on the basis of the selected value of the independent variable X.

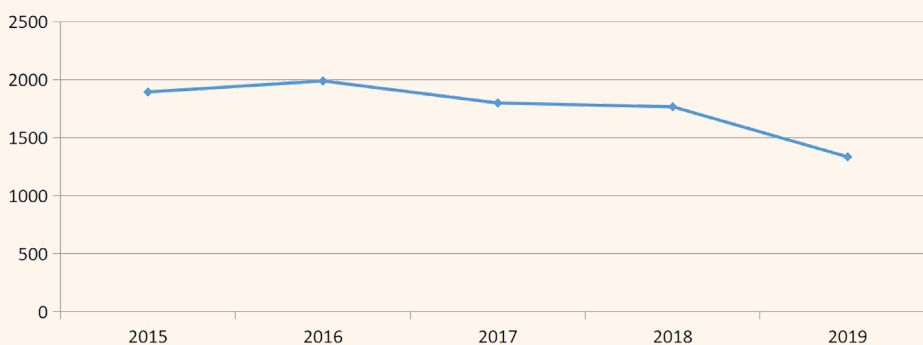
Linear trend equations were calculated ( $Y = a + bX$ ), which define the connection between two variables that have a linear relationship, as well as their statistical significance; whereby  $a$  is the estimated value of the dependent variable Y where the regression line intersects with the Y axis when X is 0. The regression coefficient (b) is the angle of the line, or the average change

**Table 1.** Number of persons newly infected with communicable diseases and incidence rates in Belgrade, in the period 2015 – 2019

of Y for each unit change (increase or decrease) of the independent variable X.

Values of  $p < 0.05$  were considered statistically significant. A positive value of the regression coefficient indicates an upward trend, while a negative value indicates a downward trend.

Data were analyzed with the statistical package SPSS Version 20.0 for Windows (SPSS Inc. Chicago, IL, USA) and with the program Microsoft Office Excel.



**Grafikon 1.** Trend stopa incidencije zaraznih bolesti, u Beogradu, u periodu 2015 - 2019

**Figure 1.** Trend of communicable diseases incidence rates, in Belgrade, in the period 2015 – 2019

se na respiratorne zarazne bolesti. Najveća vrednost obolevanja od respiratornih bolesti je zabeležena 2018. godine, a najmanja vrednost je zabeležena 2019. godine.

Obolevanje od crvenih zaraznih bolesti se smanjilo u posmatranom periodu u Beogradu, a najniže vrednosti su zapažene u 2018. i 2019. godini (Grafikon 2).

Obolevanje od polno prenosivih zaraznih bolesti, kao i od kožnih, gljivičnih i parazitarne bolesti se smanjilo u Beogradu, tokom posmatranog perioda (Grafikon 2).

Praćenjem pojedinih bolesti u grupi respiratornih zaraznih bolesti, u Beogradu, u periodu 2015 – 2019, uočavamo da je najveći broj novoinficiranih osoba obolelo od: varičele, gripa, streptokoknog faringitisa i tonzilitisa.

Zapaža se epidemijско javljanje morbila; najviše obolelih prijavljeno je 2018. godine (1.893). U Beogradu, tokom 2019. godine, prijavljeno je tri lica koja su obolela od morbila.

Broj novoinficiranih tuberkulozom opadao je tokom posmatranog perioda. Najviša vrednost novoinficiranih tuberkulozom (237) zabeležena je 2015. godine, a najniža vrednost (164) je zabeležena 2019. godine (Grafikon 3).

U okviru polno prenosivih bolesti, broj novoinficiranih HIV virusom pokazuje stabilan trend tokom posmatranog perioda. Najveći broj slučajeva novoinficiranih HIV virusom (85) prijavljen je u 2015. godini, dok je najmanji broj (68) registrovan u 2017. godini. Zapažen je manji porast broja novoobolelih od side, sa 15, u 2015. godini, na 19, u 2019. godini. Obolevanje od hlamidijaze je gotovo prepolovljeno u posmatranom

## RESULTS

In the territory of Belgrade, in the observed period (2015 – 2019), a total of 144,215 persons, newly infected with communicable diseases, was registered. Table 1 presents the number of newly infected persons and the incidence rates of communicable diseases per 100,000 population, in Belgrade, from 2015 and 2019.

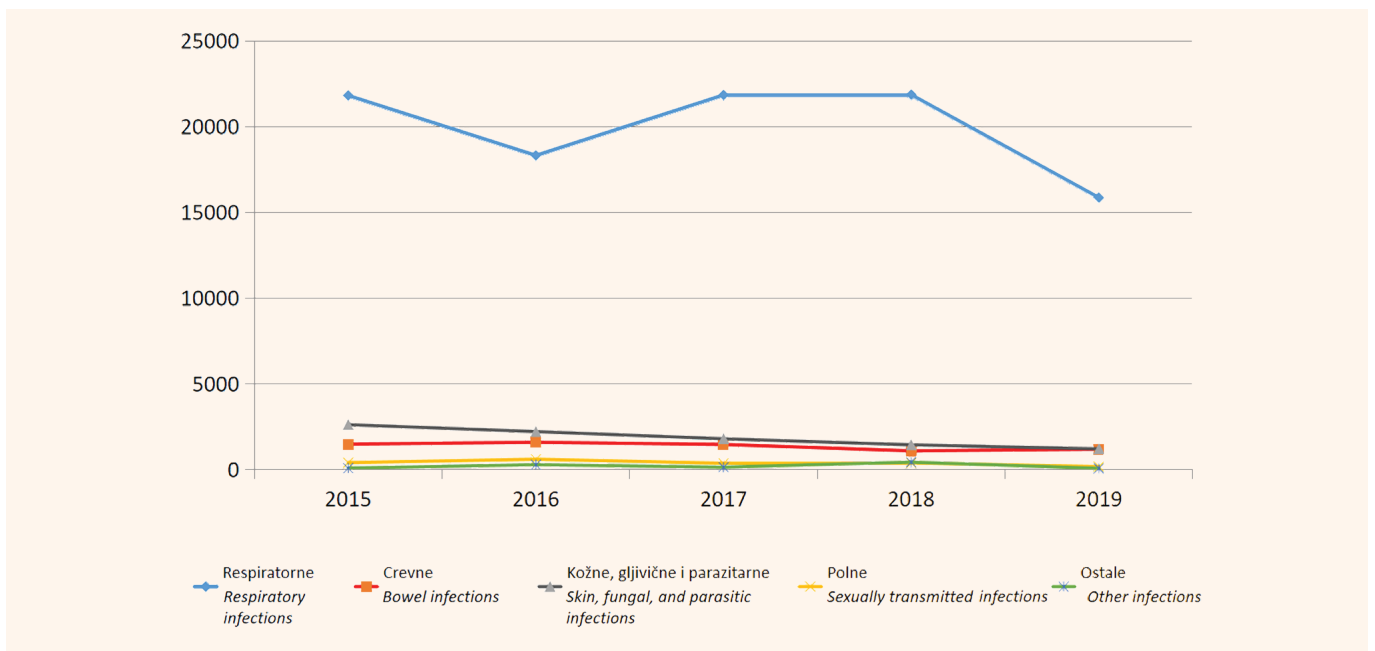
In the observed five-year period (2015 – 2019), a downward trend of persons newly infected with communicable diseases is visible. The greatest number of persons newly infected with communicable diseases was in 2016, while the smallest number of newly infected persons was in 2019 (Table 1).

The trend is a decreasing one, for communicable diseases incidence rates in Belgrade, but it is not statistically significant (equation:  $y = 2158.120 - 134.000 x$ ,  $p = 0.073$ ) (Graph 1).

In Belgrade, the greatest number of persons newly infected with communicable diseases, in the observed period, related to infectious respiratory diseases. The highest incidence of respiratory disease morbidity was registered in 2018, while the lowest incidence was registered in 2019.

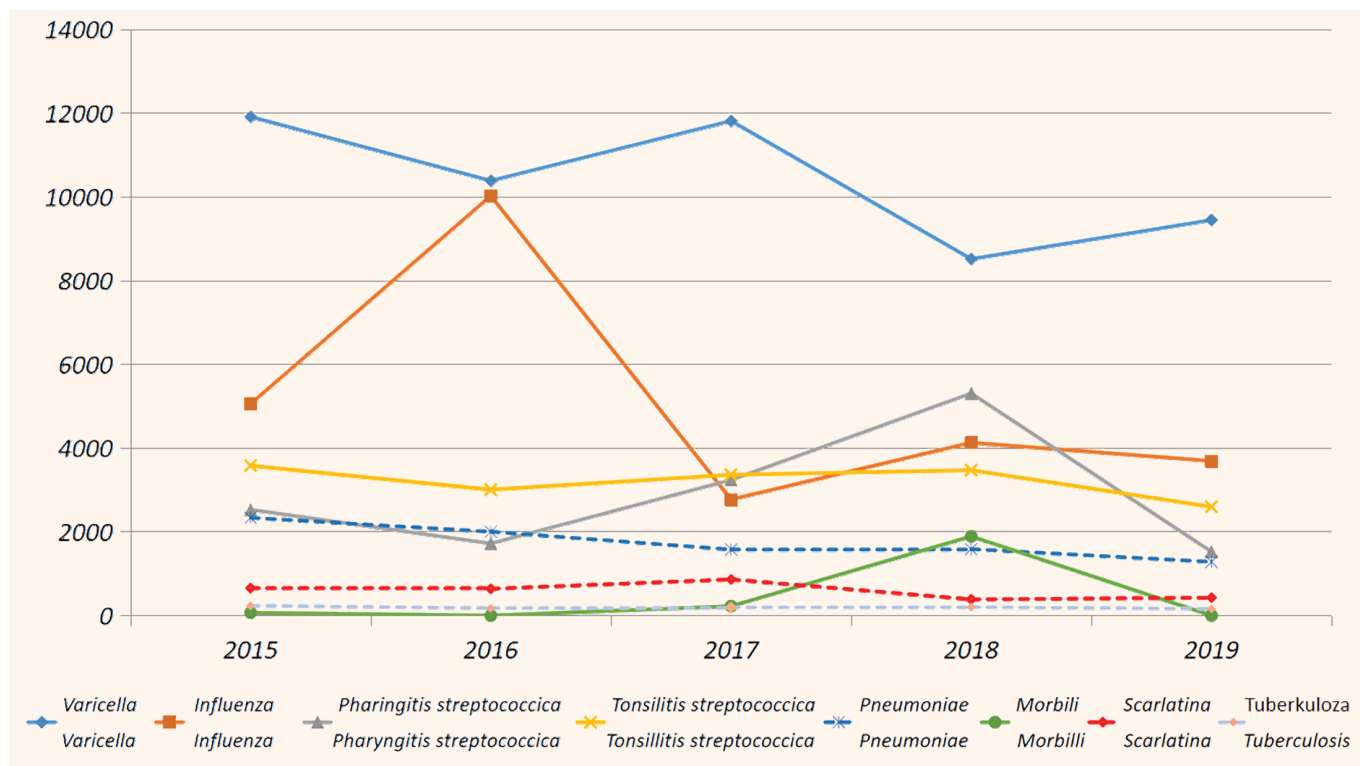
Morbidity related to infectious bowel diseases decreased in the observed period in Belgrade, and the lowest incidence was observed in 2018 and 2019 (Graph 2).

Morbidity related to sexually transmitted diseases, as well as morbidity related to skin, fungal, and parasitic diseases decreased in Belgrade, during the observed period (Graph 2).



**Grafikon 2.** Broj osoba novoinficiranih pojedinim grupama zaraznih bolesti, u Beogradu, u periodu 2015 - 2019

**Figure 2.** Number of persons newly infected with certain groups of communicable diseases, in Belgrade, in the period 2015 - 2019



**Grafikon 3.** Broj osoba novoinficiranih pojedinim bolestima u grupi respiratornih zaraznih bolesti, u Beogradu, u periodu 2015 – 2019

**Figure 3.** Number of persons newly infected with certain diseases belonging to the respiratory group of communicable diseases, in Belgrade, in the period 2015 – 2019

periodu, sa 294 (2015. godina) na 151 (2019. godina). Zapažen je manji porast obolevanja od gonoreje i sifilisa.

U Beogradu se, u posmatranom petogodišnjem periodu (2015 – 2019), zapaža porast obolevanja od potencijalno teškog vektorskog oboljenja, groznice Zapadnog Nila, koje je zabeleženo u grupi „Ostale zarazne bolesti“. Najveći broj novoinficiranih groznicom Zapadnog Nila (85) prijavljen je u 2018. godini, dok je najmanji broj (7) prijavljen u 2017. godini.

U Beogradu je, u posmatranom petogodišnjem periodu (2015 – 2019), od zaraznih bolesti umrlo 463 lica.

Uočava se porast broja umrlih od zaraznih bolesti, a najviše vrednosti su zapažene u 2018. i 2019. godini. Najveći broj umrlih od zaraznih bolesti (107) zabeležen je u 2018. godini, a najmanji broj umrlih od zaraznih bolesti (72) zabeležen je u 2017. godini.

Rastući trend stope mortaliteta od zaraznih bolesti u Beogradu nije statistički značajan (jednačina:  $y = 4,930 + 0,250x$ ,  $p = 0,369$ ), (Grafikon 4).

U Beogradu, u posmatranom periodu (2015 – 2019), najčešći uzroci smrti od zaraznih bolesti su bili: *Clostridium difficile*, sepsa, sida (HIV/AIDS), bakterijski meningitisi, tuberkuloza i groznica Zapadnog Nila. Procentualna zastupljenost najčešćih uzroka smrti od zaraznih bolesti u 2019. godini je bila: 40% preminulih od groznice Zapadnog Nila, 23% umrlih od infekcije izazvane

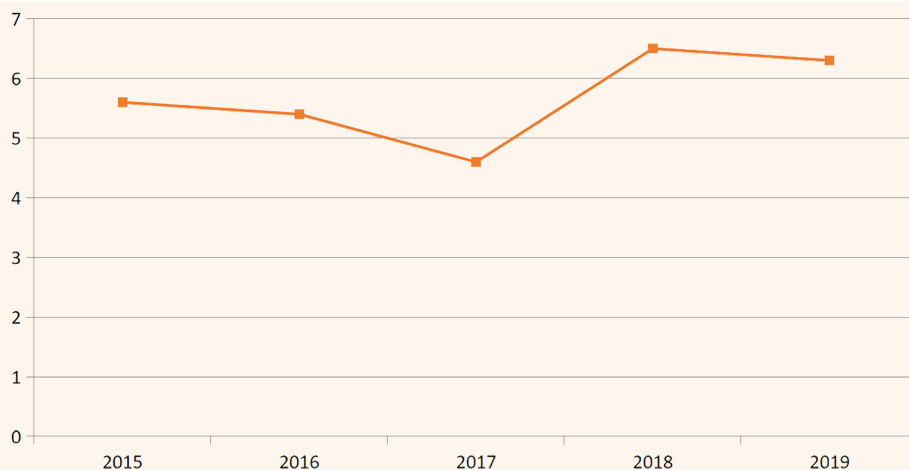
The surveillance of certain diseases in the group of communicable respiratory diseases, in Belgrade, in the period 2015 – 2019, shows that the greatest number of newly infected persons contracted the following diseases: chickenpox (varicella), influenza, streptococcal pharyngitis, and tonsillitis.

An epidemic of measles (morbili) is notable: the greatest number of diseased patients was reported in 2018 (1,893). During 2019, three persons were reported to have contracted measles in Belgrade.

In Belgrade, the number of persons newly infected with tuberculosis declined during the observed period. The highest incidence of persons newly infected with tuberculosis (237) was recorded in 2015, while the lowest incidence (164) was recorded in 2019 (Graph 3).

Amongst sexually transmitted diseases, the number of persons newly infected with the HIV virus had a stable trend during the observed period. The greatest number of persons newly infected with HIV (85) was recorded in 2015, while the smallest number (68) was registered in 2017. A small increase in the number of persons developing AIDS was noted – from 15 cases in 2015, to 19 cases in 2019. Morbidity related to chlamydiosis was almost cut in half in the observed period – from 294 (in 2015) to 151 (in 2019). A slight increase in morbidity related to gonorrhoea and syphilis was noted.





**Grafikon 4.** Trend stopa incidencije zaraznih bolesti, u Beogradu, u periodu 2015 - 2019

**Figure 4.** Trend of communicable diseases-related mortality rates in Belgrade, in the period 2015 – 2019

bakterijom *Clostridium difficile*, 19% preminulih od side, 10% preminulih od sepse, i 8% umrlih od tuberkuloze.

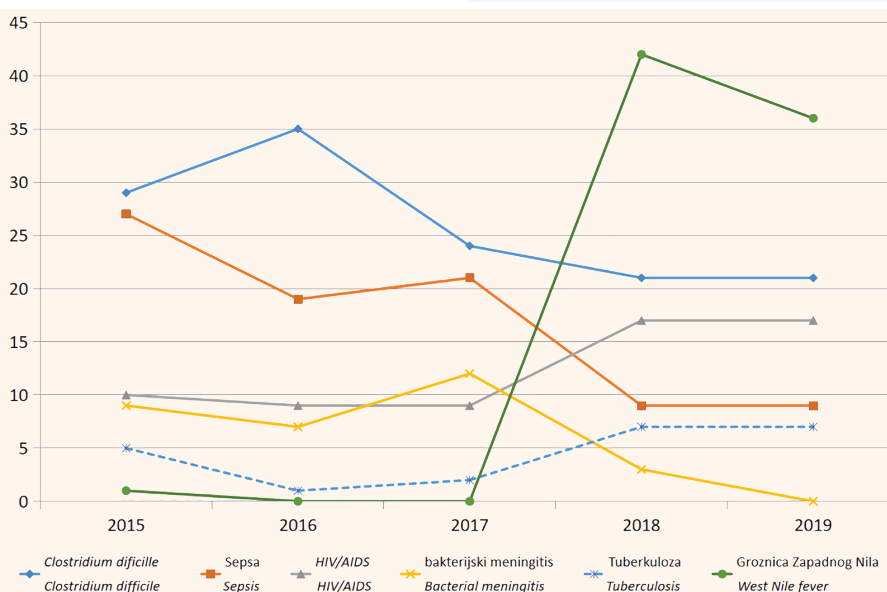
U istom periodu se uočava smanjenje broja umrlih od infekcije izazvane bakterijom *Clostridium difficile*, sa 35 preminulih (2016. godina) na 21 preminulog (2019. godina), kao i smanjenje broja umrlih od sepse za tri puta, sa 27 preminulih (2016. godina) na devet preminulih (2019. godina).

U posmatranom periodu, zapažen je porast broja umrlih lica od side, od 10 umrlih lica (2015. godina) na 17 preminulih (2019. godina), kao i porast broja umrlih osoba od tuberkuloze, od pet preminulih lica (2015. godina) na 7 preminulih (2019. godina).

Zapaža se da je, u 2018. godini, od groznice Zapadnog Nila umrlo 42 lica, a u 2019. godini 36 osoba, što čini oko 40% svih uzroka smrti od zaraznih bolesti (Grafikon 5).

In Belgrade, in the observed five-year period (2015 – 2019), an increase of morbidity related to a potentially severe vector-borne disease, West Nile fever (recorded in the group of diseases categorized as ‘Other communicable diseases’), was registered. The greatest number of persons newly infected with West Nile fever (85) was registered in 2018, while the smallest number of them (7) was registered in 2017.

In the observed five-year period (2015 – 2019), 463 persons died from communicable diseases in Belgrade. The number of persons deceased from communicable diseases was noted, with the highest incidence recorded in 2018 and 2019. The greatest number of persons deceased from communicable diseases (107) was recorded in 2018, while the smallest number of persons deceased from communicable diseases (72) was recorded in 2017.



**Grafikon 5.** Broj umrlih od najčešćih uzročnika smrti od zaraznih bolesti, u Beogradu, u periodu 2015 – 2019

**Figure 5.** Number of the most common causes of communicable diseases-related deaths in Belgrade, in the period 2015 – 2019

## DISKUSIJA

Na teritoriji Beograda, u toku posmatranog perioda (2015 – 2019), zabeležen je pad trenda incidencije zaraznih bolesti, ali nije postignuta statistička značajnost. Najveći broj novoinficiranih je bio iz grupe respiratornih zaraznih bolesti. Obolevanje od varičele je bilo na prvom mestu po učestalosti iz grupe respiratornih zaraznih bolesti. Najveći broj novoobolelih od respiratornih bolesti je zabeležen 2018. godine, kada je prijavljen i najveći broj lica novoinficiranih morbilima. Obolevanje od hlamidijaze, iz grupe polno prenosivih bolesti, smanjilo se za 50%. Broj novoinficiranih groznicom Zapadnog Nila se višestruko povećao u Beogradu, u 2018. godini, što je posledica epidemijskog javljanja ove bolesti u Srbiji, tokom 2018. i 2019. godine. U Beogradu je zabeležen porast trenda umiranja od zaraznih bolesti, ali bez statističke značajnosti. Višestruko je povećana smrtnost od groznice Zapadnog Nila, u Beogradu, tokom 2018. i 2019. godine, što je uticalo na porast trenda umiranja od zaraznih bolesti. Uočen je i porast broja umrlih od side i tuberkuloze, u 2018. i 2019. godini.

U studiji opterećenja društva bolestima (369 bolesti), sprovedenoj u 204 zemlje, u 2019. godini, objavljenoj od strane Kolaboracije za opterećenje društva bolestima i povredama, šest zaraznih bolesti je bilo među prvih deset uzroka godina života izgubljenih zbog nesposobnosti kod dece mlađe od deset godina, i to zbog infekcija donjih respiratornih puteva (rangirana na drugom mestu), dijareje (rangirana na trećem mestu), malarije (rangirana na petom mestu), meningitisa (rangiran na šestom mestu), velikog kašlja (rangiran na devetom mestu) i kongenitalnog sifilisa (rangiran na desetom mestu) [9].

Prema podacima Instituta za javno zdravlje „Dr Milan Jovanović Batut“, u Srbiji je broj prijavljenih slučajeva obolevanja od zaraznih bolesti u 2020. godini bio znatno viši, u poređenju sa 2019. godinom. Veći broj obolelih u 2020. godini bio je posledica pojave nove bolesti – COVID-19, koja je obuhvatila 79% pacijenata u strukturi obolevanja [10].

Prema podacima objavljenim na sajtu Gradskog zavoda za javno zdravlje Beograd, o kretanju zaraznih bolesti u Beogradu, za mart 2022. godine, može se uočiti da je incidencija zaraznih bolesti u Beogradu iznosila 367,13 (na 100.000), što je četiri puta niže u odnosu na posmatrani period u istraživanju. Među novoinficiranim licima, tokom marta 2022. godine, najviše slučajeva je bilo prijavljeno da boluje od COVID-19 infekcije (4.344), varičele (1.150) i gripa (380), što pokazuje da su respiratorne zarazne bolesti najučestalije u ukupnom obolevanju od zaraznih bolesti [11].

U periodu od oktobra 2021. godine do kraja jula 2022. godine, Zavod za zdravstvenu zaštitu studenata

The upward trend in the mortality rate related to communicable diseases in Belgrade was not statistically significant (equation:  $y = 4.930 + 0.250 x$ ,  $p=0.369$ ), (Graph 4).

In Belgrade, in the observed period (2015 – 2019), the most common causes of death from communicable diseases were the following: *Clostridium difficile*, sepsis, AIDS, bacterial meningitis, tuberculosis, and West Nile fever. The percentage of the most frequent causes of death related to communicable diseases in 2019, was as follows: 40% of the deceased died from West Nile fever, 23% died of infection caused by the *Clostridium difficile* bacterium, 19% of the deceased died from AIDS, 10% died of sepsis, while 8% of the deceased succumbed to tuberculosis.

In the same period, a decrease in the number of persons dying from infection caused by the *Clostridium difficile* bacterium occurred – from 35 (in 2016) to 21 (in 2019), as well as a decrease in the number of persons deceased from sepsis, by three times – from 27 deceased, in the year 2016, to nine deceased, in 2019.

In the observed period, an increase in the number of persons dying from AIDS was observed – from 10 deceased persons, in 2015, to 17 deceased, in 2019, as was a rise in the number of persons deceased from tuberculosis – from five deceased persons, in 2015, to seven deceased persons, in 2019.

In 2018, 42 persons died from West Nile fever, while in 2019, this number was 36 persons, which makes up around 40% of all causes of death from communicable diseases (Graph 5).

## DISCUSSION

In the territory of Belgrade, in the observed period (2015 – 2019), a decrease in the trend of infectious diseases incidence was observed, however, without statistical significance. The greatest number of newly infected persons was from the group of infectious respiratory diseases. In the group of communicable respiratory diseases, the leading cause of morbidity was related to chickenpox (varicella). The greatest number of newly diseased persons suffering from respiratory infections was registered in 2018, when the highest number of measles cases was also reported. In the group of sexually transmitted diseases, morbidity related to chlamydiosis decreased by 50%. In Belgrade, the number of persons newly infected with the West Nile fever increased manifold in 2018, which was the result of an epidemic of this disease in Serbia, in 2018 and 2019. In Belgrade, an increasing trend in mortality related to communicable diseases was observed, however, without statistical significance. Mortality related to West Nile fever increased manifold in Belgrade,

Beograd je sproveo istraživanje među 11.147 studenata Univerziteta u Beogradu, koji su testirani na prisustvo novog SARS-KoV-2 virusa. Istraživanje je pokazalo da je 3.278 (29,4%) studenata bilo pozitivno na novi virus [12].

Zbog nedostupnosti podataka, ograničenja rada se ogledaju u nedostatku prikaza trenda obolevanja i umiranja od zaraznih bolesti u beogradskoj populaciji, po polu i po godinama starosti, kao i u nemogućnosti prikaza trendova standardizovanih stopa incidencije i mortaliteta.

## ZAKLJUČAK

U Beogradu, u posmatranom periodu (2015 – 2019), obolevanje od zaraznih bolesti se smanjilo, a smrtnost se povećala. Trend stope incidencije zaraznih bolesti je bio u padu, a trend stope mortaliteta je bio u porastu, ali bez statističke značajnosti. Najveći broj lica novoinficiranih zaraznim bolestima odnosio se na respiratorne zarazne bolesti, među kojima je najviše obolelih bilo od varicele, gripa, streptokoknog faringitisa i tonzilitisa. Zapaženo je epidemijsko pojavljivanje morbila, u toku 2017. i 2018. godine, kada je i prijavljeno najviše obolelih – 1.893 slučaja (2018. godina). Uočeno je epidemijsko pojavljivanje groznice Zapadnog Nila tokom 2018. i 2019. godine, kada je i zabeležena najveća vrednost od 85 novoinficiranih lica (2018. godina). Najčešći uzroci smrti od zaraznih bolesti bili su: *Clostridium difficile*, sepsa, sida (HIV/AIDS), bakterijski meningitisi, tuberkuloza i groznica Zapadnog Nila. U toku 2018. i 2019. godine, oko 40% svih uzroka smrti odnosilo se na groznicu Zapadnog Nila.

Uprkos tome što spadaju u visoko preventabilne bolesti, zarazne bolesti su stalna javnozdravstvena pretnja i vodeći uzročnik smrtnosti. Pored mera opšte i lične higijene, nošenja zaštitnih maski, izbegavanja rizičnog ponašanja i zaštite od seksualno prenosivih bolesti, neophodno je javnozdravstvene mere usmeriti na zaštitu životne sredine i prevenciju širenja infektivnih agenasa van njihovih staništa, kao i na prevenciju nastanka novih infektivnih agenasa.

**Sukob interesa:** Nije prijavljen.

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during 2018 and 2019, which affected the upward trend of mortality related to communicable diseases. An increase in the number of persons dying from AIDS and tuberculosis was also noted in 2018 and 2019.

In a study of global societal burden of disease (369 diseases), carried out in 204 countries, in 2019, published by the GBD 2019 Diseases and Injuries Collaborators, six communicable diseases were amongst the ten leading causes of years of life lost due to disability in children under the age of ten years, this being due to the following: lower respiratory infections (ranked second), diarrheal diseases (ranked third), malaria (ranked fifth), meningitis (ranked sixth), whooping cough (ranked ninth), and congenital syphilis (ranked tenth) [9].

According to the data of the Institute of Public Health of Serbia *Dr Milan Jovanović Batut*, the number of reported cases of morbidity related to communicable diseases in Serbia was significantly higher in 2020, as compared to 2019. The increase in the number of cases in 2020 was the consequence of the outbreak of a new disease – COVID-19, which accounted for 79% in the morbidity structure [10].

According to the data published on the site of the City Institute of Public Health of Belgrade, regarding the fluctuation of infectious diseases in Belgrade, for March 2022, it is evident that the incidence of communicable diseases was 367.13 (per 100,000), which is four times less than the observed period in our study. Amongst the newly infected persons in March 2022, most patients were reported to be cases of COVID-19 (4,344), chickenpox (1,150), and influenza (380), which shows that communicable respiratory diseases are the most frequent in the overall morbidity related to infectious diseases [11].

In the period from October 2021 to the end of July 2022, the Belgrade Institute for Student Health Care conducted a survey amongst 11,147 University of Belgrade students, who were tested for SARS-CoV-2. The survey showed that 3,278 (29.4%) students tested positive for the new virus [12].

Due to the unavailability of data, the limitations of this study are reflected in the fact that the study has not presented the trend of mortality and morbidity related to communicable diseases in the Belgrade population, by gender and by age, as well as in the fact that we were unable to present the trends of standardized rates of incidence and mortality.

## CONCLUSION

In Belgrade, in the observed period (2015 – 2019), morbidity related to communicable diseases decreased, while mortality increased. The incidence rate of communicable diseases was declining, while the trend of

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the mortality rate was on the rise, however, without statistical significance. The greatest number of newly infected persons suffering from communicable diseases was related to respiratory infections, amongst whom the majority contracted chickenpox, influenza, streptococcal pharyngitis and tonsillitis. An epidemic of measles was registered during 2017 and 2018, when the greatest number of cases was reported – 1,893 (in 2018). An epidemic of West Nile fever was registered in 2018 and 2019, when the highest incidence of this disease was registered – 85 newly infected persons (in 2018). The most frequent causes of death from communicable diseases were as follows: *Clostridium difficile*, sepsis, AIDS, bacterial meningitis, tuberculosis, and West Nile fever. During 2018 and 2019, around 40% of all causes of death related to West Nile fever.

Although they are highly preventable, communicable diseases remain a constant threat and a leading cause of mortality. In addition to general and personal hygiene measures, wearing protective masks, avoiding risky behavior and using protection against sexually transmitted diseases, it is also necessary to focus public health measures on environmental protection and the prevention of the spread of infectious agents outside their habitats, as well as on the prevention of the emergence of new infectious agents.

**Conflict of interest:** None declared.