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SKLEROZANTNI LIMFANGITIS PENISA – PRIKAZ PACIJENTA

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SAŽETAK

Uvod/Cilj: Sklerozantni limfangitis penisa je retko nezarazno oboljenje koje se najčešće javlja kod mladih seksualno aktivnih osoba. Karakteriše ga iznenadna pojava bezbolnog trakastog zadebljanja u predelu koronalnog sulkusa kojoj su prethodili intenzivni seksualni odnosi i/ili masturbacija. Cilj rada je da prikazemo pacijenta sa karakterističnom kliničkom slikom neveneričnog sklerozantnog limfangitisa penisa i da podsetimo zdravstvene radnike, prevashodno dermatovenerologe i urologe, na ovo retko oboljenje.

Prikaz bolesnika: Pacijent star 32 godine, dobrog opšteg zdravlja, javio se dermatovenerologu zbog bezbolnog zadebljanja na telu penisa koje je nastalo nakon intenzivnih seksualnih odnosa. Kliničkim pregledom utvrđeno je prisustvo bezbolne, translucetne, zadebljane i tvrde trakaste strukture, hrskavičave konzistencije iza korone glansa, bez uvećanja regionalnih limfnih žlezda. Serološki testovi na sifilis nisu ukazivali na nedavnu infekciju. Pacijentu je savetovano uzdržavanje od seksualnih aktivnosti i nakon četiri nedelje promene su se povukle.

Zaključak: Sklerozantni limfangitis penisa je retko, benigno, nezarazno oboljenje koje se javlja kod mlađih seksualno aktivnih osoba i izaziva njihovu zabrinutost, dok zdravstvenim radnicima može predstavljati dijagnostički izazov usled kliničke sličnosti sa tromboflebitisom superficijalne vene penisa ili atipičnim penilnim lezijama ranog sifilisa, usled čega je posebno bitno da ga urolozi i dermatovenerolozi u svom svakodnevnom radu ne previde.

Ključne reči: sklerozantni limfangitis, penis, seksualni odnos

Uvod

Sklerozantni limfangitis penisa je retko nezarazno oboljenje koje se najčešće javlja kod mladih seksualno aktivnih osoba. Karakteriše ga iznenadna pojava bezbolnog trakastog zadebljanja u predelu koronalnog sulkusa kojem obično prethode intenzivni seksualni odnosi i/ili masturbacija. Oboljenje je prvi put opisao nemački dermatolog, *Erich Hoffmann*, 1923. godine, kao simulatora veneričnih bolesti (1), da bi kasnije objavio da ono nije povezano sa veneričnim bolestima i nazvao ga neveneričnim plastičnim limfangitisom (engl. *non-venereal plastic lymphangitis*) (2). U narednih devedeset godina u literaturi je objavljeno manje od 135 slučajeva ovog oboljenja (3). Cilj ovog rada je da prikazemo pacijenta sa karakterističnom kliničkom slikom neveneričnog sklerozantnog limfangitisa penisa (engl. *non-venereal sclerosing lymphangitis of the*

penis) i podsetimo zdravstvene radnike, prevashodno dermatovenerologe i urologe, na ovo retko oboljenje.

Prikaz pacijenta

Pacijent star 32 godine javio se dermatovenerologu zbog bezbolnog zadebljanja na telu penisa koje se pojavilo dva dana pre dolaska na pregled. Nije praktikovao rizične seksualne odnose, ali je sa svojim stalnim partnerom imao duže i učestalije seksualne odnose tokom poslednjih nedelju dana. Dobrog je opšteg zdravlja i nema nikakvih simptoma koji prate polno prenosive infekcije. U ličnoj anamnezi navodi podatak da je pre nekoliko godina lečen od ranog sifilisa.

Kliničkim pregledom utvrđeno je prisustvo bezbolne, translucetne, zadebljane, tvrde, trakaste

CASE REPORT

SCLEROSING LYMPHANGITIS OF THE PENIS – A CASE REPORT

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SUMMARY

Background/Aim: Sclerosing lymphangitis of the penis is a rare non-infectious condition that most commonly occurs in young sexually active individuals. It is characterized by the sudden appearance of a painless, band-like thickening in the area of the coronal sulcus, which is preceded by intense sexual intercourse or masturbation. The aim of this paper was to present a patient with the characteristic clinical picture of non-venereal sclerosing lymphangitis of the penis and to remind healthcare professionals, particularly dermatologists and urologists, of this rare condition.

Case report: A 32-year-old male in good general health presented to a dermatologist with a painless thickening on the shaft of the penis that appeared after intense sexual intercourse. Clinical examination revealed the presence of a painless, translucent, thick, band-like structure with a cartilaginous consistency behind the corona of the glans, without enlargement of regional lymph nodes. Serological tests for syphilis did not indicate recent infection. The patient was advised to refrain from sexual activity, and after four weeks, the changes had resolved.

Conclusion: Sclerosing lymphangitis of the penis is a rare benign, non-infectious condition that occurs in younger sexually active individuals and often causes concern. It can present a diagnostic challenge for healthcare providers due to its clinical similarity to superficial penile vein thrombophlebitis or atypical early syphilitic penile lesions. Therefore, it is important that urologists and dermatologists do not overlook it in their daily practice.

Keywords: sclerosing lymphangitis, penis, sexual intercourse

Introduction

Sclerosing lymphangitis is a rare non-infectious condition that most commonly occurs in young sexually active persons. It is characterized by the sudden occurrence of a painless, cord-like thickening in the area of the coronal sulcus, which is usually preceded by intense sexual intercourse and/or masturbation. The condition was first described as a simulator of venereal diseases in 1923 by a German dermatologist, Erich Hoffmann (1), while he later reported that it was not related to venereal diseases and called it non-venereal plastic lymphangitis (2). In the following ninety years, less than 135 cases of this condition were published in the literature (3). The aim of this paper was to present a patient with the characteristic clinical picture of non-venereal sclerosing lymphangitis of the penis and to remind healthcare workers,

particularly dermatologists and urologists, of this rare condition.

Case report

A 32-year-old male patient presented to a dermatologist because of a painless thickening on the shaft of the penis that had appeared two days prior to the examination. He did not engage in risky sexual behaviors, but he had longer and more frequent sexual intercourse with his regular partner during the previous week. He was in good general health and had no symptoms associated with sexually transmitted infections. In his personal history, he stated that he had been treated for early syphilis a few years ago.

Clinical examination revealed the presence of a painless, translucent, thickened, hard, cord-



Slika 1. Sklerozantni limfangitis – zadebljanje limfnog suda proksimalno od korone glansa

(engl. *cord-like*) strukture hrskavičave konzistencije, promera 5mm i dužine 3cm smeštene iza korone glansa (Slika 1). Regionalne limfne žlezde nisu bile uvećane. Direktnim mikroskopiranjem brisa uretre i bojenjem po Gramu nisu detektovani polimorfonuklearni leukociti, a serološki testovi na sifilis (VDRL – *Venereal Disease Research Laboratory*; laboratorijski test za istraživanje veneričnih bolesti i TPHA – *Treponema Pallidum Haemagglutination Assay*; *Treponema Pallidum* hemaglutinacioni test) su registrovali samo pozitivan TPHA test, koji je u ovom slučaju pokazatelj ranije lečene infekcije.

Pacijentu je savetovano uzdržavanje od seksualnih aktivnosti, a nakon četiri nedelje promene su se povukle.

Diskusija

Nevenerični sklerozantni limfangitis penisa se može javiti kod seksualno aktivnih muškaraca u svim uzrasnim grupama (4), ali je najčešće opisan u uzrastu od 20 do 40 godina (5), a manifestuje se pojavom bezbolnih trakastih zadebljanja iza korone glansa. Premda je etiologija ovog oboljenja nepoznata, pretpostavlja se da ga uzrokuju mikrotraume penisa nastale tokom grublje seksualne aktivnosti, kao što je ustanovljeno i kod našeg pacijenta, koje dovode do traumatske opstrukcije većih limfnih sudova (3). Neka istraživanja upućuju na to da bi cirkumcizija mogla biti predisponirajući faktor za nastanak ovog oboljenja usled posledičnog poremećaja limfne drenaže i eventualnih ožiljaka nastalih nakon intervencije (7), što nije slučaj kod našeg pacijenta. Iako se dijagnoza uobičajeno postavlja kliničkim pregledom, jer biopsija lezije najčešće nije neophodna, istraživanja pokazuju da histopatološke analize kod

ovog oboljenja potvrđuju prisustvo skleroze i hipertrofije limfnih sudova (6).

U diferencijalnoj dijagnozi u obzir dolaze tromboflebitis superficijalne dorzalne vene penisa – Mondorovo oboljenje (engl. *Mondor's disease*) i limfangitis penisa kod ranog sifilisa (8,9). Superficijalni tromboflebitis vene penisa je obično bolan i lokalizovan na dorzalnoj strani tela penisa, a vena je zadebljana i adherentna za kožu. Trombozi mogu prethoditi trauma, intenzivna seksualna aktivnost, lokalna infekcija, tumor karlične regije ili ubrizgavanje droga u dorzalnu venu penisa (10). Dijagnoza se postavlja ultrazvučnim Doppler pregledom vena koji ukazuje na ehogenost i nekompresibilne vene, dok se biopsijom potvrđuje opstrukcija lumena vene (8). Rani sifilis veoma često može biti praćen atipičnim manifestacijama. Studija serije slučajeva obolelih od ranog sifilisa je kod većeg broja pacijenata pokazala prisustvo tvrdog, trakastog i bezbolnog limfangitisa iza korone glansa (9). Pozitivni serološki testovi na sifilis kod našeg pacijenta bili su znak ranije lečene infekcije, a s obzirom na porast broja obolelih od ovog oboljenja u našoj zemlji (11), kod penilnog sklerozantnog limfangitisa može se obaviti i testiranje krvi na sifilis.

Nevenerični sklerozantni limfangitis penisa obično prolazi spontano, a obolelima se savetuje seksualna apstinencija u trajanju od nekoliko nedelja. Veoma retko, i to kod perzistentnog simptomatskog limfangitisa praćenog bolnim erekcijama, može biti neophodna i hirurška resekcija (7).

Zaključak

Sklerozantni limfangitis penisa je retko benigno nezarazno oboljenje koje se javlja kod mlađih



Figure 1. Sclerosing lymphangitis – thickening of the lymphatic vessel proximal to the corona of the glans

like structure of cartilaginous consistency, 5 mm in diameter and 3 cm long, behind the corona of the glans (Figure 1). Regional lymph nodes were not enlarged. Polymorphonuclear leukocytes were not detected by direct microscopy of urethral swabs and Gram staining, while serological tests for syphilis (VDRL – Venereal Disease Research Laboratory and TPHA – Treponema Pallidum Haemagglutination Assay) registered only a positive TPHA test, which in this case is an indicator of a previously treated infection.

The patient was advised to refrain from sexual activity and after four weeks, the changes resolved.

Discussion

Non-venereal sclerosing lymphangitis of the penis can occur in sexually active men in all age groups (4), but it has been described most frequently in the age group 20 to 40 years (5), and is manifested by the appearance of a painless, cord-like thickening behind the corona of the glans. Although the etiology of this condition is unknown, it is assumed that it is caused by microtraumas of the penis that appear during intense sexual intercourse, as was found in our patient, which lead to traumatic obstruction of larger lymphatic vessels (3). Some studies indicate that circumcision could be a predisposing factor for the occurrence of this condition due to the consequent disruption of lymphatic drainage and possible scars that appear after the intervention (7), which was not the case in our patient. Although the diagnosis is usually made by clinical examination, because the biopsy of the lesion is most often not necessary, studies indicate that histopathological analyses in

this condition confirm the presence of sclerosis and hypertrophy of lymphatic vessels (6).

In a differential diagnosis, thrombophlebitis of the superficial dorsal vein of the penis – Mondor's disease and lymphangitis of the penis in early syphilis (8,9) are considered. Superficial thrombophlebitis of the penile vein is usually painful and localized on the dorsal side of the shaft of the penis, and the vein is thickened and adherent to the skin. Thrombosis can be preceded by trauma, intense sexual activity, local infection, tumor of the pelvic region or injection of drugs into the dorsal vein of the penis (10). The diagnosis is made by Doppler ultrasound examination of veins, which indicates echogenicity and incompressible veins, while the biopsy confirms the obstruction of vein lumen (8). Early syphilis can often be accompanied by atypical manifestations. A case study of patients affected by early syphilis showed the presence of hard, cord-like and painless lymphangitis behind the corona of the glans in a large number of patients (9). Positive serological tests for syphilis in our patient were the sign of the previously treated infection, and considering the increase in the number of people suffering from this disease in our country (11), in penile sclerosing lymphangitis, blood testing for syphilis can also be performed.

Non-venereal sclerosing lymphangitis of the penis usually resolves spontaneously and patients are advised to refrain from sexual activity for several weeks. Very rarely, in case of persistent symptomatic lymphangitis accompanied by painful erections, surgical resection can also be necessary (7).

seksualno aktivnih osoba. Može izazvati zabrinutost pacijenta, dok zdravstvenim radnicima neretko predstavlja dijagnostički izazov usled kliničke sličnosti sa tromboflebitisom superficijalne vene penisa i atipičnim penilnim lezijama ranog sifilisa, zbog čega je od izuzetnog značaja da ga uroloziji i dermatovenerolozi u svom svakodnevnom radu ne previde.

Konflikt interesa

Autor je izjavio da nema konflikta interesa.

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Conclusion

Sclerosing lymphangitis of the penis is a rare benign non-infectious condition that occurs in younger sexually active individuals. It can cause patient's concern, and it often presents a diagnostic challenge for healthcare providers due to its clinical similarity to superficial penile vein thrombophlebitis or atypical early syphilitic penile lesions. Therefore, it is of utmost importance that urologists and dermatologists do not overlook it in their daily practice.

Competing interests

The author declared no competing interests.

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AKUTNI MASTOIDITIS: ZAŠTO JE VAŽNA OBAVEZNA IMUNIZACIJA?

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SAŽETAK

Uvod/Cilj: Akutni mastoiditis (AM) je ozbiljna bakterijska infekcija mastoidne kosti koja nastaje kao posledica akutnog zapaljenja srednjeg uva (AOM). Iako se mastoiditis može javiti u bilo kom uzrastu, većina pacijenata je mlađa od dve godine. Infekciju najčešće izazava *Streptococcus pneumoniae*. Nakon uvođenja antibiotske terapije i imunizacije protiv pneumokoka, samo 0,002% dece sa AOM razvije akutni mastoiditis. Cilj ovog rada je da prikaže slučaj četvorogodišnje devojčice sa AM kod koje je utvrđeno da nije vakcinisana konjugovanim pneumokoknom vakcinom prema Kalendaru obavezne imunizacije Republike Srbije.

Prikaz bolesnika: Prikazali smo slučaj četvorogodišnje devojčice sa AM kod koje je utvrđeno da nije vakcinisana konjugovanim pneumokoknom vakcinom. Devojčica je na pregledu bila razdražljiva, nervozna, febrilna, žalila se na bol u uvu, sa prisutnim retroaurikularnim otokom i crvenilom kože. Parametri inflamacije bili su povišeni. Zbog postojanja sumnje na akutni mastoiditis urađen je CT endokranijuma koji je potvrdio dijagnozu. Pravovremenim započinjanjem parenteralne antimikrobne terapije uz hiruršku retroaurikularnu inciziju i drenažu periostalnog apscesa, učinjenu mastoidektomiju i miringotomiju, kod devojčice je dovelo do poboljšanja opšteg stanja, a u dreniranom sadržaju je izolovan *Streptococcus pneumoniae*.

Zaključak: Prikazom slučaja nevakcinisanog deteta koje je obolelo od akutnog mastoiditisa, uzrokovanog pneumokom, odnosno infekcijom koja je vakcinom preventabilna, još jednom želimo da skrenemo pažnju na značaj pravovremene imunizacije prema Kalendaru obavezne imunizacije Republike Srbije.

Ključne reči: akutni mastoiditis, *Streptococcus pneumoniae*, konjugovana pneumokokna vakcina, obavezna imunizacija

Uvod

Akutni mastoiditis (AM) je akutno gnojno zapaljenje sluznice i kosti mastoidnog nastavka. Javlja se kao komplikacija akutne upale srednjeg uva, a predispozicija za nastanak zavisi od uzrasta, anatomskih karakteristika temporalne kosti, uzročnika i imunološkog statusa obolelog. Danas je veoma retko oboljenje zahvaljujući redovnoj vakcinaciji i upotrebi antibiotika.

Iako se mastoiditis može javiti u bilo kom uzrastu, većina pacijenata je mlađa od dve godine, sa srednjom starošću od 12 meseci. U pre-antibiotskoj eri, 20% slučajeva akutnog zapaljenja srednjeg uva je bilo komplikovano akutnim mastoiditi-

som i često povezano sa teškim intrakranijalnim komplikacijama. Nakon uvođenja antibiotske terapije i pneumokokne vakcine, samo 0,002% dece sa akutnim otitisom razvije akutni mastoiditis sa stopom mortaliteta manjom od 0,01 na 100.000 stanovnika (1).

Kao ozbiljna komplikacija zapaljenja srednjeg uva (AOM), akutni mastoiditis se kod dece manifestuje otalgijom, groznicom, retroaurikularnim otokom i bolnom osetljivošću. Infekcija je najčešće izazavana *Streptococcus-om pneumoniae*, a ređe su uključeni *Streptococcus pyogenes*, *Hemophilus influenzae*, *Staphylococcus aureus* i dr. (2).

CASE REPORT

ACUTE MASTOIDITIS: WHY MANDATORY IMMUNIZATION IS IMPORTANT?

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SUMMARY

Introduction: Acute mastoiditis (AM) is a serious bacterial infection of the mastoid bone that occurs as a consequence of acute otitis media (AOM). Although mastoiditis can occur at any age, the majority of patients are less than two years of age, with a median age of 12 months. The infection is most often caused by *Streptococcus pneumoniae*. After antibiotics and pneumococcal vaccination, 0,002% of children with AOM progress to acute coalescent mastoiditis. The aim of this study is to present the case of a four-year-old girl with AM who was found not vaccinated by pneumococcal conjugated vaccine according to the mandatory immunization schedule of the Republic of Serbia.

Case report: We describe the case of a four-year-old girl with AM, where we found that she was not regularly vaccinated by pneumococcal conjugated vaccine. The girl was presenting with irritability, fussiness, fever, ear pain, red and swollen retroauricular skin. The inflammatory markers were elevated. Due to the suspicion of acute mastoiditis, a CT scan of the endocranium was performed, which confirmed the diagnosis. Timely initiation of parenteral antimicrobial therapy with surgical retroauricular incision and drainage of the periosteal abscess, mastoidectomy and myringotomy performed on the girl led to an improvement in the general condition, and *Streptococcus pneumoniae* was isolated in the drained contents.

Conclusion: By presenting the case of an unvaccinated child who suffered from acute mastoiditis caused by a vaccine preventable disease we once again wanted to draw attention to the importance of timely immunization.

Key words: acute mastoiditis, *Streptococcus pneumoniae*, pneumococcal conjugate vaccine, mandatory immunization

Introduction

Acute mastoiditis (AM) is an acute purulent inflammation of the mucosal lining and bone in the mastoid process. It occurs as the complication of acute otitis media, while the predisposition for its occurrence depends on age, on the anatomical characteristics of the temporal bone, causative agents and the immune status of the patient. Today, the disease is very rare thanks to regular vaccination and the use of antibiotics.

Although acute mastoiditis can occur at any age, the majority of patients are younger than 2 years, with the median age of 12 months. In the pre-antibiotic era, 20% of cases of acute otitis media

were complicated by acute mastoiditis and often associated with severe intracranial complications. After the introduction of antibiotic therapy and pneumococcal vaccine, only 0.002% of children with acute otitis develop acute mastoiditis with a mortality rate of less than 0.01% per 100,000 population (1).

As a severe complication of acute otitis media (AOM), acute mastoiditis in children is manifested as otalgia, fever, retroauricular swelling and tenderness on palpation. The infection is most often caused by *Streptococcus pneumoniae*, while *Streptococcus pyogenes*, *Hemophilus influenzae*,

Diferencijalno dijagnostički retroaurikularni otok i bolna osetljivost mogu nastati kao komplikacija upale spoljašnjeg uva (AOE), koju najčešće izaziva *Pseudomonas aeruginosa*. Ova razlika u mikrobnjoj etiologiji čini razliku između akutnog mastoiditisa i periaurikularnog celulitisa koji je sekundarno važan za AOE (3).

Komplikacije AM mogu biti ekstrakranijalne i intrakranijalne, nekad veoma ozbiljne i opasne po život. Od ekstrakranijalnih komplikacija najčešća je subperiostalni apsces sa posledičnom dekalifikacijom i resorpcijom kosti (koalescentni mastoiditis), zatim labirintitis, lezije facijalnog nerva, tromboza jugularne vene. Intrakranijalne komplikacije nisu česte, ali nesumnjivo mogu biti ozbiljne i završiti se smrtnim ishodom. Simptomatologija je uglavnom neurološka i/ili septička u slučaju meningitisa, epiduralnih apscesa, encefalitisa ili tromboze kavernoznog sinusa (4). Upotreba antibiotika značajno je smanjila učestalost pomenutih komplikacija, ali takođe danas predstavlja klinički problem jer antibiotici mogu prikriti važne kliničke simptome. Zbog toga je kod dece kod koje postoji sumnja na akutni mastoiditis potrebno što ranije uraditi kompjuterizovanu tomografiju (CT) endokranijuma, praćenu magnetnom rezonancom (MR) lobanje ako postoji sumnja na intrakranijalne komplikacije (5).

Lečenje nekomplikovanih oblika AM podrazumeva upotrebu antimikrobnih lekova. S obzirom na to da je *Streptococcus pneumoniae* najčešći uzročnik i da je njegova specifična osetljivost na cefalosporine velika, savetuje se započinjanje intravenozne primene ceftriaksona kod hospitalizovanih pacijenata. Upotreba drugih antibiotika

može biti opravdana samo na osnovu antibiograma (2). U slučaju komplikacije AM pristupa se hirurškom lečenju (mastoidektomija, timpanoplastika, drenaža apscesa i dr.) (6).

Prevenција svih oboljenja izazvanih *Streptococcus pneumoniae* podrazumeva imunizaciju, a uvođenjem konjugovanih pneumokoknih vakcina zabeležen je značajan pad incidencije pneumokokne invazivne bolesti i akutnog mastoiditisa (7). Konjugovana desetovalentna pneumokokna vakcina uključena je u Kalendaru obavezne imunizacije Republike Srbije od 2018. godine.

Cilj ovog rada je da prikaže slučaj četvorogodišnje devojčice sa AM kod koje je utvrđeno da nije vakcinisana konjugovanom pneumokoknom vakcinom prema Kalendaru obavezne imunizacije Republike Srbije.

Prikaz bolesnika

Na pedijatrijski pregled dovedena je devojčica zbog povišene temperature i otoka iza desnog uva. Bolest je počela nekoliko dana pre pregleda u vidu febrilnosti do 39,3°C, potom razdražljivosti i bola u desnom uvu, a od prethodnog dana su primetili i otok iza desne ušne školjke. Anamnestički od terapije je dobijala analgoantipiretike, a nisu se javljali lekaru.

Iz lične anamneze dobijeni su podaci da je devojčica četvrto dete iz uredne trudnoće završene u terminu prirodnim putem, da je uglavnom bila zdrava i da ne postoje podaci o redovnoj imunizaciji deteta zbog čestih selidbi i menjanja mesta prebivališta. Živi u skromnim uslovima, bez tekuće vode i kanalizacije.



Slika 1. Desna ušna školjka pomerena unapred usled retroaurikularnog otoka



Slika 2. Retroaurikularni otok i crvenilo kože

Staphylococcus aureus are less frequently involved etc. (2). In the differential diagnostic evaluation, retroauricular swelling and tenderness on palpation may occur as a complication of acute otitis externa (AOE) that is most often caused by *Pseudomonas aeruginosa*. This difference in microbial etiology differentiates between acute mastoiditis and periauricular cellulitis that is secondary to AOE (3).

The complications of AM can be extracranial and intracranial, sometimes very severe and life-threatening. Of extracranial complications, the most common is subperiosteal abscess with consequent decalcification and bone resorption (coalescent mastoiditis), then labyrinthitis, lesions of facial nerve, and thrombosis of the jugular vein. Intracranial complications are not common, but they can undoubtedly be serious and fatal. The symptomatology is mainly neurological and/or septic in case of meningitis, epidural abscesses, encephalitis or cavernous sinus thrombosis (4). The use of antibiotics has significantly reduced the frequency of mentioned complications, but it is also a clinical problem today because antibiotics can mask important clinical symptoms. Therefore, in children suspected of having acute mastoiditis, it is necessary to perform computerized tomography (CT) of the endocranium as soon as possible, followed by magnetic resonance (MR) of the skull if intracranial complications are suspected (5).

The treatment of uncomplicated forms of AM involves the use of antimicrobial drugs. Given that *Streptococcus pneumoniae* is the most common causative agent and that its specific sensitivity

to cephalosporins is high, it is recommended to start the intravenous administration of ceftriaxone in hospitalized patients. The use of other antibiotics can be justified only on the basis of the antibiogram (2). In case of complications of AM, surgical treatment is performed (mastoidectomy, tympanoplasty, abscess drainage, etc.) (6).

The prevention of all diseases caused by *Streptococcus pneumoniae* involves immunization, and with the introduction of pneumococcal conjugate vaccines, a significant decrease in the incidence of pneumococcal invasive disease and acute mastoiditis was recorded (7). The ten-valent pneumococcal conjugate vaccine was included in the Mandatory Immunization Schedule in the Republic of Serbia in 2018.

The aim of this study was to present the case of a four-year-old girl with AM, who had not been vaccinated with the pneumococcal conjugate vaccine according to the Mandatory Immunization Schedule in the Republic of Serbia.

Case report

A girl was brought to a pediatric examination due to fever and swelling behind the right ear. The illness started a few days prior to the examination in the form of fever up to 39.3°C, then irritability and pain in the right ear, and since the previous day they noticed swelling behind the right auricle. Anamnestically, she received analgoantipyretics, but they did not report to the doctor.

Data were obtained from the personal anamnesis that the girl was the fourth child born as a full-term baby in a natural way, that she



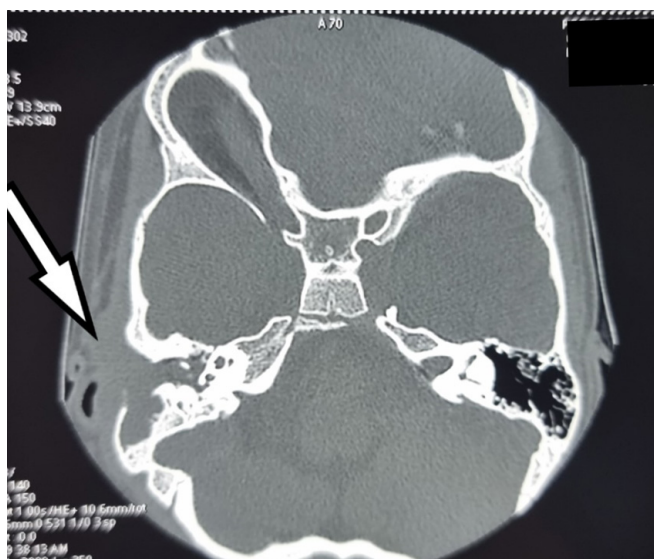
Figure 1. Right auricle displaced forward due to retroauricular swelling



Figure 2. Retroauricular swelling and redness of the skin

Na pregledu, žensko dete uzrasta tri godine i 11 meseci, telesne mase (TM) 14 kg, telesne visine (TV) 97cm, visoko febrilno (38,9°C), eupnoično i urednih vitalnih parametara. Koža topla, bleđa, sniženog turgora i elasticiteta bez patoloških eflorescencija. Glava normokranična, uobičajeno osetljiva na palpaciju. Bulbusi medioponirani, pokretni u svim pravcima, zenice kružne i izdašno reaguju na svetlost i akomodaciju. U nosu sasušen purulentan sekret. Ždrelno hiperemično. Desna ušna školjka pomerena unapred (Slika 1), a retroaurikularno desno prisutni su crvenilo kože i otok, osetljivi na pritisak. (Slika 2). Vrat valjkast, aktivno i pasivno pokretan, obostrano se palpiraju lako uvećani limfni nodusi. Grudni koš cilindričan i simetrično respiratorno pokretan. Auskultatorni nalaz nad srcem i plućima je uredan. Abdomen mek, jetra i slezina se ne palpiraju. Genitalije ženskog tipa odgovaraju uzrastu. Grub neurološki nalaz je uredan za uzrast, a meningealni znaci su negativni.

Parametri inflamacije ukazivali su na akutnu infekciju: SE 45 mm/1h, fibrinogen 5,03 g/L, CRP 149,32 mg/L, prokalcitonin 0,34 ng/L, a u krvnoj slici bilo je $20,0 \times 10^9/L$ leukocita (granulocita 71,4%, monocita 10,1%, limfocita 18,5%), $4,07 \times 10^{12}/L$ eritrocita, hemoglobin je bio 110 g/L, hematokrit 0,33, a trombocita je bilo $381 \times 10^9/L$. Biohemijske analize krvi i rutinski nalaz urina bili su uredni. Hemokulture su ostale sterilne. Učinjena je i radiografija pluća, te ultrazvučni pregled ab-



Slika 3. CT endokranijuma: semisolidni sadržaj gustih atenuacija u celosti ispunjava desni timpanični kavum sa proširenim antrumom mastoida i sadržajem koji ispunjava ceo desni mastoid

domena koji su, takođe, bili bez patološkog nalaza. Otokopija: desna bubna opna matirana, izmenjena i netransparentna.

Zbog retroaurikularnog otoka desno sa posledično odstojećom ušnom školjkom i sumnjom na AM učinjen je CT endokranijuma: semisolidni sadržaj gustih atenuacija u celosti ispunjava desni timpanični kavum, sa smanjenim denzitetom i suspektnim osteolitičkim procesom u nivou stepesa, očuvanog tegmenta timpani, zadebljale membrane, sa proširenim antrumom mastoida i sadržajem koji ispunjava ceo desni mastoid, sa osteolizom koštanih struktura, bez znakova intrakranijalne propagacije (Slika 3)

Retroaurikularnim pristupom u opštoj endotrahealnoj anesteziji učinjena je incizija i drenaža subperiostalnog apscesa, potom mastoidektomija i miringotomija sa ugradnjom aeracionih cevčica, te uzet bris sadržaja nakon incizije. Započeta je parenteralna antibiotska terapija ceftriaksonom koju je dete dobijalo tokom 14 dana. Dolazi do postepene i potpune regresije kliničkog i lokalnog nalaza (Slika 4).

U kulturi sadržaja dobijenog nakon incizije izolovan je *Streptococcus pneumoniae*.

Tokom lečenja utvrđeno je da dete nije dobilo konjugovanu pneumokoknu vakcinu.

Diskusija

Uvođenjem konjugovanih pneumokoknih vakcina u programe obavezne imunizacije primećena



Slika 4. Nakon incizije i drenaže subperiostalnog apscesa i inicijalne antibiotske terapije dolazi do regresije retroaurikularnog otoka

je inverzna veza između broja vakcinisane dece i dece sa epizodama akutnog mastoiditisa (8). Iako su opisani etiopatogeneza, klinički, dijagnostički i terapijski aspekti, akutni mastoiditis i dalje predstavlja problem (9). Dijagnoza AM je uglavnom klinička, a najčešći klinički znaci su retroaurikularni otok ili fluktuacija, eritem, bolna osetljivost, hiperemija bubne opne. Pored toga, prisustvo predisponirajućih faktora kao što su uzrast mlađi od 2 godine, visoki parametri inflamacije ili prethodni AOM takođe mogu ukazati na AM (2). Kliničke studije preporučuju kompjuterizovanu tomografiju (CT) kao senzitivnu ali nespecifičnu dijagnostičku proceduru koju je potrebno uraditi kod sve dece sa sumnjom na akutni mastoiditis i obično pokazuje zamućenje mastoidnih ćelija, zamagljivanje mastoidnih obrisa i elevaciju periosta mastoidnog nastavka (10). Kombinacija parenteralne antibiotske terapije i hirurške incizije sa drenažom sadržaja smanjuje stopu komplikacija AM. Ukoliko u vremenskom intervalu 24-48 sati nakon započinjanja lečenja ne dođe do postepene regresije simptoma i znakova bolesti, potrebno je razmotriti i mogućnost mastoidektomije, kada se kroz retroaurikularni pristup prvo evakuše subperiostalni apsces, a zatim buši mastoid dok se ne pronađe antrum. Nakon evakuacije empijema radi se neka vrsta drenaže, najčešće miringotomija uz implantaciju aeracionih cevčica. Druge procedure kao što su retro-aurikularna punkcija mastoidnog empijema ili samo miringotomija bez mastoidektomije nisu uvek dovoljno efikasne (11). Trajanje parenteralne antibiotske terapije trebalo bi da bude 10-14 dana (3).

Prikazali smo slučaj devojčice sa akutnim mastoiditisom izazvanim *Streptococcus-om pneumoniae* koja nije bila vakcinisana protiv pneumokoka, a ta informacija može biti jedan od značajnih predisponirajućih faktora za razvoj bolesti.

Na osnovu kliničke slike odmah smo posumnjali da se kod deteta radi o AM, ali uzrast stariji od dve godine i nekompletni anamnestički podaci o prethodnim bolestima i imunizaciji diferencijalno dijagnostički mogli su ukazivati i na lokalni cellulitis ili adenitis. Febrilnost i visoki parametri inflamacije (CRP 149,32 mg/L, prokalcitonin 0,34 ng/L, leukociti $20,0 \times 10^9/L$) ukazivali su na akutnu infekciju, a radiografijom pluća i ultrazvučnim pregledom abdomena isključene su inflamacije respiratornog i urinarnog trakta. Naš prikaz slučaja potvrdio je da CT dijagnostika predstavlja senzitivnu dijagnos-

tičku proceduru kojom smo potvrdili dijagnozu. Pravovremenim započinjanjem parenteralne antimikrobne terapije uz hiruršku retroaurikularnu inciziju i drenažu subperiostalnog apscesa, mastoidektomiju i miringotomiju desne bubne opne sa ugradnjom aeracionih cevčica drugog dana hospitalizacije, kod devojčice je dovelo do poboljšanja opšteg stanja, a u dreniranom sadržaju je izolovan uzročnik infekcije.

Po našem mišljenju prikazani slučaj može biti zanimljiv u svakodnevnoj praksi jer se radilo o detetu koje anamnestički prethodno nije imalo upale srednjeg uva, koje nije vakcinisano konjugovanim pneumokoknom vakcinom i kod koga je u dreniranom sadržaju izolovan uzročnik infekcije – pneumokok, a ova bolest je vakcinom preventabilna.

Zaključak

Broj obolelih od akutnog mastoiditisa i njegovih komplikacija u pedijatrijskoj populaciji značajno se smanjio uvođenjem konjugovane pneumokokne vakcine. Prikazom slučaja nevakcinisanog deteta koje je obolelo od akutnog mastoiditisa izazvanog pneumokom, odnosno infekcijom koja je vakcinom preventabilna, još jednom želimo da skrenemo pažnju na značaj pravovremene imunizacije prema Kalendaru obavezne imunizacije Republike Srbije.

Konflikt interesa

Autori su izjavili da nema konflikta interesa.

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gradual and complete regression of clinical and local findings (Picture 4).

Streptococcus pneumoniae was isolated in the culture of the contents obtained after the incision. It was found during the treatment that the child had not received the pneumococcal conjugate vaccine.

Discussion

With the introduction of pneumococcal conjugate vaccine in the programs of mandatory immunization, an inverse relationship was observed between the number of vaccinated children and children with episodes of acute mastoiditis (8). Although the etiopathogenesis, clinical, diagnostic and therapeutic aspects were described, mastoiditis is still a problem (9). The diagnosis of AM is mostly clinical, and the most common clinical signs are retroauricular swelling or fluctuation, erythema, tenderness on palpation, hyperemia of the tympanic membrane. In addition, the presence of predisposing factors such as age younger than 2 years, high parameters of inflammation, or previous AOM may also indicate AM (2). Clinical studies recommend computed tomography (CT) as a sensitive but non-specific diagnostic procedure which should be performed in all children suspected of acute mastoiditis and it usually shows the opacification of mastoid cells, haziness of the mastoid outline and the elevation of the periosteum of the mastoid process (10). The combination of parenteral antibiotic therapy and surgical incision with drainage of the contents reduces the complication rate of AM. If there is no gradual regression of symptoms and signs of the disease in the time interval 24-48 hours after the beginning of treatment, the possibility of mastoidectomy should be considered, when the subperiosteal abscess is first evacuated through the retroauricular approach and then the mastoid is drilled until the antrum is found. After the empyema is evacuated, some kind of drainage is performed, most often myringotomy with the implantation of aeration tubes. Other procedures such as the retroauricular puncture of mastoid empyema or just myringotomy without mastoidectomy are not always effective enough (11). Duration of the parenteral antibiotic therapy should be 10-14 days (3).

We presented the case of the girl with acute mastoiditis caused by *Streptococcus pneumoniae*,

who was not vaccinated against pneumococci, and this information may be one of significant predisposing factors for the development of this disease.

Based on the clinical picture, we immediately suspected that the child had AM, but the age older than 2 years and incomplete anamnestic data on previous diseases and immunizations could also indicate local cellulitis or adenitis. Febrility and high inflammation parameters (CRP 149.32 mg/L, procalcitonin 0.34 ng/L, leukocytes $20.0 \times 10^9/L$) indicated an acute infection, and chest radiography and abdominal ultrasound ruled out the inflammation of respiratory and urinary tract. Our case report confirmed that CT diagnostics is a sensitive diagnostic procedure with the help of which we confirmed the diagnosis. The timely administration of parenteral antimicrobial therapy with surgical retroauricular incision and drainage of the subperiosteal abscess, mastoidectomy and myringotomy of the right tympanic membrane with the insertion of aeration tubes on the second day of hospitalization led to the improvement in the girl's general condition, and the causative agent of the infection was isolated in the drained contents.

In our opinion, the case report can be interesting in everyday practice because it included the child who did not previously have otitis media in her anamnesis, who was not vaccinated by pneumococcal conjugate vaccine, and in whom the causative agent of infection – pneumococcus – was isolated in the drained contents, and this disease is vaccine preventable.

Conclusion

The number of patients with acute mastoiditis and its complications in the pediatric population has significantly decreased with the introduction of pneumococcal conjugate vaccine. By presenting the case of an unvaccinated child who suffered from acute mastoiditis caused by pneumococcus, that is, an infection that is vaccine preventable, we once again want to draw attention to the importance of timely immunization according to the Mandatory Immunization Schedule of the Republic of Serbia.

Competing interests

The authors declared no competing interests.

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PROMENE VREDNOSTI INDIKATORA KVALITETA U KAPITACIONOJ FORMULI ZA PRIMARNU ZDRAVSTVENU ZAŠTITU U SRBIJI TOKOM PANDEMIJE

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SAŽETAK

Uvod/Cilj: Pandemija COVID-19 stvorila je nove izazove i zadatke za primarnu zaštitu, utičući na rutinske zdravstvene usluge. Ova studija je imala za cilj da izmeri promene vrednosti pokazatelja učinka koji su deo kapitacione formule u Srbiji na osnovu podataka dobijenih od Fonda za zdravstveno osiguranje.

Metode: Podaci su analizirani na nacionalnom nivou. Promena indikatora je merena kao apsolutna razlika u vrednostima indikatora između 2020. i 2019. godine.

Rezultati: U službi za zdravstvenu zaštitu odraslog stanovništva, vrednosti tri indikatora koji se odnose na savete o načinu života porasle su u 2020. godini između 3,0% i 3,8%, dok su vrednosti indikatora koji se odnose na šećernu bolest, povišen arterijski pritisak i među pacijentima sa prethodnim infarktom miokarda smanjile u rasponu od 0,5% do 2,4%. Vrednosti indikatora koji se odnose na savetovanje gojazne dece, odgovarajući broj pregleda novorođenčadi i usluga koji se odnose na rano otkrivanje i savetovanje trudnica povećani su za 1,2% na 10,2%. Ostali indikatori su zabeležili pad vrednosti do 9,9%.

Zaključak: Uprkos preprekama sa kojima se suočavala tokom pandemije COVID-19, primarna zdravstvena zaštita je igrala i nastavlja da igra značajnu ulogu u očuvanju i poboljšanju zdravlja stanovništva.

Ključne reči: COVID-19, kvalitet zdravstvene zaštite, prevencija

Uvod

Pojava novog soja koronavirusa u Kini dovela je do globalne pandemije koja je uticala na sve aspekte života (1-4). To je uključivalo i pružanje zdravstvene zaštite. Virus COVID-19 bolesti se brzo proširio širom sveta, izazivajući do tada neviđenu društvenu, psihološku i ekonomsku štetu. U Srbiji je Ministarstvo zdravlja potvrdilo prvi slučaj zaraze 6. marta 2020. godine (5). Nakon toga, vlada je proglasila vanredno stanje 15. marta (6).

Kao i u drugim zemljama, zdravstveni sistem u Srbiji se suočio sa inicijalnim uticajem ove nove pretnje. Većina resursa bila je usmerena na rano otkrivanje, dijagnozu, lečenje zaraženih osoba i sprečavanje daljeg širenja u zajednici. Neke zdravstvene ustanove bile su isključivo posvećene lečenju obolelih od COVID-19, što je uticalo na njihovu sposobnost da pruže redovnu zdravstvenu zašti-

tu pacijentima. Ove velike promene su se odrazile kroz negativan uticaj na ostale usluge zdravstvene zaštite, uključujući one koje se pružaju pacijentima koji nisu oboleli od COVID-19 i drugim ranjivim grupama, poput hroničnih bolesnika, starih, dece i trudnica (7,8). Ove značajne promene, iako su bile neophodne, predstavljale su različite izazove i trebalo ih prihvatiti sa razumevanjem.

Zdravstveni sistem Srbije se pre svega finansira kroz obavezno zdravstveno osiguranje, pri čemu je Republički fond za zdravstveno osiguranje (RFZO) glavni naručilac usluga. Sistem nudi usluge na primarnom, sekundarnom i tercijarnom nivou. Na primarnom nivou, usluge se pružaju u domovima zdravlja u okviru primarne zdravstvene zaštite (PZZ). Pruža ih „izabrani lekar“ koji može biti lekar opšte prakse ili specijalista opšte medicine, pedi-

CHANGES IN THE VALUE OF QUALITY INDICATORS IN THE CAPITATION FORMULA FOR PRIMARY HEALTH CARE IN SERBIA DURING THE PANDEMIC

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SUMMARY

Introduction/Aim: The COVID-19 pandemic created new challenges and assignments for primary care, affecting routine health services. This study aimed to measure the changes in the values of the performance indicators that are part of the capitation formula in Serbia using data obtained from the National Health Insurance Fund.

Methods: Data were analyzed at the national level. The indicator change was measured as the absolute difference in the indicator’s values between 2020 and 2019.

Results: In the healthcare services for adults, the values of three indicators related to lifestyle advice increased in 2020 between 3.0% and 3.8%, while the values of indicators related to diabetes, arterial hypertension, and among patients with previous myocardial infarction have decreased in the range of 0.5% to 2.4%. The values of indicators associated with counseling obese children, the adequate number of check-ups of newborns, and services related to early detection and counseling among pregnant women increased by 1.2% to 10.2%. The other indicators recorded a decline in their value up to 9.9%.

Conclusion: Despite the obstacles faced during the COVID-19 pandemic, primary healthcare has played and continues to play a substantial role in preserving and improving the population’s health.

Keywords: COVID-19, Quality of Health Care, Prevention

Introduction

The emergence of a new strain of coronavirus in China led to a global pandemic that impacted all aspects of life (1-4). That included a healthcare provision also. The COVID-19 virus spread rapidly worldwide, causing unprecedented social, psychological, and economic damage. In Serbia, the Ministry of Health confirmed the first case of infection on March 6, 2020 (5). Following this, the government declared a state of emergency on March 15 (6).

Like other countries, the Serbian healthcare system faced the initial impact of this new threat. Most resources were directed towards early detection, diagnosis, treatment of infected individuals, and prevention of further community spread. Some healthcare institutions were exclusively dedicated to treating COVID-19 patients,

which affected their ability to provide regular patient care. These massive changes reflected their negative impact on other healthcare services, including those provided to non-COVID patients and vulnerable groups such as the chronically ill, the elderly, children, and pregnant women (7, 8). These significant changes, while necessary, presented various challenges and should be recognized with empathy.

The Serbian healthcare system is primarily funded through compulsory health insurance, with the National Health Insurance Fund (NHIF) being the leading purchaser of services. The system offers services at primary, secondary, and tertiary levels. At the primary level, services are provided in primary healthcare centers (PHCs). They are delivered by a “chosen doctor” who can be a general practitioner

jatrije, ginekologije ili stomatologije (9). Domovi zdravlja primarne zdravstvene zaštite su organizovani na nivou opštine ili grada, sa mrežom lokalnih ambulanti u gradskim i ruralnim zajednicama (10). Ovaj pristup ima za cilj da primarnu zdravstvenu zaštitu učini lako dostupnom korisnicima.

Od 2012. godine, ustanovama primarne zdravstvene zaštite se nadoknađuju troškovi za pružanje usluga na osnovu ugovora sa RFZO koji se zasniva na kapitacionoj formuli (10). Kao rezultat toga, domovi zdravlja primarne zdravstvene zaštite moraju da daju izveštaj o pruženim uslugama, pri čemu se kvalitet ocenjuje uz pomoć unapred utvrđenih indikatora (11). RFZO izračunava ove indikatore i objavljuje ih na svom sajtu na osnovu izveštaja dobijenih od zdravstvenih ustanova. Ovi indikatori prate sprovođenje različitih programa primarne i sekundarne prevencije koji su usmereni na određene grupe stanovništva. Indikator odražava procenat ljudi u toj populacionoj grupi koji primaju unapred definisane preventivne mere uključene u kapitacionu formulu. Ovi programi su kreirani da preveniraju ili rano otkriju zdravstvene probleme. Stoga bi ovaj indikator u idealnom slučaju trebalo da bude blizu 100%. Primarna zdravstvena zaštita je bila na prvoj liniji odbrane u pandemiji, igrajući ključnu ulogu u identifikaciji, upravljanju, praćenju i lečenju obolelih od COVID-19. Pored toga, bila je važna u brzom sprovođenju kampanja masovne vakcinacije, naglašavajući njenu jedinstvenu i ključnu ulogu u sistemu zdravstvene zaštite (12).

Međutim, prisustvo virusa COVID-19 ne znači da nestaju sve druge zdravstvene potrebe. Čak i u vanrednim okolnostima, lekari primarne zdravstvene zaštite i medicinski tim nastavili su da pružaju kontinuiranu negu, zadovoljavajući zdravstvene potrebe pacijenata s obzirom da su prva tačka kontakta sa zdravstvenim sistemom. Cilj ovog rada je da predstavi promene indikatora kvaliteta uključenih u kapitacionu formulu pre i tokom pandemije.

Metode

Svrha ove studije bila je da se sprovede deskriptivna analiza retrospektivnih anonimizovanih podataka sa sajta RFZO (13). Prikupljeni su zbirni podaci za 154 od 175 dostupnih domova zdravlja primarne zdravstvene zaštite, u periodu od 1. januara 2019. do 31. decembra 2020. U studiju nisu uključeni indikatori koji pokrivaju period duži od 12 meseci. Analizirani indikatori su izračunati kao

jednostavan odnos uz pomoć brojioca i imenioca. Imenilac je predstavljao broj registrovanih osiguranika sa određenom karakteristikom, kao što je starosna grupa, dijagnostikovana bolest ili trudnoća. Sa druge strane, brojilac je ukazivao na broj pacijenata koji su dobili uslugu među registrovanim osiguranicima sa određenom karakteristikom. Vrednosti indikatora mogu se kretati od 0 do 100%. Na primer, vrednost indikatora od 50% bi značila da je polovina osiguranika sa određenom karakteristikom dobila specifičnu preventivnu uslugu. Važno je napomenuti da se sve usluge koje se pominju u studiji odnose samo na klasični kontakt licem u lice. Kompletan lista analiziranih indikatora nalazi se u Tabeli 1. Promena indikatora je merena kao apsolutna razlika u godišnjim vrednostima indikatora između 2019. i 2020. godine.

Rezultati

Kada su u pitanju usluge opšte prakse, između 2019. i 2020. godine, došlo je do smanjenja vrednosti indikatora u rasponu od 0,5% do 2,4% (Slika 1). Samo su vrednosti četiri indikatora porasle u ovom periodu, od kojih su se tri odnosila na savetovanje o zdravim navikama: saveti za ishranu kod dijabetičara porasli su za 3,0%, saveti koji su se ticali načina života kod pacijenata sa hipertenzijom porasli su za 3,4%, saveti koji su se ticali načina života kod pacijenata sa infarktomiokarda porasli su za 3,8%. Ovi indikatori su bili među najvišim, sa vrednostima iznad 50% za obe godine. Pored toga, uočen je blagi porast od 0,3% za procenat pacijenata sa prethodnom istorijom infarkta miokarda sa EKG snimkom u prethodnih 12 meseci.

Smanjenje vrednosti indikatora u okviru usluga za decu i omladinu bilo je do 9,9% u zavisnosti od indikatora (Slika 2). Smanjenje je posebno bilo izraženo za indikatore koji se odnose na zdravstvenu zaštitu adolescenata. Povećane su vrednosti samo dva pokazatelja: procenat dece uzrasta dve godine koja su imala najmanje tri preventivna pregleda u toku prve godine (za 1,2%) i procenat gojazne dece i mladih koji su dobili savete o ishrani u prethodnih 12 meseci (do 10,2%).

Vrednosti pokazatelja kada su u pitanju zdravstvene usluge koje se pružaju ženama smanjene su za 0,9% za pregled i palpaciju dojki kod žena uzrasta 15 i više godina, za 2,7% za savete o planiranju porodice kod žena 15-49 godina i 6,5% za preventivne preglede kod žena uzrasta 15 i više godina (Slika 3). U isto vreme, pokazatelji izračunati među

or a specialist in general medicine, pediatrics, gynecology, or dentistry (9). PHCs are organized at the municipal or city level, with a network of local ambulatories in local urban and rural communities (10). This approach aims to make primary healthcare easily accessible to users.

Since 2012, primary healthcare institutions have been reimbursed for service provision under a contract with NHIF based on the capitation formula (10). As a result, PHCs must report on the quantity of provided services, with the quality being assessed using predetermined indicators (11). NHIF calculates these indicators and publishes them on its website based on reports received from healthcare institutions. These indicators monitor the implementation of various primary and secondary prevention programs targeting specific population groups. The indicator reflects the percentage of people in that population group who receive predefined preventive measures included in the capitation formula. These programs are designed to prevent or detect health issues early. Therefore, this indicator should ideally be as close as 100%.

Primary care has been at the forefront of the pandemic, playing a crucial role in identifying, managing, monitoring, and treating COVID-19 cases. Additionally, it has been instrumental in the rapid execution of mass vaccination campaigns, highlighting its unique and essential role in the healthcare system (12).

However, the presence of COVID-19 does not mean that all other health needs disappear. Even in extraordinary circumstances, primary healthcare physicians and the medical team have continued to provide continuous care, meeting patients' health needs as their first point of contact with the healthcare system. This paper aims to present the changes in the quality indicators included in the capitation formula before and during the pandemic.

Methods

The purpose of this study was to conduct a descriptive analysis of retrospective anonymized data from the NHIF website (13). Aggregated data were collected for 154 out of 157 available PHCs, covering the period from January 1, 2019, to December 31, 2020. The study did not include indicators that cover a period longer than 12 months. Analyzed indicators were calculated as a simple ratio using a numerator and denominator. The denominator represented the number of registered

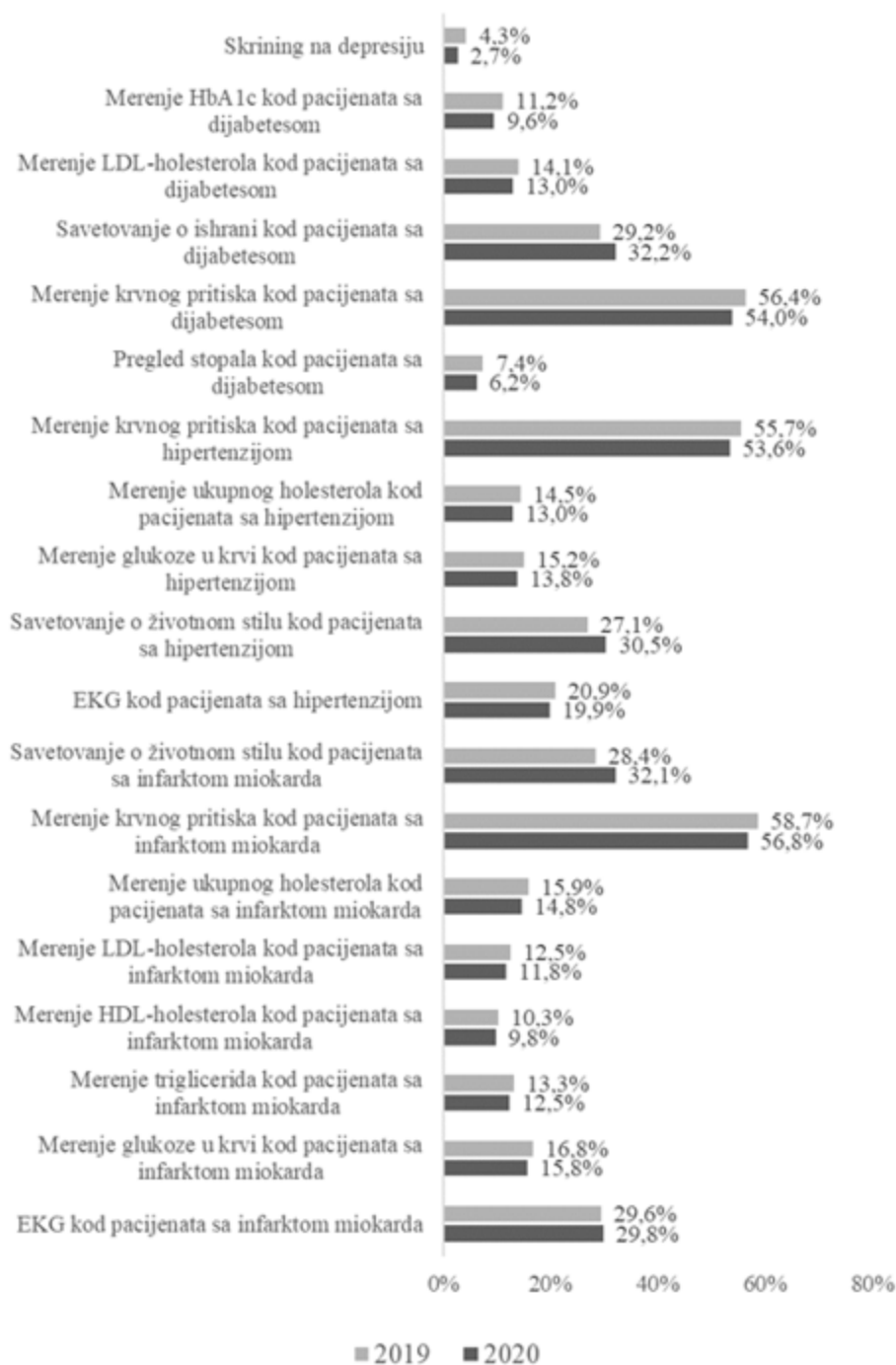
insured persons with a specific characteristic, such as age group, diagnosed disease, or pregnancy. On the other hand, the numerator indicated the number of patients that received a service among the registered, insured persons with a specific characteristic. The indicator values can range from 0 to 100%. For example, an indicator value of 50% would mean that half of the insured with a particular characteristic received a specific preventive service. It's important to note that all services referred to in the study pertain to classic face-to-face contact only. The complete list of analyzed indicators can be found in Table 1 in the Supplement. The change in the indicators was measured as the absolute difference in the annual values of the indicators between 2020 and 2019.

Results

In general practice services, between 2019 and 2020, there was a decrease in the indicators in the range from 0.5% to 2.4% (Figure 1). Only four indicators increased over this period, three related to counseling on healthy habits: Diet advice among diabetic patients increased by 3.0%, Lifestyle advice among hypertensive patients increased by 3.4%, and Lifestyle advice among patients with myocardial infarction increased by 3.8%. These indicators were among the highest, with values above 50% in both years. Additionally, a slight increase of 0.3% was observed for the percentage of Patients with a history of myocardial infarction with ECG recording in the previous 12 months.

A decrease in the value of indicators within the services for the children and youth diminished by up to 9.9% depending on the indicator (Figure 2). The reduction was especially prominent for indicators related to adolescent care. Only two indicators increased: The percentage of children at the age of two who had at least three preventive check-ups during the 1st year (by 1.2%) and the percentage of children and youth with obesity who received nutritional advice in the previous 12 months (by 10.2%).

The values of indicators in women's health services decreased by 0.9% for Breast inspection and palpation among women aged 15 and over, 2.7% for Family planning advice among women aged 15-49, and 6.5% for Preventive check-ups aged 15 and above (Figure 3). At the same time, indicators calculated among pregnant women increased by 5.2% for Early detection of gestational diabetes,



Slika 1. Indikatori primarne zdravstvene zaštite: usluge primarne zdravstvene zaštite za odrasle
 Legenda: HbA1c – glikolizirani hemoglobin; LDL – lipoprotein niske gustine; EKG – elektrokardiogram;
 HDL – lipoprotein visoke gustine; MI – infarkt miokarda

trudnicama porasli su za 5,2% za rano otkrivanje gestacijskog dijabetesa, 5,5% za rano otkrivanje EPH-gestoze (EPH: edemi – proteinurija - hipertenzija) i 8,9% za savete o načinu života.

Diskusija

Indikatori koji se koriste za izračunavanje plaćanja na osnovu kapacitacije su u početku bili niski u Srbiji, ali su najviše opali tokom pandemi-

je. Kada su u pitanju usluge primarne zdravstvene zaštite, 15 od 19 posmatranih indikatora pokazalo je smanjenje. Kada su u pitanju usluge zdravstvene zaštite dece i omladine, vrednosti šest od osam indikatora su se smanjile, dok su vrednosti tri od šest indikatora opale za usluge zdravstvene zaštite žena. Ovo je u skladu sa nalazima u Kataloniji, gde je došlo do značajnog pada vrednosti indikatora posebno kada je u pitanju skrining, i nalazima studi-

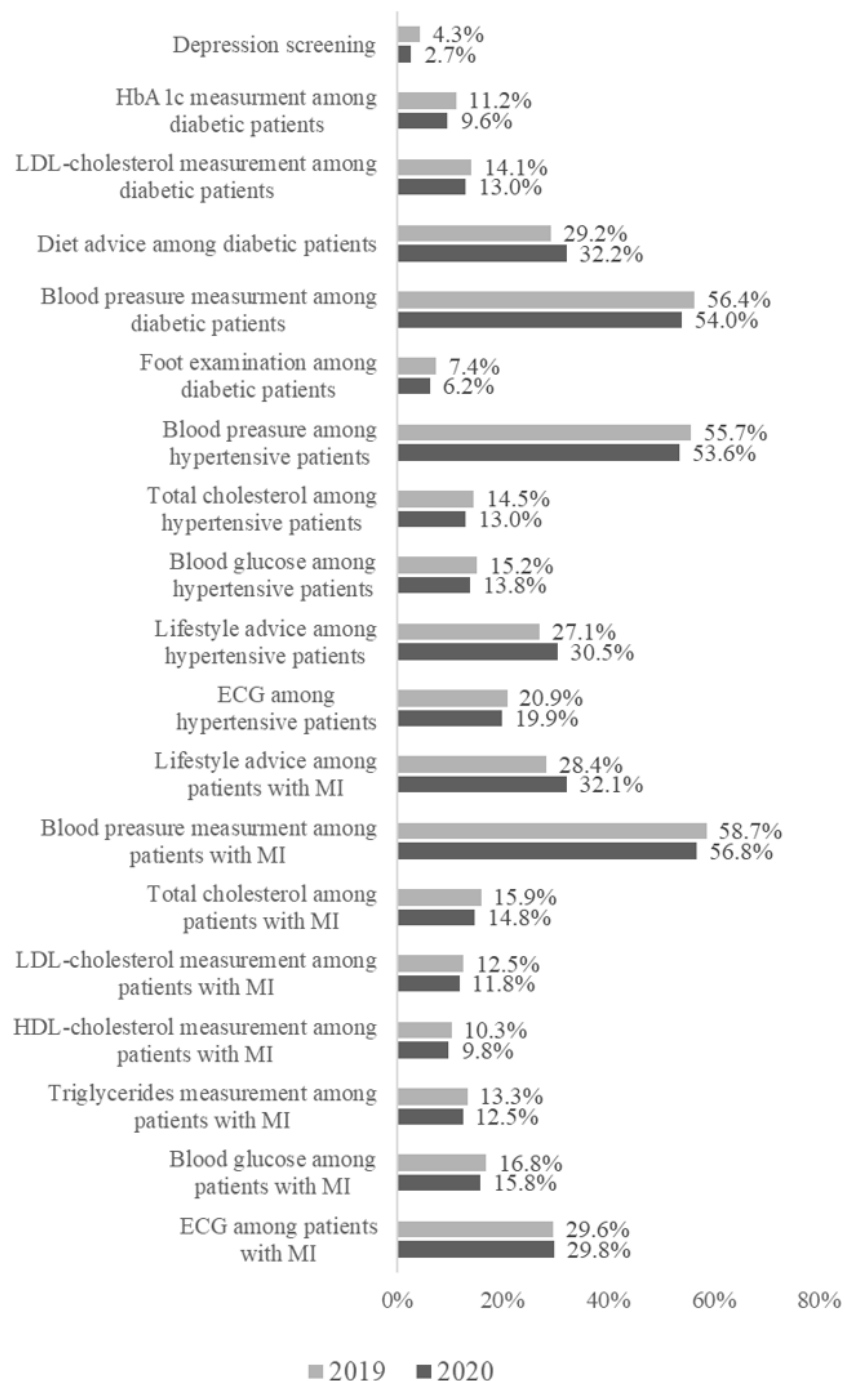


Figure 1. Indicators of primary healthcare: Primary healthcare services for adults

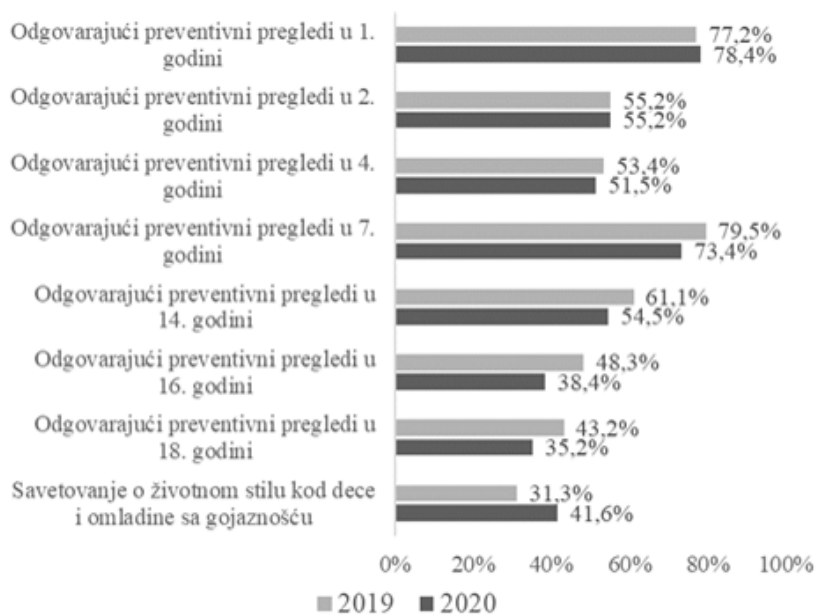
Legend: HbA1c - glycated haemoglobin; LDL - low-density lipoprotein; ECG - electrocardiogram; HDL - high-density lipoprotein; MI - myocardial infraction

5.5% for Early detection of Edema-proteinuria-hypertension (EPH) gestosis, and 8.9% for Lifestyle advice.

Discussion

The indicators used for calculating capitation-based payments in Serbia were initially low, but most declined during the pandemic. In primary healthcare services for adults, 15 out of 19

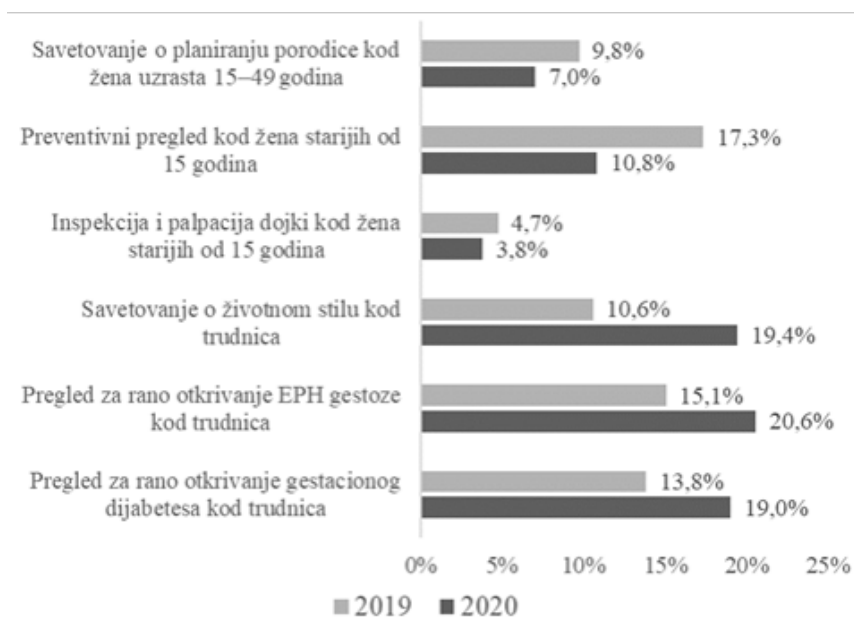
observed indicators showed a reduction. Six of eight indicators in children and youth healthcare services decreased; three of six indicators declined in women's healthcare services. This aligns with findings in Catalonia, where there was a significant drop in indicators, particularly in screening, and a study documenting decreases in consultation counts and chronic disease monitoring (14). Rachamin et al. documented substantial declines in consultation



Slika 2. Indikatori primarne zdravstvene zaštite: zdravstvene usluge za decu i omladinu

je koja dokumentuje smanjenje broja konsultacija i praćenja hroničnih bolesti (14). *Rachamin* i saradnici su dokumentovali značajno smanjenje broja konsultacija i opšteg praćenja hroničnih bolesti dijabetesa, hipertenzije i kardiovaskularnih bolesti (15). Pad vrednosti indikatora može biti posledica izbegavanja ustanova zdravstvene zaštite od strane pacijenata, smanjenog broja medicinskog osoblja i ograničene kliničke aktivnosti, naročito kada su u pitanju skrining i urgentni slučajevi. Kako se smanjuje broj osoba koje posećuju izabranog lekara, smanjuje se i broj ljudi koji mogu biti podvrgnuti preventivnim pregledima i skriningu.

Podaci Nacionalnog instituta za javno zdravlje takođe ukazuju na smanjeno korišćenje usluga zdravstvene zaštite i manje poseta „izabranom lekaru“. Ovi podaci ukazuju da su nivoi korišćenja zdravstvenih usluga izraženi kroz prosečan broj poseta po lekaru u periodu pre epidemije bili manje više stabilni u sve tri službe (16,17). Nasuprot tome, posete zdravstvenim službama za odrasle su smanjene za 10%, dok su posete zdravstvenim službama za decu i omladinu i zdravstvenim ustanovama za žene smanjene za 35% i 24% 2020. godine u poređenju sa 2019. godinom (18,19).



Slika 2. Indikatori primarne zdravstvene zaštite: zdravstvene usluge za decu i omladinu

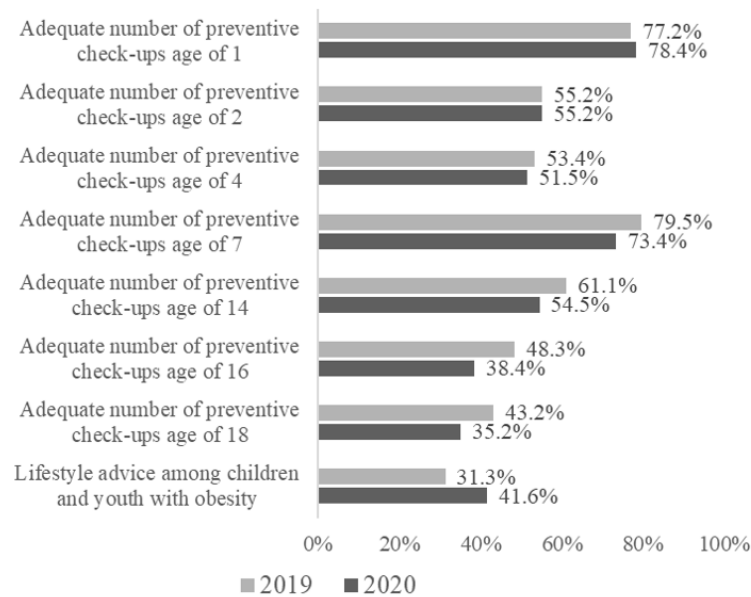


Figure 2. Indicators of primary healthcare: Children and youth healthcare services

counts and general chronic disease monitoring of diabetes, hypertension, and cardiovascular disease (15). The decline in indicators may be due to patients avoiding healthcare facilities, reduced medical personnel, and limited clinical activity, especially for screening and urgent cases. As the number of clients visiting selected doctors decreases, the number of people who can undergo preventive examinations and screenings also decreases.

Data from the National Institute for Public Health also indicate reduced use of healthcare services and fewer visits to “chosen doctors”. These data suggest that the levels of use of health services

expressed through the average number of visits per doctor in the earlier pre-epidemic period were more or less stable in all three services (16, 17). On the contrary, visits to adult healthcare services decreased by 10%, while visits to children and youth healthcare services and women's healthcare services decreased by 35% and 24% in 2020 compared to 2019, respectively (18, 19).

Children's primary care is particularly vulnerable to changes in the healthcare system. Children received less primary care due to increasing requirements to treat a growing burden of adult chronic disease. Nine out of ten children in Serbia

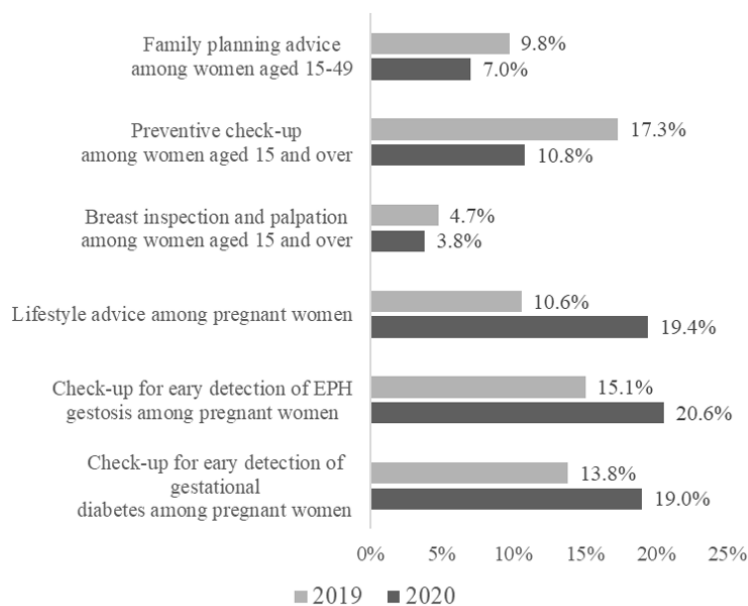


Figure 3. Indicators of primary healthcare: Women’s healthcare services

Primarna zdravstvena zaštita dece je posebno osetljiva na promene u sistemu zdravstvene zaštite. Deca su dobijala manje nege u primarnoj zdravstvenoj zaštiti zbog sve većih potreba i sve većeg opterećenja kada je u pitanju lečenje hroničnih bolesti odraslih. Devet od desetero dece u Srbiji ima „izabranog lekara“, a roditelji generalno imaju poverenje u lekare svoje dece, koje je najveće u ranom uzrastu. Ne iznenađuje što se stopa usklađenosti za indikatore u prvim godinama života nije promenila. Međutim, stope usklađenosti za indikatore se smanjuju kako deca rastu.

Međutim, nisu se vrednosti svih pokazatelja smanjile. Zabeležen je porast pokazatelja koji su se odnosili na nove skrininge kod trudnica. Uprkos povećanju, vrednosti ovih pokazatelja bile su neprihvatljivo niske. Nasuprot zdravstvenoj zaštiti dece, manje od polovine žena ima izabranog ginekologa u državnim zdravstvenim ustanovama u Srbiji (20). Većina njih preferira privatne zdravstvene službe. Žene su češće izbegavale pristup zdravstvenim uslugama tokom pandemije (21). Uopšteno govoreći, ima mnogo prostora za poboljšanje rada zdravstvenih službi za žene u primarnoj zdravstvenoj zaštiti, čak i u urgentnim stanjima. Brojni dokumenti, uključujući Nacionalni program zdravstvene zaštite žena, dece i adolescenata podstiču promociju i pristup zdravstvenoj zaštiti kod najčešćih zdravstvenih problema i povezanih terapija za bolesti, a rutinski pristup preventivnim uslugama je suštinski deo tog programa (22).

Iako je primarna zdravstvena zaštita odigrala ključnu ulogu u odgovoru na pandemiju, postoji prostor za poboljšanje, posebno kada je u pitanju zdravstvena zaštita žena. Uprkos izazovima sa kojima smo se suočili 2020. godine, pokazalo se da je primarna zdravstvena zaštita neophodna, a njeno jačanje bi trebalo da bude prioritet za buduće vanredne situacije koje se tiču javnog zdravlja.

Sistem plaćanja po učinku u RFZO ima i prednosti i nedostatke (23,24). U ovoj studiji, pružaoci zdravstvene zaštite prijavljuju potrebne vrednosti parametara za izračunavanje vrednosti indikatora. Više vrednosti indikatora se povezuju sa većim prihodima, što bi moglo da ugrozi preciznost izveštavanja. Lečenje starijih ljudi i ljudi sa više bolesti je posebno složeno i izazovno za izračunavanje. Autori priznaju ograničenja prikupljenih podataka, koji zavise od više faktora, i izazov koji se tiče prilagođavanja kovarijanse (25).

Zaključak

Naši rezultati su pokazali da je pandemija COVID-19 uticala na rutinske zdravstvene usluge. Vrednosti indikatora primarne zdravstvene zaštite su se promenile 2020. godine. Od 33 indikatora, kod 24 je zabeležen pad 2020. godine u poređenju sa 2019. godinom. Vrednost tog smanjenja bila je do 9,9%. Kod ostalih indikatora je zabeležen rast u rasponu od 0,3% (EKG kod pacijenata sa prethodnim infarktomiokarda) do 10,2% (saveti o načinu života kod dece i mladih sa gojaznošću). Buduća istraživanja bi trebalo da se bave nedostacima u arhivskim podacima uz pomoć analize razlika u uočenim promenama u smislu nejednakosti između urbanih i ruralnih zajednica, dostupnosti privatne zdravstvene zaštite i nezadovoljenih potreba za zdravstvenim uslugama.

Konflikt interesa

Autori su izjavili da nema konflikta interesa.

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have a “chosen doctor”, and parents generally trust their children’s doctors, particularly in the early years (20). Parents generally have exceptional trust in their children’s doctors, which is strongest in the infant period. Unsurprisingly, the compliance rate for the indicators in the first years of life did not change. However, compliance rates for indicators decrease as children get older.

However, not all indicators have decreased. Indicators related to the newly established screenings among pregnant women recorded growth. Despite the increase, the values of these indicators are unacceptably low. Contrary to the health care of children, less than half of women have a chosen gynecologist in publicly owned health institutions in Serbia (20). Most of them prefer private healthcare services. Women were more likely to avoid accessing health services during the pandemic (21). In general, there is much room for improvement in the work of women’s health services in PHC, even during an emergency. Numerous documents, including the National Program for the Health Care of Women, Children, and Adolescents, encourage health promotion and access to care for the most common health disorders and related disease therapies, and routine access to preventative services is an essential part of that program (22).

While primary care has played a significant role in the pandemic response, there is room for improvement, especially in women’s health services. Despite the challenges in 2020, primary care has proven to be essential, and strengthening it should be a priority for future public health emergencies.

The pay-for-performance system of the NHIF has both advantages and disadvantages (23, 24). In this study, healthcare providers report the necessary parameter values to calculate the indicator values. Higher indicator values are linked to higher incomes, which could compromise reporting accuracy. Treating the elderly and people with multiple diseases is particularly complex and challenging to measure. The authors acknowledge the limitations of aggregated data, which depend on various factors, and the challenge of adjusting for covariates (25).

Conclusion

Our results showed that the COVID-19 pandemic influenced routine health services. In 2020, the values of primary healthcare indicators changed. Of 33 indicators, 24 recorded a decrease in 2020 compared to 2019. The drop value was up to 9.9%. Other indicators recorded growth in the range of 0.3% (ECG among patients with previous Acute myocardial infarction) to 10.2% (Lifestyle advice among children and youth with obesity). Future research should address the gaps in archival data by analyzing differences in perceived change in light of inequalities between urban and rural communities, availability of private health care, and unmet needs for health services.

Competing interests

The authors declared no competing interests.

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PREDIKTORI NAMERE KORIŠĆENJA FUNKCIONALNIH APLIKACIJA ZA MOBILNO ZDRAVSTVO U REPUBLICI SRBIJI PRIMENOM PROŠIRENOG UTAUT2 MODELA

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SAŽETAK

Uvod/Cilj: Zdravstvene mobilne aplikacije pružaju mogućnost da svaki korisnik može preventivno da prati svoje zdravlje i da upravlja njime. Mobilna aplikacija *mHealth* koristi najnoviju tehnologiju sa ciljem da učini zdravstvenu zaštitu dostupnijom i pristupačnijom većem broju korisnika. Cilj ovog rada je bio da se identifikuju faktori, definisani prema proširenom UTAUT2 (engl. *Unified Theory of Acceptance and Use of Technology*, Objedinjene teorije prihvatanja i upotrebe tehnologije) modelu, koji imaju uticaj na nameru korišćenja aplikacija za mobilno zdravstvo (*mHealth*) u R. Srbiji.

Metode: Studijom preseka su obuhvaćena 64 ispitanika (prigodni uzorak), bivših studenta, nastavnika i saradnika Akademije strukovnih studija Zapadna Srbija, koji su popunili onlajn upitnik u periodu od maja do novembra 2024. godine. U analizi podataka su korišćeni Krombahov koeficijent α , Pirsonov koeficijent korelacije i regresiona analiza.

Rezultati: Pet od 7 elemenata (očekivani učinak - PE, očekivani trud - EE, društveni uticaj - SI, cenovna vrednost - PV i olakšavajući uslovi - FC) UTAUT2 modela predstavljaju značajne prediktore za nameru ispitanika da prihvate i koriste usluge mobilnih aplikacija za *mHealth*. Elementi navika (H) i hedonistička motivacija (HM) nemaju značajan uticaj na korišćenje mobilnih aplikacija za *mHealth*. Korelaciona analiza ukazuje da namera ponašanja značajno jako pozitivno korelira sa EE, FC i PE, a značajno pozitivno ali slabije sa SI i PV. Nije utvrđena značajna korelacija sa HM i H.

Zaključak: Neophodna su dalja istraživanja u ovoj oblasti, posebno istraživanja koja se odnose na testiranje i korišćenje konkretne mobilne aplikacije za *mHealth* prema elementima UTAUT2 modela.

Ključne reči: tehnologije, mobilne aplikacije, *mHealth*, UTAUT2 model

Uvod

Sa naglim razvojem nauke i tehnologije dolazi i do naglog razvoja zdravstva i sve veće potrebe za informacionom tehnologijom u zdravstvu. Shodno tome, javlja se velika potražnja za određenim aplikacijama koje su u mogućnosti da korisnicima, na upit, pruže raznovrsna i svrsishodna personalizovana iskustva. Razvoj aplikacija namenjenih zdravstvu kontinuirano raste zahvaljujući integraciji naprednih mobilnih tehnologija kao što su veštačka inteligencija, mašinsko učenje, blok lanac i povezani uređaji. Prema podacima iz literature, danas na tržištu postoji više od 350.000 zdravstvenih aplikacija (1). Mobilne aplikacije daju doprinos efikasnosti zdravstvenih sistema kroz racionalizaciju administrativnih zadataka i smanjenje

papirologije. Kao takve, one imaju značajano veliki potencijal u poboljšanju angažmana pacijenata, što rezultira poboljšanjem zdravstvenih rezultata i razvojem pristupačnijeg zdravstvenog iskustva pacijenta. Iako postoji evidentan napredak u razvoju dostupnih raznovrsnih mobilnih aplikacija, istraživači se slažu da postoji potreba da se istraži trenutno stanje u smislu prihvatanja onih mobilnih zdravstvenih aplikacija koje su prilagođene da omogućavaju lakši pristup pacijentima i upravljanje medicinskim informacijama (2). Bez obzira na činjenicu da sve veći broj aplikacija za mobilno zdravstvo (engl. *mobile health - mHealth*) postaje dostupan za preuzimanje i korišćenje na mobilnim uređajima, još uvek su malobrojna istraživanja us-

PREDICTORS OF INTENTION TO USE FUNCTIONAL APPLICATIONS FOR MOBILE HEALTH IN THE REPUBLIC OF SERBIA USING EXTENDED UTAUT2 MODEL

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SUMMARY

Introduction/Aim: Health mobile applications provide an opportunity for each user to proactively monitor and manage their health. The mHealth mobile application uses the latest technology with the aim of making healthcare more accessible and affordable to more users. The aim of this paper was to identify factors, defined according to the expanded UTAUT2 (Unified Theory of Acceptance and Use of Technology) model, which have an impact on the intention to use mobile health applications (mHealth) in the Republic of Serbia.

Methods: The cross-sectional study included 64 respondents (convenience sample), former students, teachers and associates of the Academy of Vocational Studies in Western Serbia, who filled out an online questionnaire in the period May - November 2024. Cronbach's coefficient α , Pearson correlation coefficient and regression analysis were used in the data analysis.

Results: Five of the 7 elements (Performance Expectancy - PE, Effort Expectancy - EE, Social Influence - SI, Price Value - PV and Facilitating Conditions - FC) of the UTAUT2 model are significant predictors of respondents' intention to accept and use mHealth mobile application services. Habit (H) elements and hedonic motivation (HM) have no significant effect on the use of mHealth mobile applications. Correlation analysis indicates that behavioral intention (BI) correlates significantly strongly positively with EE, facilitating conditions - FC and PE, and significantly positively but weakly with SI and PV. No significant correlation was found with HM and H.

Conclusion: Further research in this area is necessary, especially research related to the testing and use of a specific mobile application for mHealth according to the elements of the UTAUT2 model.

Keywords: technologies, mobile applications, mHealth, UTAUT2 model

Introduction

With the rapid development of science and technology comes the rapid development of health care and the increasing need for information technology in health care. Therefore, there is a high demand for certain applications, which can provide users, on demand, with diverse and purposeful personalized experiences. The development of applications intended for health care is growing continuously due to the integration of advanced mobile technologies such as artificial intelligence, machine learning, blockchain and connected devices. According to literature data, there are more than 350,000 health applications in the market today (1). Mobile applications

contribute to the efficiency of health care systems through the rationalization of administrative tasks and reduction in paperwork. As such, they have a significantly great potential to improve the engagement of patients, which results in improved health outcomes and development of more accessible health experience of patients. Although the progress is evident in the field of developing diverse and available mobile applications, researchers agree that it is necessary to examine the current state in terms of accepting those mobile health applications that are created to facilitate the accessibility to patients and the management of medical information (2). Despite

merena na razumevanje namere da se koristi ova vrsta aplikacija (3).

Trenutno, najprihvaćeniji model ispitivanja prihvatanja tehnologije je model UTAUT2 (Proširena objedinjena teorija prihvatanja i upotrebe tehnologije, engl. *Unified Theory of Acceptance and Use of Technology*), jer daje mogućnost da se predvidi namera prihvatanja tehnologije u kontekstu korisnika. Prema dostupnim podacima do 2020. godine, postoji mali broj studija u kojima je korišćen model UTAUT2 za predviđanje namere korisnika da prihvati aplikacija za mHealth, kao i pozitivnih potvrda o njegovoj podobnosti za zdravstveni sektor. U našem radu je korišćen model UTAUT2 koji je postepeno usvojen za potrebe istraživanja različitih pitanja, kao što su usvajanje pametnih mobilnih uređaja (mobilnih telefona, tableta, pametnih satova), učenje, prihvatanje softvera za upravljanje i zdravstvenu industriju. Ključne komponente UTAUT2 modela su: očekivani učinak (engl. *Performance Expectancy* - PE) – određuje uverenje korisnika da će upotreba rešenja biti efikasnija i produktivnija; očekivani napor (engl. *Effort Expectancy* – EE) - označava korisnikovu procenu napora za postizanje stručnosti za upotrebu odabranih rešenja; društveni uticaj (engl. *Social Influence* - SI) - pokazuje uverenje pojedinca da će njegova okolina podržati upotrebu rešenja (mobilne aplikacije); olakšavajući uslovi (engl. *Facilitating Conditions* - FC) - "stepen do kojeg pojedinac veruje da postoji organizacijska i tehnička infrastruktura koja podržava upotrebu sistema"; hedonistička motivacija (engl. *Hedonic Motivation* - HM) - očekivanje ili iskustvo pojedinca da korišćenje rešenja deluje prijatno ili zabavno; i dobra vrednost cene za uloženi novac tj. cenovna vrednost (engl. *Price Value* - PV) - procena pojedinca da će upotreba rešenja biti isplativa u odnosu na novčanu nadoknadu (4,5). U našem radu uvedena je i komponenta navika (engl. *Habit* - H) - korisnikova procena koliko će mu, uzimajući u obzir dosadašnje iskustvo, korišćenje rešenja postati svakodnevna rutina (4).

Kroz očekivani učinak (PE), korisnici mobilnih aplikacija za mHealth se izjašnjavaju o svojim očekivanjima. Ova varijabla sugerše da će pojedinci koristiti usluge aplikacija ako veruju da će imati pozitivne rezultate (5). Očekivani učinak meri stepen do kojeg korisnik veruje da će mu prihvatanje i korišćenje usluga mobilnih aplikacija biti od koristi u svakodnevnoj i preventivnoj

brizi o sopstvenom zdravlju. Na polju mobilnih aplikacija, do sada, najviše istraživanja je urađeno o prihvatanju tehnologije mobilnih aplikacija za bankarsko poslovanje (engl. *mbanking*) prema UTAUT2 modelu. Korisnici *mbanking*-a smatraju, da je očekivani učinak jedan od najvažnijih pokazatelja (indikatora) namere ponašanja (engl. *Behavioral Intention* - BI) (6,7). Istraživanja sprovedena u Kini imala su za cilj da ispituju odnose između elemenata UTAUT2 modela i namere prihvatanja tehnologije za mHealth. Istraživači su u tu svrhu, radi preciznog merenja dimenzije svake varijable, redefinisali varijable na osnovu specifičnog konteksta mHealth-a (8). Očekivani učinak (PE) se odnosi na uverenje korisnika mobilne tehnologije za mHealth, da se efikasnost i kvalitet zdravstvenih usluga mogu poboljšati kada se koristi mobilna aplikacija, što se može sagledati kroz mogućnosti korisnika usluga da pristupi osnovnim zdravstvenim informacijama ili uslugama bilo kada i bilo gde, lako i brzo putem mobilnih uređaja (8).

Prema UTAUT2 modelu (5), očekivani trud (napor) (EE) koji je potrebno uložiti kako bi se nesmetno koristile mobilne aplikacije, utiče na korisnikovu nameru da te aplikacije i koristi. Očekivani trud (napor) (8) predstavlja stepen poteškoća koje korisnici mogu imati pri korišćenju aplikacije mHealth-a, što se može manifestovati u troškovima učenja i u naporu koji korisnici usluga moraju da ulože.

Uticaj okruženja (društveni uticaj) (SI) odnosi se na činjenicu, da na ponašanje korisnika utiče način na koji vršnjaci, prijatelji ili članovi porodice vrednuju upotrebu mobilnih aplikacija za mHealth. Posebno je važan u ranim fazama prihvatanja i primene nove tehnologije, kada većina korisnika nema iskustva ili informacije o tehnologiji, pa se zato oslanja na mišljenje javnosti (9). Uticaj okruženja (8) se odnosi na uticaj ponašanja i stava drugih ljudi ili okoline na nameru upotrebe tehnologije.

Četvrti element iz UTAUT2 modela su olakšavajući uslovi (FC). Pod olakšavajućim uslovima se posmatra subjektivna ocena potencijalnih i postojećih korisnika mobilnih aplikacija o postojanju neophodnih resursa, korisničkih kompetencija, uputstva za upotrebu mobilnih aplikacija za mHealth. Olakšavajući uslovi su definisani kao stepen u kome pojedinac veruje da organizaciona i tehnička infrastruktura može da podrži upotrebu sistema (5). Upotreba tehnologije mobilnih aplikacija zahteva

the fact that the increasing number of mobile health applications are becoming available, so that they can be downloaded and used on mobile devices, there is still little research focused on understanding the intention to use this type of applications (3).

Currently, the most accepted model for testing the acceptance of technology is the UTAUT2 model (Unified Theory of Acceptance and Use of Technology), because it provides the possibility to predict the intention to accept technology in the context of users. According to the available data up to the year 2020, there are few studies that used the UTAUT2 model to predict the intention of users to accept mHealth applications, and that confirmed the model's suitability for the health sector. In our study, we used the UTAUT2 model, which was gradually adopted in order to investigate different issues, such as self-service technology, acceptance of smart mobile devices (mobile phones, tablets, smart watches), learning, acceptance of software for management and healthcare industry. The key components of the UTAUT2 model are: Performance Expectancy (PE) – which determines the user's belief that the use of the solution will be more efficient and productive; Effort Expectancy (EE) – which indicates the user's assessment of efforts needed to achieve proficiency in using the selected solutions; Social Influence (SI) – shows an individual's belief that his environment will support the use of solutions (mobile applications); Facilitating Conditions (FC) – “the degree to which an individual believes that there is an organizational and technical infrastructure that supports the use of the system”; Hedonic Motivation (HM) – the expectation or experience of an individual that using a solution seems pleasant or fun; and good value for the invested money, that is, Price Value (PV) – the assessment of an individual that using the solution will be profitable in relation to the invested money (4,5). In our study, the component of Habits (H) was introduced – the user's estimate whether and to which degree, considering his previous experience, the use of this solution will become a daily routine (4).

The users of mHealth applications express their expectations through Performance Expectancy (PE). This variable suggests that individuals will use the services of applications if they believe that they will have positive results (5). Performance Expectancy (PE) measures the degree to which the user believes

that the acceptance and use of services of mobile applications will be useful in his daily and preventive health care. In the field of mobile applications, so far, most research has been conducted on the acceptance of mobile applications for banking (mbanking) based on the UTAUT2 model. The users of mbanking think that Performance Expectancy is one of the most important indicators of Behavioral Intention (BI) (6,7). The aim of studies conducted in China was to examine the relations between the elements of the UTAUT2 model and intention to accept technology for mHealth. Therefore, researchers redefined the variables based on the specific context of mHealth in order to measure the dimension of each variable accurately (8). Performance Expectancy (PE) refers to the belief of users of mobile technology for mHealth that the efficiency and quality of health services can be improved when using a mobile application, which can be explained by the possibility that users of these services can access basic health information or services anytime, and anywhere, easily and quickly using mobile devices (8).

According to the UTAUT2 model (5), Effort Expectancy (EE) that has to be invested in order to use mobile applications easily, affects the user's intention to use these applications. Effort Expectancy (EE) (8) represents the degree of difficulties that users may have when using mHealth applications, which can be manifested in learning costs and in the effort that service users must make.

Social Influence (SI) refers to the fact that users' behavior is influenced by the way peers, friends or family members value the use of mobile applications for mHealth. It is especially important in the early stages of acceptance and implementation of new technologies, when most users have no experience or information about the technology, and therefore, it relies on public opinion (9). The social influence (8) refers to the influence of behavior and attitude of other people or the environment on the intention to use technology.

The fourth element from the UTAUT2 model is Facilitating Conditions (FC). Facilitating Conditions refer to the subjective evaluation of potential and existing users of mobile applications regarding the existence of necessary resources, user competences, instructions for using mobile applications for mHealth. Facilitating Conditions

dostupnost odgovarajućih resursa, znanja i tehnološke infrastrukture. Takođe, u smislu olakšavanja uslova, pogodnosti mogu predstavljati onlajn tutorijali ili demo (trial) verzije mobilnih aplikacija, i kao takvi, doprinose većoj verovatnoći prihvatanja mobilnih aplikacija za *mHealth*. Olakšavajući uslovi (8) se odnose na percepciju korisnika o pogodnosti i stepenu tehničke podrške, a posebno se odnose na mogućnost blagovremenog dobijanja pomoći i podrške.

Hedonistička motivacija (HM) je prvi element koji je dodat UTAUT2 metodi i definiše se kao zabava ili zadovoljstvo koje proizilazi iz upotrebe tehnologije (4). Ovaj element određuje očekivanja ili iskustvo pojedinca, i upućuje na uživanje ili sreću koja je rezultat korišćenja tehnologije.

Autori UTAUT2 modela smatraju da je cenovna vrednost tehnologije koja se koristi značajna kada se posmatra namera korišćenja, prihvatanje i upotreba tehnologije. Pretpostavlja se da korisnici percipiraju kvalitet tehnologije prema cenovnom rangu, i zbog toga se smatra da je cenovna vrednost bitan i značajan prediktor namere korišćenja (4). Element cenovna vrednost je pozitivna, ukoliko su prednosti korišćenja mobilnih aplikacija za *mHealth* veće od povezanih troškova. Uključuje spremnost da se plati za neke od karakteristika ili usluga, i zadovoljstvo primljenim informacijama ili uslugama. U suštini svi uređaji koji se danas koriste, povezani su sa tehnologijom (10). Neki ljudi koriste tehnologiju po potrebi, dok drugi postaju zavisni od nje i ne mogu svoj svakodnevni život da zamisle bez nje (11).

Poslednji pridodati faktor modelu je navika. Navika se razvija kroz iskustvo u korišćenju tehnologije i odnosi se na percepcije korisnika o upotrebi tehnologije koju koristi (4). Posmatra se kao nesvesno ili automatsko ponašanje (4), a odražava višestruke rezultate prethodnih iskustava i učestalost ponašanja u prošlosti. Smatra se jednom od glavnih odrednica sadašnjeg ponašanja (12). Navika može imati značajan uticaj na nameru korišćenja, jer kontinuirana upotreba tehnologije dovodi do toga da rutina postaje važnija od spoljnih faktora (13). Otežavajuća okolnost je što ne postoje radovi koji istražuju važnost navike na nameru korišćenja telemedicinskih usluga.

Prema istraživanjima koja su vršili *Zhu* i saradnici (8) neke od varijabli u UTAUT2 modelu ne uklapaju se u scenarije *mHealth*-a i nemaju uticaj na nameru prihvatanja mobilnih aplikacija *mHealth*-a.

Zbog toga su istraživači izvršili prilagođavanje varijabli i njihovo redefinisavanje, kako bi model učinili kompatibilnijim sa njihovim scenarijima. Isključili su varijable hedonistička motivacija i navika. Razlog su našli u tome, što su kroz sprovedene intervjuje otkrili, da je većina scenarija bila fokusirana na kontekst medicinske nege, gde korisnici uzimaju u obzir faktore kao što su pristup, efikasnost i kvalitet medicinskih usluga. Utvrdili su, da hedonistički faktori nisu bili deo potreba korisnika u ovom kontekstu. Pored toga, medicinske potrebe su bile relativno niske u njihovom svakodnevnom životu, tako da *mHealth* nije mogao da utiče na formiranje navike. Oni su, takođe, dodali nove varijable: uočeni rizik i uočeno poverenje. Nova varijabla uočeni rizik je dodata, jer su utvrdili da kod korisnika postoji nesigurnost po pitanju ishoda njihovog ponašanja prilikom kupovine, jer im ta nesigurnost može naneti štetu (14). Medicinske usluge su vezane za život i zdravlje ljudi, pa je logično da je kontrola zdravstvenih rizika oduvek bila briga (8). *Zhu* i saradnici (8) su otkrili, da su ispitanici birali različite načine za pristup medicinskim i zdravstvenim uslugama, u zavisnosti od težine bolesti i kada bi se suočili sa težim uslovima, postali bi oprezniji u donošenju odluke da li da koriste *mHealth* aplikacije ili ne. Oni su uveli još jednu varijablu, uočeno poverenje. U trenutnom socio-ekonomskom okruženju, poverenje je postalo jedan od važnih faktora uticaja u procesu transakcije, koji utiče na nameru i ponašanje.

Cilj ovog istraživanja je bio da se identifikuju prediktori, prema proširenom modelu UTAUT2, koji imaju uticaj na nameru korišćenja aplikacija za mobilno zdravstvo (*mHealth*) u R. Srbiji.

Metode

U ovu studiju preseka uključeno je 63 ispitanika (prigodni uzorak), bivših studenta, nastavnika i saradnika Akademije strukovnih studija Zapadna Srbija, koji su putem imejla primili link za popunjavanje onlajn upitnika u periodu od maja do novembra 2024. godine. Na početku upitnika ispitanicima je dato obaveštenje, sa molbom da pažljivo popune upitnik za istraživanje na temu korišćenja mobilnih aplikacija u eZdravstvu, da je upitnik anoniman i da će se rezultati koristiti isključivo u naučne svrhe.

Podaci za ovo istraživanje su prikupljeni elektronskim putem. Svi ispitanici su popunjavali upitnik koji je se sastojao iz 3 grupe pitanja. Prva grupa pitanja se odnosila na socio-demografske karak-

are defined as the degree to which an individual believes that the organizational and technical infrastructure can support the use of the system (5). The use of technology of mobile applications requires the availability of appropriate resources, knowledge and technological infrastructure. Also, facilitating conditions can include online tutorials or demo (trial) versions of mobile applications, and as such contribute to higher probability of accepting mobile applications for mHealth. Facilitating conditions (8) refer to the users' perception of convenience and level of technical support, and in particular, they refer to the possibility of receiving help and support in a timely manner.

Hedonic Motivation (HM) is the first element added to the UTAUT2 method and it is defined as fun or pleasure derived from using technology (4). This element determines the individual's expectation or experience, and refers to the enjoyment or happiness which results from using technology.

The authors of the UTAUT2 model believe that the price value of the technology used is significant when considering the intention to use it, the acceptance and use of technology. It is assumed that users perceive the quality of technology according to the price range, and therefore, price value is considered to be an important predictor of intention to use (4). The element price value is positive if the advantages of using mobile applications for mHealth outweigh the associated costs. It includes the willingness to pay for some of the features or services, and satisfaction with received information or services. In essence, all devices that are used today are connected to technology (10). Some people use technology when needed, while others become dependent on it and cannot imagine their daily life without it (11).

The last factor added to the model is Habit (H). Habit develops through experience related to using technology and it refers to the users' perception of technology they use (4). It is seen as unconscious or automatic behavior (4), and it reflects the multiple results of previous experiences and frequency of behavior in the past. It is deemed to be one of the main determinants of current behavior (12). Habit can have a significant effect on the intention to use technology, because the continuous use of technology causes routine to become more important than external factors (13). One of

the limitations is that there are no studies that investigate the importance of habit relating to the intention to use telemedicine services.

According to a study by Zhu and associates (8), some of the variables in the UTAUT2 model do not fit into the scenarios of mHealth and they do not influence the intention to accept mHealth applications. Therefore, researchers adjusted the variables and redefined them to make the model more compatible with their scenarios. They excluded the variables of hedonic motivations and habits. They found the reason in the fact that, through the conducted interviews, they discovered that most of these scenarios were focused on the context of medical care, where users consider factors such as access, efficiency and quality of medical services. They determined that hedonic factors were not part of the users' needs in this context. In addition, medical needs were relatively low in their daily lives, so mHealth could not influence the formation of habits. They also added new variables: perceived risk and perceived trust. A new variable, perceived risk, was added because they found that users feel uncertain about the outcome of their purchasing behavior, because this uncertainty can cause them harm (14). Medical services are related to the life and health of people, so it is logical that the control of health risks has always been a concern (8). Zhu et al. (8) found that respondents chose different ways to access medical and health services, depending on the severity of the disease and when they faced with more difficult conditions, they would become more cautious in deciding whether to use mHealth applications or not. They introduced one more variable, perceived trust. In the current socio-economic environment, trust has become one of the important influencing factors in the transaction process that influences intention and behavior.

The aim of this study was to identify predictors, according to the UTAUT2 model, which have an impact on the intention to use mobile health applications (mHealth) in the Republic of Serbia.

Methods

This cross-sectional study included 63 respondents (convenience sample), former students, teachers and associates of the Academy of Vocational Studies Western Serbia, who received a link via email to fill out an online questionnaire

teristike ispitanika (pol, starost, obrazovanje, zanimanje i visinu mesečnih prihoda). Sledeća grupa pitanja odnosila se na upravljanje e-zdravstvenim informacijama upotrebom mobilnih aplikacija za *mHealth* (svrha korišćenja mobilnog telefona, kako se snalaze sa korišćenju mobilnih aplikacija, da li smatraju da bi im bila potrebna pomoć za njihovo efikasno korišćenje, da li su upoznati sa mobilnim aplikacijama za *mZdravlje* koje pomažu korisnicima i da li koriste ili su koristili neku od mobilnih aplikacija *mZdravlje*). Treći deo upitnika sastojao se od 25 tvrdnji. Tvrdnje u upitniku su preuzete iz relevantne literature i prilagođene za potrebe ovog istraživanja. Grupisane su u 7 varijabli prema UTAUT2 modelu: očekivani učinak (engl. *Performance Expectancy* - PE); očekivani napor (engl. *Effort Expectancy* - EE); društveni uticaj (engl. *Social Influence* - SI); olakšavajući uslovi (engl. *Facilitating Conditions* - FC); hedonistička motivacija (engl. *Hedonic Motivation* - HM); dobra vrednost cene za uloženi novac tj. cenovna vrednost (engl. *Price Value* - PV); navika (engl. *Habit* - H) (5). Dodatno je uneta varijabla namera ponašanja (engl.

Behavior Intention - BI), kao osma, zavisna varijabla. Ispitanici su svoj stepen slaganja iskazivali na petostepenoj Likertovoj skali (1 - u potpunosti se ne slažem, 5 - u potpunosti se slažem).

Analiza prikupljenih podataka izvršena je u programu za statističku obradu podataka SPSS v. 20 (engl. *The Statistical Package for the Social Sciences*). Od statističkih analiza sprovedene su deskriptivna statistička analiza, analiza pouzdanosti i korelaciona i regresiona analiza. Pouzdanost upitnika je ispitana metodom unutrašnje konzistencije, koja se odnosi na opseg u kome varijable mere istu stvar, i proverava se unutrašnja usaglašenost tvrdnji u mernom instrument (Kronbahov koeficijent α). Da bi se dizajnirao pouzdan merni instrument teži se da rezultati na sličnim stavkama budu povezani, odnosno da budu usaglašeni, ali i da svaki od njih da pun doprinos jedinstvenim informacijama. Nijedan upitnik nije apsolutno validan niti apsolutno pouzdan, ali se uvek teži da Kronbahov koeficijent α bude što viši. Korelacionom analizom je meren stepen linearne veze između dve varijable (19). Što je koeficijent

Tabela 1. Prikaz demografskih podataka (N=63)

Varijable	Kategorija	Broj	%
Pol	Ženski	30	47,6
	Muški	33	52,4
Godine	18 - 25	10	15,9
	26 - 35	19	30,2
	36 - 45	15	23,8
	46 - 55	6	9,5
	56 - 65	7	11,1
	65 i više	6	9,5
	Osnovna škola	2	3,2
Nivo obrazovanja	Srednja stručna sprema	24	38,1
	Visoka stručna sprema	37	58,7
Zanimanje	Student	4	6,3
	Menadžer, preduzetnik	8	12,7
	Profesor, lekar, inženjer	15	23,8
	Radnik	13	20,6
	Penzioner	9	14,3
	Ostalo	14	22,2
	Mesečni prihodi	Manje od 50.000 din.	3
od 50.000 - 70.000 din.		8	12,7
od 70.000 - 100.000 din.		3	4,8
više od 100.000 din.		7	11,1
ne želim da se izjasnim		42	66,7

in the period May – November 2024. At the beginning of the questionnaire, respondents were given a notice, asking them to carefully fill out the questionnaire for the research on using mobile applications in mHealth, that the questionnaire was anonymous and that results would be used exclusively for scientific purposes.

Data for this research were collected electronically. All respondents filled out the questionnaire which consisted of three groups of questions. The first group of questions related to the socio-demographic characteristics of respondents (gender, age, education, occupation and amount of monthly income). The next group of questions related to the management of e-health information using mHealth applications (the purpose of using a mobile phone, how they cope with using mobile applications, whether they think they would need help to use them effectively, whether they are familiar with mHealth mobile applications that help users and whether they use or have used any of mHealth applications). The third part of the questionnaire consisted of 25

statements. The statements in the questionnaire were taken from the relevant literature and adapted for the needs of this research. They were grouped into 7 variables according to the UTAUT2 model: Performance Expectancy (PE); Effort Expectancy (EE); Social Influence (SI); Facilitating Conditions (FC); Hedonic Motivation (HM), good value for the invested money, that is, Price Value (PV); Habit (H) (5). Additionally, the variable Behavioral Intention (BI) was added as the eighth dependent variable. Respondents expressed their degree of agreement on a five-point Likert scale (1 – completely disagree, 5 – completely agree).

The analysis of collected data was carried out in the program for statistical data processing SPSS v. 20 (The Statistical Package for Social Sciences). Statistical analyses that were conducted were descriptive statistical analysis, reliability analysis and correlation and regression analysis. The reliability of the questionnaire was tested using the internal consistency method, which refers to the range in which the variables measure the same thing, and the internal consistency of

Table 1. Display of demographic data (N=63)

Variables	Category	Number	%
Broj	Female	30	47.6
	Male	33	52.4
Years	18 - 25	10	15.9
	26 - 35	19	30.2
	36 - 45	15	23.8
	46 - 55	6	9.5
	56 - 65	7	11.1
	65 +	6	9.5
	Elementary school	2	3.2
Level of education	Secondary vocational education	24	38.1
	Higher vocational education	37	58.7
Occupation	A student	4	6.3
	Manager, entrepreneur	8	12.7
	Professor, doctor, engineer	15	23.8
	Worker	13	20.6
	Pensioner	9	14.3
	The rest	14	22.2
Monthly income	Less than 50.000 rsd.	3	4.8
	From 50.000 - 70.000 rsd	8	12.7
	From 70.000 - 100.000 rsd	3	4.8
	More than 100.000 rsd	7	11.1
	I don't want to make a statement	42	66.7

Tabela 2. Pouzdanost skale

Varijable	Cronbach's Alpha
Očekivani učinak	0,846
Očekivani trud	0,841
Uticaj okruženja, Društveni uticaj	0,869
Olakšavajući uslovi	0,839
Hedonistička motivacija	0,755
Cenovna vrednost	0,870
Navika	0,789
Namera ponašanja	0,869

korelacije po apsolutnoj vrednosti bliži jedinici, sve je jača korelaciona veza između pojava. S obzirom da je u radu vršeno posmatranje jednog obeležja elementa posmatranog skupa, i da je vršena samo analiza strukture i osobine skupa po tom obeležju, urađena je regresiona analiza, jer se u praksi često javlja potreba da se istovremeno prate dve ili više varijabli, i da se ispita da li između njih postoji međusobni uticaj.

Rezultati

U naše istraživanje uključena su 63 ispitanika od kojih su 52,4% (33) činili muškarci, a 47,6% (30) žene (Tabela 1). Najveći deo ispitanika čine osobe starosti 26-35 godina, njih 30,2%. Kada je obrazovna struktura u pitanju, najviše ispitanika i to 58,7% ima visoko obrazovanje. Prema zanimanju, najveći deo ispitanika su činili profesori, lekari i inženjeri (23,8%) i radnici (20,6%). O visini mesečnih primanja, najveći deo ispitanika nije želeo da se izjasni (66,7 %).

U delu koji se odnosi na upravljanje e-zdravstvenim informacijama trećina ispitanika, njih 33,3%

je odgovorila da im nije potrebna nikakva pomoć u smislu efikasnog korišćenja informacija iz oblasti e-zdravstva. Značajan deo ispitanika, njih 17,5%, izjasnilo se da im je potrebna pomoć prilikom traženja potrebnih e-zdravstvenih informacija. Na pitanje da li su upoznati sa mobilnim aplikacijama koje pomažu korisnicima da efikasno upravljaju e-Zdravstvenim informacijama, trećina ispitanika, njih 34,9% je odgovorila da su upoznati, ali da ih ne koriste. Petina ispitanika (22,2%) je odgovorila da koriste aplikacije e-zdravstva manje (9,5%) ili više (12,7%) od pola godine. Skoro petina anketiranih (19%) se izjasnila da nisu bili upoznati sa ovom vrstom mobilnih aplikacija, ali bi voleli da saznaju i nauče više o njima. Ono što je afirmativno je to da je nešto više od petine ispitanika (20,6%), upoznato sa aplikacijama za mHealth i da planira da ih koristi u budućnosti.

Analiza pouzdanosti mernog instrumenta sprovedena je izračunavanjem *Cronbach*-ovog koeficijenta alfa, koji meri unutrašnju konzistentnost skale. Vrednosti se kreću u intervalu od 0 do 1, pri čemu se vrednosti iznad 0,70 uobičajaje-

Tabela 3. Korelaciona analiza komponenata UTAUT2 modela

	BI	PE	EE	SI	FC	HM	PV	HB
BI	1	0,495**	0,625**	0,416**	0,620**	0,185	0,324**	0,242
PE	0,518**	1	0,476**	0,340**	0,486**	0,359**	0,371**	0,417**
EE	0,686**	0,524**	1	0,435**	0,843**	0,290*	0,501**	0,142
SI	0,439**	0,344**	0,442**	1	0,290*	0,506**	0,497**	0,299*
FC	0,633**	0,516**	0,836**	0,288*	1	0,152	0,495**	0,009
HM	0,141	0,335**	0,187	0,476**	0,084	1	0,419**	0,323**
PV	0,324**	0,333**	0,387**	0,479**	0,400**	0,344**	1	0,301*
HB	0,198	0,354**	0,122	0,327**	0,012	0,287*	0,333**	1

*Statistically significant at the level of 0.05; **Statistically significant at the level of 0.01

PE - Performance Expectancy / Očekivani učinak; EE - Effort Expectancy / Očekivani trud; SI - Social Influence) / Uticaj okruženja, Društveni uticaj; FC - Facilitating Conditions / Olakšavajući uslovi; HM - Hedonic Motivation / Hedonistička motivacija; PV - Price Value / Cenovna vrednost; HB - Habit / Navika; BI - Behavior Intention / Namera ponašanja.

Table 2. Reliability of the scale

Variables	Cronbach's Alpha
Performance Expectancy (PE)	0.846
Effort Expectancy (EE)	0.841
Social Influence (SI)	0.869
Facilitating Conditions (FC)	0.839
Hedonic Motivation (HM)	0.755
Price Value (PV)	0.870
Habit (H)	0.789
Behavior Intention (BI)	0.869

claims in the measuring instrument is checked (Cronbach's coefficient α). In order to design a reliable measuring instrument, the results for similar items should be connected, that is, they should be harmonized, but each of them should fully contribute to unique information. There are no questionnaires that are absolutely valid or absolutely reliable, but the Cronbach's coefficient α should always be as high as possible. Correlation analysis was used to measure the degree of linear relationship between two variables. The closer the correlation coefficient is, according to the absolute value, to one, the stronger the correlation between phenomena is. Considering that we observed in this study one feature of the element of the observed set, and analyzed the structure and features of that set, regression analysis was conducted because in practice there is often a need to monitor two or more variables at the same time and to examine whether there is a mutual influence between them.

Results

Our study included 63 respondents, of whom 52.4% (33) were men, and 47.6% (30) were women (Table 1). The majority of respondents were people aged 26-35 years, that is, 30.2% of respondents. When it comes to the educational structure, most respondents, 58.7% had higher education. When it comes to the respondents' occupation, the majority of them were professors, doctors and engineers (23.8%) and workers (20.6%). As far as their monthly income is concerned, the majority of them did not want to specify (66.7%).

In the part related to the management of e-health information, a large number of respondents, 33.3% of them answered that they did not need any help in terms of the efficient use of information in the field of e-health. A significant number of respondents, 17.5% of them, stated that they needed help when searching for the necessary e-health information. When asked if they were familiar with mobile applications that help users manage e-health information efficiently, a large number of respondents, that is, 34.9% of

Table 3. Correlation analysis components of UTAUT2 model

	BI	PE	EE	SI	FC	HM	PV	H
BI	1	0.495**	0.625**	0.416**	0.620**	0.185	0.324**	0.242
PE	0.518**	1	0.476**	0.340**	0.486**	0.359**	0.371**	0.417**
EE	0.686**	0.524**	1	0.435**	0.843**	0.290*	0.501**	0.142
SI	0.439**	0.344**	0.442**	1	0.290*	0.506**	0.497**	0.299*
FC	0.633**	0.516**	0.836**	0.288*	1	0.152	0.495**	0.009
HM	0.141	0.335**	0.187	0.476**	0.084	1	0.419**	0.323**
PV	0.324**	0.333**	0.387**	0.479**	0.400**	0.344**	1	0.301*
HB	0.198	0.354**	0.122	0.327**	0.012	0.287*	0.333**	1

*Statistically significant at the level of 0.05; **Statistically significant at the level of 0.01

PE - Performance Expectancy; EE - Effort Expectancy; SI - Social Influence; FC - Facilitating Conditions; HM - Hedonic Motivation; PV - Price Value; HB - Habit; BI - Behavior Intention.

Tabela 4. Prosta regresiona analiza (Zavisna varijabla - Ponašanje, Namera)

Nezavisna varijabla	R ²	β	t	p
Očekivani učinak	0,518	0,621**	4,733	<0,01
Očekivani trud	0,676	0,686**	7,361	<0,01
Uticaj okruženja, Društveni uticaj	0,439	0,636**	3,820	<0,01
Olakšavajući uslovi	0,633	0,624**	6,381	<0,01
Hedonistička motivacija	0,141	0,197	1,114	n.s.
Cenovna vrednost	0,324	0,377**	2,765	<0,01
Navika	0,198	0,229	1,577	n.s.

β – standardizovani regresioni koeficijent; R² – koeficijent determinacije u univarijantnoj regresiji; n.s. – nije statistički značajno; **Statistička značajno na nivou od 1%

no smatraju zadovoljavajućim pokazateljem pouzdanosti. Dobijene vrednosti *Cronbach*-ovog koeficijenta alfa za šest latentnih konstrukata (očekivani učinak, očekivani trud, društveni uticaj, olakšavajući uslovi, cenovna vrednost i namera ponašanja) kreću se u intervalu od 0,839 do 0,870, što ukazuje na visoku unutrašnju konzistentnost (Tabela 2). Konstrukti cenovna vrednost ($\alpha = 0,755$) i navika ($\alpha = 0,789$) takođe imaju zadovoljavajuće vrednosti, koje ukazuju na dobru pouzdanost skala.

Prema rezultatima korelacione analize, može se zaključiti da postoji značajna pozitivna veza na nivou 0,01 (verovatnoća 99%) između zavisne varijable namera ponašanja (BI) i sledećih pojedinačnih varijabli: očekivani učinak, očekivani napor, društveni uticaj, olakšavajući uslovi i vrednost cene (Tabela 3). Pozitivna korelacija ukazuje da sa povećanjem vrednosti jedne varijable, raste i vrednost druge varijable, kao i obrnuto.

Rezultati univarijantne regresione analize pokazuju da pet nezavisnih varijabli UTAUT2 modela — očekivani učinak, očekivani trud, društveni uticaj, olakšavajući uslovi i vrednost cene — imaju statistički značajan pozitivan uticaj na nameru korisnika da koriste *mHealth* aplikacije (Tabela 4). Koeficijent determinacije (R²) korišćen je kao deskriptivna mera kojom se procenjuje koliko dobro nezavisna varijabla objašnjava varijansu zavisne varijable (namera korišćenja). Uočen nivo objašnjenog varijabiliteta kretao se od 32,4% za varijablu *vrednost cene*, do 67,6% za *očekivani trud*. S druge strane, varijable *hedonistička motivacija* i *navika* nisu imale statistički značajan uticaj na nameru korišćenja *mHealth* aplikacija.

Diskusija

Prema rezultatima univarijantne regresione analize, pet od 7 elemenata (PE, EE, SI, PV i FC)

UTAUT2 modela predstavljaju značajne prediktore za BI ispitanika da prihvate i koriste usluge mobilnih aplikacija za *mHealth*. Najslabiji uticaj na BI korišćenja usluga mobilnih aplikacija za *mHealth* ima PV, jer kada je zdravlje pojednca u pitanju cena korišćenja komercijalnih mobilnih aplikacija za *mHealth*, neće predstavljati faktor sa presudnim uticajem.

Prema našoj studiji, elementi HB i HM nisu značajni prediktori korišćenja mobilnih aplikacija za *mHealth*, što može koincidirati sa društveno-ekonomskim i socijalno-kulturnim okruženjem, kulturom i navikama koje nisu na zadovoljavajućem nivou kada je u pitanju briga ljudi o sopstvenom zdravlju. Pozitivne implikacije se odnose i na nameru većine ispitanika, da se edukuju kako bi dobili više znanja o korišćenju *mHealth* mobilnih aplikacija. Iako su među ispitanicima većinom bili ljudi sa visokom stručnom spremom, većina njih je upoznata sa postojanjem mobilnih aplikacija za *mHealth*, ali ih ne koristi. *Zhu* i saradnici su došli do sličnog zaključka po pitanju HM i HB (8). Međutim, *Schomakers* i saradnici (15) u svom istraživanju o prihvatanju aplikacije za stil života i terapije, dolaze do podataka da na prihvatanje aplikacije za *mHealth*, utiču emocionalni faktori kao što je HM i delimično HB. *Schretzmaier*, *Hecker* i *Ammenwerth* (16) su u svojoj studiji uspeli da potvrde relevantnost svih egzogenih komponenti UTAUT2 modela u predviđanju prihvatanja *mHealth*-a, koristeći dijabetes kao primer. Oni su utvrdili da HM ima značaj u samoupravljanju *mHealth*-om kod dijabetesa, što je u skladu sa nekoliko prethodnih istraživanja (17-20). Uživanje u korišćenju tehnologije, ili osećaj da tehnologija pruža zadovoljstvo (npr. vizualizacija napretka ili personalizovane preporuke) može doprineti boljem korišćenju *mHealth* aplikacija povezanih sa dijabetesom.

Table 4. Simple regression analysis (Dependent variable Behavior Intention)

Independent variable	R ²	β	t	p
Performance Expectancy	0.518	0.621**	4.733	<0.01
Effort Expectancy	0.676	0.686**	7.361	<0.01
Social Influence	0.439	0.636**	3.820	<0.01
Facilitating Conditions	0.633	0.624**	6.381	<0.01
Hedonic Motivation	0.141	0.197	1.114	n.s.
Price Value	0.324	0.377**	2.765	<0.01
Habit	0.198	0.229	1.577	n.s.

β - standardized regression coefficient; R² - coefficient of determination in univariate regression; ns – non statistically significant; **Statistically significant at the level of 1%

them answered that they were familiar with them, but did not use them. One fifth of respondents (22.2%) answered that they used e-health applications less (9.5%) or more (12.7%) than half a year. Almost one fifth of respondents (19%) stated that they were not familiar with this type of mobile applications, but they would like to know and learn more about them. What is positive is the fact that slightly more than a fifth of respondents (20.6%) were familiar with mHealth applications and planned to use them in the future.

The reliability analysis of the measuring instrument was carried out by calculating Cronbach's coefficient alpha, which measures the internal consistency of the scale. Values range from 0 to 1, with values above 0.70 usually considered a satisfactory indicator of reliability (19). The obtained values of Cronbach's alpha for six latent constructs (expected performance, expected effort, social influence, facilitating conditions, price value and behavioral intention) range from 0.839 to 0.870, which indicates high internal consistency (Table 2). The constructs price value ($\alpha = 0.755$) and habit ($\alpha = 0.789$) also have satisfactory values, which indicate good reliability of the scales.

According to the results of correlation analysis, it can be concluded that there is a significant positive relationship at the 0.01 level (99% probability) between the dependent variable of behavioral intention (BI) and the following individual variables: performance expectancy, effort expectancy, social influence, facilitating conditions and price value (Table 3). A positive correlation indicates that when the value of one variable increases, so does the value of other variable, and vice versa.

The results of the univariate regression analysis show that the five independent variables

of the UTAUT2 model - performance expectancy, effort expectancy, social influence, facilitating conditions and price value - have a statistically significant positive impact on users' intention to use mHealth applications (Table 4). The coefficient of determination (R²) was used as a descriptive measure that assesses how well the independent variable explains the variance of the dependent variable (intention to use). The observed level of explained variability ranged from 32.4% for the price value variable to 67.6% for effort expectancy. On the other hand, the variables hedonic motivation and habit did not have a statistically significant influence on the intention to use mHealth applications.

Discussion

Five of the seven elements (PE, EE, SI, PV and FC) of the UTAUT2 model are significant predictors of respondents' BI to accept and use the services of mHealth applications. PV has the weakest influence on BI to use mHealth services, because when it comes to health, the price of using commercial mHealth applications will not be the factor with a decisive influence.

According to our study, HB and HM are not significant predictors of using mHealth applications, which may coincide with the socio-economic and socio-cultural environment, culture and habits that are not at a satisfactory level when it comes to people's care about their own health. The positive implications also refer to the intention of the majority of respondents to educate themselves in order to gain more knowledge about the use of mHealth applications. Although most of the respondents had a university degree, most of them were familiar with the existence of mHealth applications, but they did not use them. Zhu and

Neki istraživači su dokazali, da su četiri egzogene UTAUT2 konstrukta: FC, PE, EE i SI, relevantni za prihvatanje *mHealth*-a kod osoba sa dijabetesom (16), što je uočeno i u drugim studijama za *mHealth* (21-24). Dostupnost pametnih telefona ili interneta, kao i podrške u korišćenju *mHealth* aplikacija, doprineće da osobe sa dijabetesom lakše usvoje *mHealth* rešenja. Pokušaji prijatelja, zdravstvenih radnika i članova porodice da podstaknu upotrebu *mHealth* aplikacija može značajno uticati na ponašanje osoba sa dijabetesom. Ako osobe sa dijabetesom smatraju da je korišćenje tehnologije preporučeno ili uobičajeno, kao i da ne zahteva puno tehničkog znanja, to može povećati njihovu nameru da koriste te aplikacije. Posebno je istaknuto, da su HM i HB od suštinskog značaja za prihvatanje i dugoročnu upotrebu aplikacija za samoupravljanje *mHealth* kod dijabetesa (25).

Na osnovu naših rezultata, značajan i najjačiji uticaj na nameru korišćenja mobilnih aplikacija za *mHealth*-a, ima varijabla EE ($\beta=0,686$), što pokazuje da korisnici smatraju da sa lakoćom mogu da shvate na koji način će aplikacija da funkcioniše. Dobijeni rezultat je u skladu sa nalazima više istraživanja (8,15,21-23,26,27). Značajan i sa jakim uticajem, u našoj studiji, na nameru korišćenja mobilnih aplikacija za *mHealth* ima varijabla SI ($\beta=0,636$), što ukazuje na pozitivan uticaj društvenih grupa iz bližeg okruženja na potencijalnog korisnika, što je u skladu sa rezultatima drugih istraživača (8,15,16,21-23,27-30). Takođe, varijabla FC ($\beta=0,624$) je značajna za prihvatanje mobilnih aplikacija za *mHealth*. Korisnici su svesni da upotreba aplikacije *mHealth*-a zavisi od internet mreže i podrške koju može da pruži mobilni uređaj, ali i od blagovremene pomoći i podrške samog dizajna korisničkog interfejsa (26,28-30). Prema rezultatima našeg istraživanja varijabla PE ($\beta=0,621$) je značajna za prihvatanje aplikacije za *mHealth*, što ukazuje da aplikacija može pomoći korisnicima da poboljšaju i unaprede medicinske usluge u smislu efikasnosti i efektivnosti. Efikasnost podrazumeva da upotreba mobilne aplikacije *mHealth* pruža najbolje moguće rezultate uz minimalna ulaganja ljudskih resursa, vremena, novca i energije. Efektivnost je usmerena na postizanje ishoda koji su u skladu sa postavljenim ciljevima. Ona podrazumeva da se upotrebom mobilnih aplikacija *mHealth*-a mogu ostvariti očekivanja korisnika. Slično je uočeno u radovima drugih autora (8,16,21-24,26-30). Varijabla PV ($\beta=0,377$),

u našoj studiji, ima značajan uticaj na korišćenje *mHealth* mobilne aplikacije od strane korisnika, ali u odnosu na ostale statistički relevantne varijable, ima najslabiji uticaj na nameru korisnika da koriste ove mobilne aplikacije. To se može objasniti činjenicom da je određena grupa korisnika spremna da plati veću cenu kako bi dobila adekvatnu medicinsku uslugu. Neki autori su povrdili da ova varijabla ima značajnu relevantnost sa namerom prihvatanja mobilne aplikacije za *mHealth* od strane korisnika (31-33). Kulturno okruženje je važan faktor ponašanja potrošača.

Kao mnoga istraživanja i ovo istraživanje ima ograničenja. Najznačajnije ograničenje se odnosi na veličinu uzorka i reprezentativnost uzorka. Buduća istraživanja trebalo bi da se sprovedu na većem i reprezentativnom uzorku, pri čemu bi i ovaj kreirani merni instrument mogao poslužiti za buduća istraživanja iz navedene oblasti. Ograničenje predstavlja i činjenica da u Republici Srbiji ne postoje radovi koji se bave analizom namere pojedinca da koriste mobilne aplikacije za *mHealth*. S obzirom da je ovo prvo istraživanje namere upotrebe mobilnih aplikacija za *mHealth* u Srbiji, autori su se odlučili da, za početak, u radu koriste predloženi konceptualni model koji razmatra isključivo varijable UTAUT2 modela koje su razvili (4), bez obzira na jako tehnološki orijentisane varijable UTAUT2 modela. Brojne studije drugih autora ukazuju da i druge varijable koje nisu prisutne u ovom modelu, mogu implicirati usvajanje mobilnih aplikacija za *mHealth*. U narednim istraživanjima bi se uključile i nove varijable, kako bi se razmotrio njihov uticaj na nameru korišćenja razmatranih mobilnih aplikacija.

Zaključak

Neophodna su dalja istraživanja u ovoj oblasti, posebno istraživanja koja se odnose na testiranje i korišćenje konkretne mobilne aplikacije za *mHealth* prema elementima UTAUT2 modela.

Konflikt interesa

Autori su izjavili da nema konflikta interesa.

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associates reached a similar conclusion regarding HM and HB (8). However, Schomakers and associates (15) in their research on the acceptance of lifestyle and therapy applications, found out that the acceptance of mHealth applications is influenced by emotional factors such as HM and partially HB. Schretzmaier, Hecker and Ammenwerth (16) in their study managed to confirm the relevance of all exogenous components of the UTAUT2 model in predicting mHealth acceptance, using diabetes as an example. They found that HM has significance in the self-management of diabetes using mHealth, which is consistent with several previous studies (17-20). Enjoyment of using technology, as well as the feeling that technology provides satisfaction (e.g. visualization of progress or personalized recommendations) may contribute to better use of mHealth applications associated with diabetes.

Some researchers have proven that the four exogenous UTAUT constructs: FC, PE, EE and SI are relevant for the acceptance of mHealth in people with diabetes (16), which was also observed in other studies about mHealth (21-24). The availability of smartphones or the Internet, as well as the support in using mHealth applications, will contribute to the easier adoption of mHealth solutions by people with diabetes. Attempts of friends, healthcare professionals and family members to encourage the use of mHealth can significantly influence the behavior of people with diabetes. If people with diabetes think that use of technology is recommended or common, and that it does not require much technical knowledge, this may increase their intention to use those applications. In particular, it has been pointed out that HM and HB are essential for the acceptance and long-term use of mHealth applications for the self-management of diabetes (25).

Based on our results, the variable EE ($\beta=0.686$) has the significant and strongest influence on the intention to use mHealth applications, which shows that users think that they can easily understand how the application will work. The obtained result is in accordance with the findings of several studies (8,15,21-23,26,27). In our study, the variable SI ($\beta=0.636$) has a significant and strong influence on the intention to use mobile applications for mHealth, which indicates a positive influence of social groups from the immediate environment on the potential user, which is consistent with the results of other researchers (8,15,16,21-23,27-

30). Also, the variable FC ($\beta=0.624$) is significant for the acceptance of mobile applications for mHealth. Users are aware that the use of mHealth applications depends on the Internet network and support that can be provided by the mobile device, but also on the timely help and support of the user interface design itself (26, 28-30). According to the results of our study, the PE variable ($\beta=0.621$) is significant for the acceptance of the application for mHealth, which indicates that the application can help users improve medical services in terms of efficiency and effectiveness. The efficiency means that the use of mHealth application provides the best possible results with minimal investment of human resources, time, money, and energy. Effectiveness is aimed at achieving outcomes that are consistent with the set goals. It implies that user expectations can be realized by using mHealth applications. Similar results were observed in the studies conducted by other authors (8,16,21-24,26-30). The PV variable ($\beta=0.377$) in our study has a significant influence on the use of mHealth mobile application by users, but in comparison to other statistically relevant variables, it has the weakest impact on users' intention to use these mobile applications. This can be explained by the fact that a certain group of users is ready to pay a higher price in order to receive an adequate medical service. Some authors have confirmed that this variable has a significant relevance with the intention to accept a mobile mHealth application by users (31-33). Cultural environment is an important factor in consumer behavior.

Like many studies, this study has limitations. The most significant limitation relates to sample size and sample representativeness. Future research should be conducted on a larger representative sample, while the created measuring instrument could be used for future research in the above-mentioned field. One of the limitations refers to the fact that in the Republic of Serbia, there are no studies dealing with the analysis of the intention of an individual to use mobile applications for mHealth. Given that this is the first research on the intention to use mobile applications for mHealth in Serbia, the authors decided to use the proposed conceptual model that analyzes only the variables of the UTAUT2 model developed by them (4), regardless of the highly technologically oriented variables of the UTAUT2 model. Numerous studies of other authors indicate that other variables

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that are not present in this model may imply the adoption of mobile applications for mHealth. New variables could be included in the future research, in order to consider their influence on the intention to use the analyzed mobile applications.

Conclusion

Further research in this field is needed, especially research related to the testing and use of specific mobile application for mHealth according to the elements of the UTAUT2 model.

Competing interests

The authors declared no competing interests.

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KVALITET ŽIVOTA BOLESNIKA NA HRONIČNOM PROGRAMU HEMODIJALIZE U KLINIČKOM CENTRU CRNE GORE

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SAŽETAK

Uvod/Cilj: Kvalitet života povezan sa zdravljem (engl. *Health Related Quality of Life*, HRQoL) predstavlja jedan od niza važnih prediktora smrtnog ishoda i hospitalizacije osoba na hemodijalizi (HD) usled terminalne bubrežne insuficijencije. Cilj ovog istraživanja je da se proceni HRQoL obolelih u terminalnoj fazi hronične bubrežne insuficijencije koji se leče HD u Centru za hemodijalizu Kliničkog centra Crna Gora (KCCG).

Metode: Studijom preseka obuhvaćeno je 43 ispitanika sa terminalnom fazom hronične bubrežne insuficijencije koji su bili na HD tokom januara 2025. godine u Centru za hemodijalizu KCCG. Podaci od ispitanika su prikupljeni opštim i standardizovanim anonimnim upitnikom *Kidney Disease Quality of Life Short Form* (KDQOL-SF™) (srpska verzija). U cilju analize podataka korišćen je Pearsonov koeficijent korelacije.

Rezultati: Postoji značajna negativna korelacija između doživljaja uspešnosti i zadovoljstva sa zaokupljenošću bubrežnom bolešću prilikom obavljanja svakodnevnih aktivnosti ($r = -0,45$; $p < 0,001$). Zadovoljstvo lečenjem lica na HD je manje što je veći uticaj bubrežne bolesti na život bolesnika ($r = -0,47$; $p < 0,001$). Više je problema u seksualnom funkcionisanju što je veći uticaj bolesti na psihičko stanje ($r = 0,54$; $p < 0,001$), kao i kada je veća zaokupljenost osobe bolešću tokom obavljanja svakodnevnih životnih aktivnosti ($r = 0,67$; $p < 0,001$) i kada je veći uticaj bubrežne bolesti na život ($r = 0,46$; $p < 0,001$).

Zaključak: Neophodna su dalja istraživanja u ovoj oblasti u cilju sagledavanja kvaliteta života osoba sa hroničnim bubrežnim oboljenjima koji su na HD u odnosu na demografske i kliničke parametre, kao i u cilju identifikacije nezavisnih prediktora kvaliteta života.

Ključne reči: terminalna bubrežna insuficijencija, hronična bubrežna bolest, kvalitet života, hemodijaliza

Uvod

U svetu, poslednjih decenija životni vek ljudi je sve duži, pa je stim u vezi došlo i do povećanja globalnog broja starijih osoba sa hroničnim nezaraznim bolestima, kao što su hipertenzija, dijabetes melitus i druge autoimune bolesti koje doprinose razvoju hronične bolesti bubrega (1,2). Završni stadijum hronične bubrežne bolesti dovodi do terminalne bubrežne insuficijencije koja zahteva hitnu medicinsku intervenciju u vidu hemodijalize, peritoneumske dijalize i transplantacije bubrega. Svaka od navedenih terapija utiče na kvalitet života povezan sa zdravljem (engl. *Health Related Quality of Life*, HRQoL)(3).

Svetska zdravstvena organizacija (SZO) naglašava da HRQoL predstavlja „individualnu procenu bolesnika o tome koliko bolest i primenjena terapija utiču na njegov psihofizički, socijalni i emocionalni osećaj „dobrog“ (6). Istraživanja sugerišu da bolesnici na HD često prijavljuju niži nivo kvaliteta života u odnosu na one koji su na peritoneumskoj dijalizi ili su podvrgnuti transplantaciji. Takođe, HRQoL je pouzdan prediktor smrtnog ishoda i hospitalizacije bolesnika na HD (4,5). Cilj svakog lečenja osoba u terminalnoj fazi hronične bubrežne insuficijencije je da doprinese povećanju HRQoL (6,7). Osobe na HD, u odnosu na opštu populaci-

QUALITY OF LIFE OF PATIENTS ON CHRONIC HEMODIALYSIS PROGRAM IN THE CLINICAL CENTER OF MONTENEGRO

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SUMMARY

Introduction/Aims: Health-related quality of life (HRQoL) is one of the key predictors of mortality and hospitalization in patients undergoing hemodialysis (HD) due to terminal kidney failure. The aim of our study was to examine the HRQoL of individuals with terminal chronic kidney disease who are undergoing HD at the Hemodialysis Center of the Clinical Center of Montenegro (CCM).

Methods: A cross-sectional study included 43 participants with terminal chronic kidney disease who were on HD during January 2025 at the Hemodialysis Center of CCM. Data were collected from participants using a general and standardized anonymous questionnaire, the Kidney Disease Quality of Life Short Form (KDQOL-SF™) (Serbian version). Pearson's correlation coefficient was used for data analysis.

Results: There is a significant negative correlation between the perception of success and satisfaction with the impact of kidney disease on daily activities ($r = -0.45$; $p < 0.001$). Satisfaction with treatment in HD patients is lower when the impact of kidney disease on their lives is greater ($r = -0.47$; $p < 0.001$). Sexual functioning issues are more pronounced when the impact of the disease on mental health is greater ($r = 0.54$; $p < 0.001$), as well as when there is more preoccupation with the disease during daily activities ($r = 0.67$; $p < 0.001$) and when the impact of kidney disease on life is greater ($r = 0.46$; $p < 0.001$).

Conclusion: Further research is needed in this area to assess the quality of life of individuals with chronic kidney disease undergoing HD in relation to demographic and clinical parameters, as well as to identify independent predictors of quality of life.

Keywords: terminal kidney failure, chronic kidney disease, quality of life, hemodialysis

Introduction

Global life expectancy has increased around the world in recent decades, with the resulting increase in the global number of elderly persons with chronic non-infectious diseases, such as hypertension, diabetes mellitus and other autoimmune diseases, which contribute to the development of chronic kidney disease (1,2). The end-stage chronic kidney disease leads to end-stage kidney failure which requires urgent medical intervention, including hemodialysis, peritoneal dialysis and kidney transplant. Each of the mentioned treatments affects the Health Related Quality of Life (HRQoL) (3).

The World Health Organization (WHO) emphasizes that HRQoL represents “the individual assessment of how disease and treatment affect the patient’s sense of psychological, physical, social and emotional well-being” (6). Studies have suggested that patients receiving HD often report a lower level of quality of life in comparison to those patients receiving peritoneal dialysis (PD) or kidney recipients. Also, HRQoL is a reliable predictor of mortality and hospitalization in HD patients (4,5). The goal of any treatment for patients with end-stage kidney failure is to contribute to an increase in HRQoL (6,7). Patients receiving HD, compared

ju, imaju značajno niži HRQOL (7,8). Stoga, adekvatna terapija i individualni pristupi u zbrinjavanju pacijenata sa terminalnom hroničnom bubrežnom insuficijencijom su od suštinskog značaja za poboljšanje njihovog HRQOL (7,8). HD je sama po sebi povezana s dužom hospitalizacijama i postojanjem brojnih simptoma: nesаница, umor, slab apetit, depresivno ili anksiozno ponašanje, podhranjenost, seksualna disfunkcija i poremećaj libida (9). Cilj ovog istraživanja je bio da se proceni HRQoL obolelih u terminalnoj fazi hronične bubrežne insuficijencije koji se leče HD u Centru za hemodijalizu, Kliničkog Centra Crne Gore (KCCG).

Metode

Studijom preseka je obuhvaćeno 43 ispitanika u terminalnoj fazi hronične bubrežne insuficijencije koji su bili na HD tokom januara 2025. godine u Centru za hemodijalizu, KCCG. Osobe na HD su popunile opšti (pol, uzrast, obrazovanje, dužina trajanja HD, komorbiditeti, hospitalizacija tokom poslednjih 12 meseci) i standardizovani anonimni upitnik *Kidney Disease Quality of Life Short Form (KDQOL-SF™)* (srpska verzija) (10). KDKOL-SF je alat za samoprocenu kvaliteta života osoba sa oboljenjem bubrega i za one na dijalizi. Ova kraća verzija alata uključuje 43 stavke usmerene na bubrežne bolesti, kao što su efekti bolesti na aktivnosti svakodnevnog života, radni status i društvene interakcije, kao i 36 stavki koje obezbeđuju meru fizičkog i mentalnog zdravlja, i jedna stavka ukupne zdravstvene ocene u rasponu od 0 („najgore moguće zdravlje“) do 10 („najbolje moguće zdravlje.“). Za popunjavanje upitnika od 80 stavki neophodno je oko 16 minuta. Svi ispitanici su pre popunjavanja upitnika potpisali informativni pristanak za učešće u studiji. Istraživanje je odobreno od strane Klinike za nefrologiju, KCCG 16.01.2024. godine (broj: 03/01-820). U cilju analize podataka korišćena je proporcija, Pearsonov koeficijent korelacije i univarijantna regresiona analiza.

Rezultati

Studijom preseka je obuhvaćeno 43 ispitanika (22 muškarca i 21 žena) koja su na hroničnom programu HD u Centru za dijalizu KCCG u Podgorici. Najveći broj ispitanika je bilo uzrasta 51-60 godina (39,5%) i 61 i više godina (39,5%), a najmanje u uzrastu 50 i manje godina (21,0%). Visoko i više obrazovanje je imalo 9,3% ispitanika, srednje 65,1%, a osnovno 16,3%. Kada je u pitanju dužina lečenja

HD, 28 (65,1%) ispitanika se lečila između jedne i pet godina, 12 (27,9%) između šest i deset godina, a troje (7,0%) duže od deset godina. Najčešće ispitanici su imali od komorbiditeta hipertenziju (32,6%) i policističnu bolest bubrega (20,9%), a zatim hronični glomerulonefritis (14%) i ostale bolesti (14,0%) (dijabetes, hronični pijelonefritis, nepoznato). Svi ispitanici su bili bar jednom hospitalizovani tokom poslednjih 12 meseci.

Analiza kvaliteta života u vezi sa sveukupnim zdravljem pokazuje da sveukupno zdravlje značajno negativno korelira sa strahom za zdravlje ($r = -0,60$; $p < 0,001$), ograničenošću u obavljanju svakodnevnih aktivnosti ($r = -0,56$; $p < 0,001$) i društvenog funkcionisanja ($r = -0,54$; $p < 0,001$) (Tabela 1). Takođe, osobe koje više strahuju za svoje zdravlje imaju manje kvalitetan san ($r = -0,36$; $p = 0,02$), a više se žale na otežano socijalno funkcionisanje ($r = 0,59$; $p < 0,001$), otežano obavljanje svakodnevnih aktivnosti ($r = 0,64$; $p < 0,001$) i otežano obavljanje posla usled prisustva telesnog bola ($r = 0,38$; $p = 0,01$). Visoka je i značajna pozitivna korelacija između teškoća u obavljanju svakodnevnih aktivnosti i teškoća u učestvovanju u socijalnim/društvenim aktivnostima ($r = 0,70$; $p < 0,001$), a obe ove varijable značajno pozitivno koreliraju sa smetnjama u obavljanju radnih zadataka usled telesnog bola ($r = 0,47$; $p < 0,001$ i $r = 0,54$; $p < 0,001$), dok značajno negativno koreliraju sa kvalitetom sna ($r = -0,51$; $p < 0,001$ i $r = -0,39$; $p = 0,01$). Pokazalo se da prisustvo telesnog bola značajno pozitivno korelira sa otežanim obavljanjem svakodnevnih aktivnosti ($r = 0,33$; $p = 0,04$) i obavljanje poslova ($r = 0,82$; $p < 0,001$). Zadovoljstvo vremenom koje ispitanici provode sa porodicom i prijateljima značajno pozitivno korelira sa zadovoljstvom vezanim za porodičnu podršku ($r = 0,74$; $p < 0,001$), a obrnuto sa otežanim društvenim funkcionisanjem ($r = -0,45$; $p < 0,001$). Zadovoljstvo porodičnom podrškom značajno negativno korelira sa otežanim obavljanjem svakodnevnih aktivnosti ($r = -0,33$; $p = 0,04$).

Analiza kvaliteta života u odnosu na bubrežnu bolest pokazuje da postoji značajna negativna korelacija između doživljaja uspešnosti i zadovoljstva i zaokupljenošću bubrežnom bolešću prilikom obavljanja svakodnevnih aktivnosti ($r = -0,45$; $p < 0,001$) (Tabela 2). Što je veći uticaj bubrežne bolesti na život pacijenta, to je značajno veći uticaj na njihovo psihičko stanje ($r = 0,46$; $p < 0,001$), značajno veća je njegova zaokupljenost bolešću prilikom obavljanja svakodnevnih aktivnosti ($r = 0,64$; $p <$

to the general population, have significantly lower HRQoL (7,8). Therefore, adequate treatment and individual approach in the healthcare of patients with end-stage kidney failure can contribute to the increase in their HRQoL (7,8). HD itself is associated with longer hospitalization and the existence of numerous symptoms: insomnia, fatigue, poor appetite, depressive or anxious behavior, malnutrition, sexual dysfunction and libido disorder (9). The aim of this study was to assess the HRQoL of patients with end-stage chronic renal disease treated at the Hemodialysis Center of the Clinical Center of Montenegro.

Methods

The cross-sectional study included 43 respondents with end-stage chronic kidney disease who received hemodialysis during January 2025 at the Hemodialysis Center of the Clinical Center of Montenegro (CCM). Patients on HD filled out a general questionnaire (gender, age, education, duration of HD, comorbidities, hospitalization during the last 12 months) and a standardized anonymous questionnaire Kidney Disease Quality of Life Short Form (KDQoL-SFTM) (Serbian version) (10). KDQoL-SF is a tool for the self-assessment of the quality of life of patients with kidney disease and those on dialysis. This shorter version of the tool includes 43 items focused on kidney diseases, such as the impact of disease on daily activities, work status and social interactions, as well as 36 items that provide a measure of physical and mental health, and one item related to overall health score ranging from 0 ("worst possible health") and 10 ("best possible health"). It takes about 16 minutes to complete the questionnaire consisting of 80 items. All participants signed informed consent for participation in the study before they filled out the questionnaire. The study was approved by the Clinic for Nephrology, CCM on January 16th, 2024 (number: 03/01-820). Proportion, Pearson's correlation coefficient and the analysis of variance were used for the analysis of data.

Results

The cross-sectional study included 43 respondents (22 men and 21 women) who were on the chronic HD program at the Hemodialysis Center of CCM in Podgorica. The largest number of respondents were aged 51-60 years (39.5%) and 61 and over (39.5%), while the least of them

were in the age group 50 and younger (21.0%). 9.3% of respondents had a higher education, 65.1% had high school education and 16.3% had primary education. When it comes to the duration of HD treatment, 28 (65.1%) of respondents were treated between one and five years, 12 (27.9%) between six and ten years, and three (7.0%) longer than ten years. The respondents most frequently had the following comorbidities: hypertension (32.6%), polycystic kidney disease (20.9%), followed by glomerulonephritis (14%) and other diseases (14%) (diabetes, chronic pyelonephritis, unknown). All respondents were hospitalized at least once during the last 12 months.

The analysis of the quality of life in relation to overall health shows that there is a significant negative correlation between overall health and fear for their health ($r = -0.60$; $p < 0.001$), limitations in performing daily activities ($r = -0.56$; $p < 0.001$) and social functioning ($r = -0.54$; $p < 0.001$) (Table 1). Also, persons who fear more for their health have poor sleep ($r = -0.36$; $p = 0.02$), and they complain more about poorer social functioning ($r = 0.59$; $p < 0.001$), difficulties regarding performing daily activities ($r = 0.64$; $p < 0.001$), and difficulties regarding functioning in work due to the presence of physical pain ($r = 0.38$; $p = 0.01$). There is a high and significant positive correlation between difficulties related to performing daily activities and difficulties related to participating in social activities ($r = 0.70$; $p < 0.001$), and both of these variables have a significant positive correlation with difficulties related to performing work tasks due to physical pain ($r = 0.47$; $p < 0.001$ and $r = 0.54$; $p < 0.001$), while they have a significant negative correlation with the quality of sleep ($r = -0.51$; $p < 0.001$ and $r = -0.39$; $p = 0.001$). It has been shown that there is a significant positive correlation between the presence of physical pain and difficulties related to performing daily activities ($r = 0.33$; $p = 0.04$) and performing work tasks ($r = 0.82$; $p < 0.001$). Satisfaction with the time respondents spend with family and friends is positively correlated with satisfaction related to family support ($r = 0.74$; $p < 0.001$), and inversely with difficult social functioning ($r = -0.45$; $p < 0.001$). There is a significant negative correlation between satisfaction with family support and limitations in daily activities ($r = -0.33$; $p = 0.04$).

The analysis of the quality of life related to kidney disease shows that there is a significant

Tabela 1. Pirsonov koeficijenti korelacija i p - vrednost za različite pokazatelje kvaliteta života u vezi sa celokupnim zdravljem lica na hemodijalizi

r/p	Procjena koliko je dobro vase sveukupno zdravlje	Koliko strahujete za svoje zdravlje	Koliko je zdravstveno i/ili emocionalno stanje otežalo društveno funkcionisanje	Koliko ste bili ograničeni u obavljanju svakodnevnih aktivnosti	Prisustvo tjelesne boli	Koliko je bol ometala obavljanje poslova	Ukupni kvalitet spavanja	Zadovoljstvo količinom vremena provedenog sa porodicom i prijateljima	Zadovoljstvo podrškom koju dobijate od porodice i prijatelja
Procjena koliko je dobro vase sveukupno zdravlje		-0,60** <0,001	-0,56** <0,001	-0,54** <0,001	0,10 0,55	-0,26 0,10	0,26 0,10	0,23 0,15	0,17 0,23
Koliko strahujete za svoje zdravlje	-0,60** <0,001	1	0,59** <0,001	0,64** <0,001	0,25 0,11	0,38* 0,01	-0,36* 0,02	-0,24 0,13	-0,21 0,19
Koliko je zdravstveno i/ili emocionalno stanje otežalo društveno funkcionisanje	-0,56** <0,001	0,59** <0,001	1	0,70** <0,001	0,25 0,11	0,54** <0,001	-0,39* 0,01	-0,45** <0,001	-0,27 0,10
Koliko ste bili ograničeni u obavljanju svakodnevnih aktivnosti	-0,54** <0,001	0,64** <0,001	0,70** <0,001	1	0,33* 0,04	0,47** <0,001	-0,51** <0,001	-0,30 0,07	-0,33* 0,04
Prisustvo tjelesne boli	0,10 0,55	0,25 0,11	0,25 0,11	0,33* 0,04	1	0,82** <0,001	-0,09 0,58	-0,12 0,47	-0,15 0,35
Koliko je bol ometala obavljanje poslova	-0,26 0,10	0,38* 0,01	0,54** 0,00	0,47** 0,00	0,82** 0,00	1	-0,10 0,52	-0,08 0,64	-0,06 0,69
Ukupni kvalitet spavanja	-0,26 0,10	-0,36* 0,02	-0,39* 0,01	-0,51** <0,001	-0,09 0,58	-0,10 0,52	1	0,23 0,16	0,03 0,84
Zadovoljstvo količinom vremena provedenog sa porodicom i prijateljima	0,23 0,15	-0,24 0,13	-0,45** <0,001	-0,30 0,07	-0,12 0,47	-0,08 0,64	0,23 0,16	1	0,74** <0,001
Zadovoljstvo podrškom koju dobijate od porodice i prijatelja	0,17 0,23	-0,21 0,19	-0,27 0,10	-0,33* 0,04	-0,15 0,35	-0,06 0,69	0,03 0,84	0,74** <0,001	1

**korelacija je značajna na nivou 0,01; *korelacija je značajna na nivou 0,05

0,001) i značajno više je problema u njegovom seksualnom funkcionisanju ($r = 0,46$; $p < 0,001$), a značajno manje je zadovoljstvo lečenjem na dijalizi ($r = -0,47$; $p < 0,001$). Što je veći uticaj bolesti na psihičko stanje to je više problema u seksualnom funkcionisanju ($r = 0,54$; $p < 0,001$) i veća je zaokupljenost bolešću tokom obavljanja svakodnevnih aktivnosti ($r = 0,67$; $p < 0,001$) i veći je uticaj bubrežne bolesti na život ($r = 0,46$; $p < 0,001$). Između problema u seksualnom funkcionisanju i zaokupljenosti bolešću takođe postoji značajna pozitivna korelacija ($r = 0,47$; $p < 0,001$), kao i problema u seksualnom funkcionisanju i većeg uti-

caja bubrežne bolesti na život ($r = 0,46$; $p < 0,001$) i psihičko stanje ($r = 0,54$; $p < 0,001$). Zadovoljstvo lečenjem na dijalizi je bilo značajno negativno u korelaciji sa uticajem bubrežne bolesti na život osobe ($r = -0,47$; $p < 0,001$).

Analizom varijanse nije utvrđena značajna razlika u kvalitetu života osoba na HD u odnosu na pol, starost, obrazovanje, dužinu bolesti i komorbiditete.

Diskusija

Prema rezultatima našeg istraživanja, celokupno zdravlje osoba sa hroničnom bubrežnom bolešću koje su na HD značajno negativno kore-

Table 1. Pearson's correlation coefficient and p value for different indicators of quality of life related to the overall health of persons on hemodialysis

r/p	Assessment of how good your overall health is	How much fear do you feel for your health	To what extent the health and/or emotional state made social functioning difficult	How limited were you in doing your daily activities	Presence of physical pain	How pain made it hard for you to perform work tasks	Overall sleep quality	Satisfaction with the amount of time spent with family and friends	Satisfaction with support you receive from family and friends
Assessment of how good your overall health is		-0.60** <0.001	-0.56** <0.001	-0.54** <0.001	0.10 0.55	-0.26 0.10	0.26 0.10	0.23 0.15	0.17 0.23
How much fear do you feel for your health	-0.60** <0.001	1	0.59** <0.001	0.64** <0.001	0.25 0.11	0.38* 0.01	-0.36* 0.02	-0.24 0.13	-0.21 0.19
To what extent the health and/or emotional state made social functioning difficult	-0.56** <0.001	0.59** <0.001	1	0.70** <0.001	0.25 0.11	0.54** <0.001	-0.39* 0.01	-0.45** <0.001	-0.27 0.10
How limited were you in doing your daily activities	-0.54** <0.001	0.64** <0.001	0.70** <0.001	1	0.33* 0.04	0.47** <0.001	-0.51** <0.001	-0.30 0.07	-0.33* 0.04
Presence of physical pain	0.10 0.55	0.25 0.11	0.25 0.11	0.33* 0.04	1	0.82** <0.001	-0.09 0.58	-0.12 0.47	-0.15 0.35
How pain made it hard for you to perform work tasks	-0.26 0.10	0.38* 0.01	0.54** 0.00	0.47** 0.00	0.82** 0.00	1	-0.10 0.52	-0.08 0.64	-0.06 0.69
Overall sleep quality	-0.26 0.10	-0.36* 0.02	-0.39* 0.01	-0.51** <0.001	-0.09 0.58	-0.10 0.52	1	0.23 0.16	0.03 0.84
Satisfaction with the amount of time spent with family and friends	0.23 0.15	-0.24 0.13	-0.45** <0.001	-0.30 0.07	-0.12 0.47	-0.08 0.64	0.23 0.16	1	0.74** <0.001
Satisfaction with support you receive from family and friends	0.17 0.23	-0.21 0.19	-0.27 0.10	-0.33* 0.04	-0.15 0.35	-0.06 0.69	0.03 0.84	0.74** <0.001	1

*correlation is significant at the 0.05 level; **correlation is significant at the 0.01 level

negative correlation between the experience of success and satisfaction and preoccupation with kidney disease when performing daily activities ($r = -0.45$; $p < 0.001$) (Table 2). The impact of kidney disease on the patient's life is greater when the impact on his mental state is greater ($r = 0.46$; $p < 0.001$), as well as when the preoccupation with the disease when performing daily activities is greater ($r = 0.64$; $p < 0.001$), and problems related to sexual functioning are more pronounced ($r = 0.46$; $p < 0.001$), while satisfaction with dialysis treatment is significantly lower ($r = -0.47$; $p <$

0.001). The impact of the disease on the mental state is greater when problems related to sexual functioning are more pronounced ($r = 0.54$; $p < 0.001$), as well as when there is more preoccupation with the disease during daily activities ($r = 0.67$; $p < 0.001$), and when the impact of kidney disease on life is greater ($r = 0.46$; $p < 0.001$). There is also a significant positive correlation between problems related to sexual functioning and preoccupation with the disease ($r = 0.47$; $p < 0.001$), as well as between problems related to sexual functioning and greater impact of kidney disease on life ($r =$

Tabela 2. Pirsonov koeficijent korelacije i p vrednost za različite pokazatelje kvaliteta života u vezi sa bubrežnom bolešću osoba na hemodijalizi

r/p	Procjena uspešnosti i zadovoljstva	Uticaj bubrežne bolesti na život	Uticaj bubrežne bolesti na psihičko stanje	Zaokupljenost tjelesnim simptomima	Zaokupljenost bubrežnom bolešću u obavljanju svakodnevnih aktivnosti	Problemi u seksualnom funkcionisanju usled bubrežne bolesti	Problemi sa snom	Zadovoljstvo liječenjem na dijalizi
Procjena uspešnosti i zadovoljstva	1	-0,22 0,19	-0,10 0,58	-0,07 0,91	-0,45** 0,00	-0,16 0,36	-0,15 0,38	0,32 0,05
Uticaj bubrežne bolesti na život	-0,22 0,19	1	0,46** <0,001	-0,22 0,72	0,64** <0,001	0,46** <0,001	0,09 0,58	-0,47** <0,001
Uticaj bubrežne bolesti na psihičko stanje	-0,10 0,58	0,46** <0,001	1	-0,08 0,90	0,67** <0,001	0,54** <0,001	0,23 0,15	-0,26 0,10
Zaokupljenost tjelesnim simptomima	-0,07 0,91	-0,22 0,72	-0,08 0,90	1	0,07 0,91	-0,43 0,47	0,58 0,31	-0,67 0,22
Zaokupljenost bubrežnom bolešću u obavljanju svakodnevnih aktivnosti	-0,45** 0,00	0,64** <0,001	0,67** <0,001	0,07 0,91	1	0,47** <0,001	0,19 0,23	-0,24 0,13
Problemi u seksualnom funkcionisanju usled bubrežne bolesti	-0,16 0,36	0,46** <0,001	0,54** <0,001	-0,43 0,47	0,47** <0,001	1	0,16 0,33	-0,23 0,16
Problemi sa snom	-0,15 0,38	0,09 0,58	0,23 0,15	0,58 0,31	0,19 0,23	0,16 0,33	1	-0,09 0,58
Zadovoljstvo liječenjem na dijalizi	0,32 0,05	-0,47** <0,001	-0,26 0,10	-0,67 0,22	-0,24 0,13	-0,23 0,16		1

**korelacija je značajna na nivou 0,01; *korelacija je značajna na nivou 0,05

lira sa strahom za svoje zdravlje, zdravstvenim/emocionalnim stanjem koje je otežalo društveno funkcionisanje i ograničenjima u obavljanju svakodnevnih aktivnosti. Prisustvo telesne boli visok značajno pozitivno korelira sa ometanjem u obavljanju poslova.

Procenjuje se da je najmanje 80% bolesnika sa hroničnom insuficijencijom bubrega na HD (11). HD je jedna od tri vrste terapija koje se sprovode kod osoba sa terminalnom hroničnom bubrežnom insuficijencijom. Veliki broj studija je pokazalo da HD utiče na HRQoL (12,13). U cilju procene kvaliteta života lica na HD mogu se koristiti različiti alati za merenje HRQoL, od opštih do specifičnih. Jedan od specifičnih i najčešće korišćenih alata je KD-QOL-SF upitnik (kratki upitnik za procenu kvaliteta života lica s bubrežnom bolešću) (14,15). Hronična bolest bubrega (HBB) značajno utiče na mnoge aspekte života, zdravlja i dobrobiti bolesnika, što se odražava na njihovu radnu sposobnost, porod-

icu, radno okruženje i zajednicu u celini (16). Na kvalitet života osoba sa HBB utiču i njihove individualne karakteristike: godine starosti, psihofizičke sposobnosti, dužina trajanja dijalize, prisustvo komorbiditeta i socijalni status (16). Sistematski pregled je pokazao da su neke karakteristike ličnosti (neuroticizam, majstorstvo/uspešnost, optimizam i osećaj koherentnosti) češće bile konzistentno povezane sa psihosocijalnim aspektima nego fizičkim aspektima HRQoL (16,17). Mnoge studije su ukazale da je vreme provedeno na dijalizi u pozitivnoj korelaciji s opterećenjem bolesnika simptomima bolesti (18-20). Umor je obično posledica anemije kod bubrežne insuficijencije, a javlja se kod 80% osoba na dijalizi (19). Često se javlja anoreksija, bol, mučnina, svrab, kratak dah, grčevi mišića, parestezija, osećaj depresije, seksualne poteškoće i poremećaj sna (19). Oni mogu doprineti smanjivanju kvaliteta života lica na dijalizi. U 574 studije, pacijenti na peritonealnoj dijalizi (PD) oce-

Table 2. Pearson's correlation coefficient and p value for different indicators of quality of life related to persons with kidney disease on hemodialysis

r/p	Assessment of success and satisfaction	Impact of kidney disease on life	Impact of kidney disease on mental state	Preoccupation with physical symptoms	Preoccupation with kidney disease in performing daily activities	Sexual functioning issues related to kidney disease	Sleep problems	Satisfaction with dialysis treatment
Assessment of success and satisfaction	1	-0.22 0.19	-0.10 0.58	-0.07 0.91	-0.45** 0.00	-0.16 0.36	-0.15 0.38	0.32 0.05
Impact of kidney disease on life	-0.22 0.19	1	0.46** <0.001	-0.22 0.72	0.64** <0.001	0.46** <0.001	0.09 0.58	-0.47** <0.001
Impact of kidney disease on mental state	-0.10 0.58	0.46** <0.001	1	-0.08 0.90	0.67** <0.001	0.54** <0.001	0.23 0.15	-0.26 0.10
Preoccupation with physical symptoms	-0.07 0.91	-0.22 0.72	-0.08 0.90	1	0.07 0.91	-0.43 0.47	0.58 0.31	-0.67 0.22
Preoccupation with kidney disease in performing daily activities	-0.45** 0.00	0.64** <0.001	0.67** <0.001	0.07 0.91	1	0.47** <0.001	0.19 0.23	-0.24 0.13
Sexual functioning issues related to kidney disease	-0.16 0.36	0.46** <0.001	0.54** <0.001	-0.43 0.47	0.47** <0.001	1	0.16 0.33	-0.23 0.16
Sleep problems	-0.15 0.38	0.09 0.58	0.23 0.15	0.58 0.31	0.19 0.23	0.16 0.33	1	-0.09 0.58
Satisfaction with dialysis treatment	0.32 0.05	-0.47** <0.001	-0.26 0.10	-0.67 0.22	-0.24 0.13	-0.23 0.16		1

*correlation is significant at the 0.05 level; **correlation is significant at the 0.01 level

0.46; $p < 0.001$) and mental state ($r = 0.54$; $p < 0.001$). There is a significant negative correlation between satisfaction with dialysis treatment and the impact of kidney disease on the quality of life ($r = -0.7$, $p < 0.001$).

The analysis of variance did not reveal a significant difference in the quality of life of patients on HD in relation to gender, age, education, duration of disease and comorbidities.

Discussion

According to the results of our study, there is a significant negative correlation between the overall health of persons with chronic kidney disease receiving HD and fear for their health, as well as the health/emotional state that hindered social functioning and limitations in performing daily activities. There is also a significant positive correlation between the presence of physical pain and limitations in daily activities.

It is estimated that at least 80% of patients with chronic kidney failure are on HD (11). HD is one of

three therapies that are administered in patients with end-stage renal failure. A large number of studies have shown that HD affects HRQoL (12,13). In order to assess the quality of life of people on HD, different tools can be used to measure HRQoL, from general to specific. One of the specific and most commonly used tools is KDQOL-SF questionnaire (Kidney Disease Quality of Life – Short Form) (14,15). Chronic kidney disease (CKD) significantly influences many aspects of patient's life, health and well-being, which reflects on their ability to work, on their family, work environment and community as a whole (16). The quality of life of persons with CKD is also influenced by their individual characteristics: age, psychological and physical abilities, duration of dialysis, presence of comorbidities and social status (16). A systematic review has shown that some personality traits (neuroticism, mastery/achievement, optimism and sense of coherence) are more often consistently associated with psychosocial aspects of HRQoL in comparison to physical aspects of

nili su da imaju bolji kvalitet života nego pacijenti na HD (21). Ukupni rezultat HRQoL u studiji Raoofi i saradnika, za pacijente koji su podvrgnuti HD je bio 60,52 (95%CI: 57,79-63,26), a za pacijente na PD 59,61 (95%CI: 41,31-77,91)(22). U istraživanju Jankowska-Polanska-je i saradnika, učestvovalo je ukupno 100 ispitanika na HD, a njihova prosečna starost je bila 57 godina (23). Čak 73,3% njih je prijavilo hospitalizaciju u proteklih godinu dana, a 66,7% čest umor ($p < 0,001$).

Naša studija ukazuje da što je veći uticaj bubrežne bolesti na život pacijenta, to je značajno veći uticaj na njihovo psihičko stanje, a značajno je manje zadovoljstvo lečenjem dijalizom. Postojanje podrške od strane prijatelja/porodice značajno dobronosi boljem društvenom funkcionisanju.

Brojni istraživači, takođe, navode da su sa kvalitetom života osoba na HD povezani umor i slabost, svrab, grčevi u mišićima, loši životni uslovi, nedostatak socijalne podrške i poremećaj raspoloženja (24,25). Istraživanja su pokazala da pacijenti koji imaju snažnu emocionalnu podršku od porodice i prijatelja imaju niži nivo anksioznosti i depresije. Emocionalna podrška može pomoći pacijentima da se suoče sa stresom povezanim sa bolešću. Društvena podrška može povećati osećaj povezanosti i svrhe kod pacijenata. Osećaj podrške od zajednice ili socijalne mreže može poboljšati opšte mentalno zdravlje osobe na HD. Postoji niz dokaza koji sugerišu da psihosocijalna podrška može pozitivno uticati na fizičko zdravlje pacijenata, smanjujući učestalost hospitalizacija i poboljšavajući biološke markere bolesti. Bolesnici na HD takođe pate od poremećaja spavanja, posebno od poteškoća s kratkim snom i česta noćna buđenja, što rezultira lošim kvalitetom sna, neproduktivnošću na poslu i nezadovoljstvom socijalnim okruženjem (24-26).

Prema našim rezultatima, osobe na HD imaju značajno više problema u seksualnom funkcionisanju što je veći uticaj bubrežne bolesti na psihičko stanje osobe, kada je značajno veća njihova zaokupljenost bubrežnom bolešću tokom obavljanja svakodnevnih životnih aktivnosti i kada je značajno veći uticaj bubrežne bolesti na život. Istraživači ističu da što je veći uticaj bubrežne bolesti na život bolesnika, to je veći uticaj na njegovo psihofizičko zdravlje povezano sa kvalitetom života (27-30). Procenjuje se da je seksualna disfunkcija često prisutna među pacijentima koji su na HD. HBB može dovesti do smanjenja libida, erektilne disfunkcije

kod muškaraca i smanjenja seksualnog zadovoljstva kod žena. Fizički simptomi (npr. umor, bolovi, slabost) mogu imati ključnu ulogu kod seksualne disfunkcije, kao i smanjenje nivoa hormona (kao što su testosteron i estrogen). HD može uticati na proizvodnju ovih hormona. Anksioznost, depresija i stres zbog bolesti mogu značajno uticati na seksualno zdravlje. Mnogi pacijenti osećaju sram ili stigmatu vezano za svoje zdravstveno stanje, što može otežati seksualnu intimnost.

Ističemo da je naša studija sprovedena samo u jednom centru za dijalizu od ukupno 12 centara u Crnoj Gori, što ograničava mogućnost generalizacije zaključaka na sve bolesnike sa hroničnom bubrežnom insuficijencijom koji se leče na HD. Takođe, istraživanje je sprovedeno na malom broju ispitanika, pa su i analizirane podgrupe uključivale jako mali broj ispitanika za analizu. Međutim, rezultati ovog istraživanja, pomažu u unapređenju kvaliteta života lica na HD.

Zaključak

Celokupno zdravlje osoba na HD je značajno lošije sa većim strahom za svoje zdravlje, sa lošijim društvenim funkcionisanjem i sa više ograničenja za sprovođenje svakodnevnih aktivnosti, a zadovoljstvo lečenjem je značajno manje što je veći uticaj bubrežne bolesti na život osobe. Više je problema u seksualnom funkcionisanju što je veći uticaj bolesti na psihičko stanje osobe na HD, kada je veća njihova zaokupljenost bolešću tokom obavljanja svakodnevnih životnih aktivnosti i kada je veći uticaj bubrežne bolesti na život. Postojanje podrške od strane prijatelja/porodice dobronosi značajno boljem društvenom funkcionisanju. Neophodna su dalja istraživanja u ovoj oblasti u cilju analize kvaliteta života osoba na HD u odnosu na demografske i kliničke parametre, kao i u cilju identifikacije nezavisnih prediktora kvaliteta života.

Konflikt interesa

Autori su izjavili da nema konflikta interesa.

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HRQoL (16,17). Many studies have shown that the time spent on dialysis is positively correlated with the patient's burden of disease (18-20). Fatigue is often the consequence of anemia in renal failure, and it occurs in 80% of patients on dialysis (19). Anorexia, pain, nausea, itchy skin, shortness of breath, muscle spasms, paresthesia, feeling of depression, sexual difficulties and sleep disorders commonly occur (19). They can contribute to reducing the quality of life of patients receiving dialysis. In 574 studies, patients receiving peritoneal dialysis (PD) claimed to have a better quality of life than HD patients (21). In a study by Raoofi and associates, the overall HRQoL score for patients on HD was 60.52 (95%CI: 57.79-63.26), and for patients on PD 59.61 (95%CI: 41.31-77.91) (22). In a study by Yankowska-Polanska et al, the total of 100 respondents on HD participated, and their average age was 57 years (23). Even 73.3% of them reported hospitalization in the previous year, while 66.7% of them reported frequent fatigue ($p < 0.001$).

Our study indicates that the impact of kidney disease on the patient's life is greater when the impact on their psychological state is significantly greater, and when patient satisfaction with dialysis treatment is significantly lower. The existence of family/friends support contributes significantly to better social functioning.

Numerous researchers also state that fatigue and weakness, itchy skin, muscle spasms, poor living conditions, lack of social support and mood disorders are associated with the quality of life of patients on HD (24,25). Research has shown that patients who have strong emotional support from family and friends have a lower level of anxiety and depression. Emotional support can help patients cope with the stress associated with the disease. Social support can increase patients' sense of connection and purpose. Support from family or social networks can improve the overall mental health of persons receiving HD. There is a body of evidence which suggest that psychosocial support can positively influence patients' physical health, thus reducing the frequency of hospitalizations and improving biological markers of disease. HD patients also suffer from sleep disorders, especially disorders related to short sleep and frequent night awakenings, resulting in poor sleep quality, unproductive work and dissatisfaction with social environment (24-26).

According to our results, persons receiving HD have significantly more problems related to sexual dysfunction, when the impact of kidney disease on the patient's mental state is greater, when there is more preoccupation with kidney disease during daily activities and when the impact of kidney disease on patient's life is greater. Researchers emphasize that the impact of kidney disease on patient's life is greater when the influence on his psychophysical state related to quality of life is greater (27-30). It is estimated that sexual dysfunction is often present among patients on HD. CKD can lead to decreased libido, erectile dysfunction in men and decreased sexual satisfaction in women. Physical symptoms (e.g. fatigue, pain, weakness) can play a key role in sexual dysfunction, as can a decrease in hormone levels (such as testosterone and estrogen). HD can affect the production of these hormones. Anxiety, depression, and stress caused by disease can significantly influence sexual health. Many patients feel shame or stigma related to their medical condition, which can make sexual intimacy difficult.

Our study was conducted at one dialysis center out of a total of 12 centers in Montenegro, which limits the possibility of generalizing conclusions to all patients with chronic renal failure undergoing HD treatment. Also, the study was conducted on a small number of respondents, and therefore, the analyzed subgroups included a very small number of respondents for analysis. However, the results of this study help to improve the quality of life of persons on HD.

Conclusion

The overall health of persons on HD is significantly worse when the fear for their own health is greater, social functioning poorer and when there are more limitations in daily activities, while patient satisfaction with treatment is significantly lower when the impact of kidney disease on their lives is greater. Sexual functioning issues are more pronounced when the impact of the disease on mental health is greater, as well as when there is more preoccupation with the disease during daily activities and when the impact of kidney disease on life is greater. The presence of support from friends/family contributes significantly to better social functioning. Further research is needed in this field in order to analyze the quality of life of persons undergoing HD in relation to demographic

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and clinical parameters, as well as to identify the independent predictors of quality of life.

Competing interests

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ULOGA LOGOPEDA U TRETMANU SA DECOM OŠTEĆENOG SLUHA – ZNAČAJ RANE INTERVENCIJE

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SAŽETAK

Cilj ovog preglednog rada je da predstavi vezu između rane intervencije u rehabilitaciji govora i uspeha logopeda u habilitaciji govora kod dece oštećenog sluha. Uredan sluh je jedan od najvažnijih preduslova za pravilan razvoj govora, jer se govor uči slušajući. Neophodno je da se roditelji obrate logopedu za pomoć, ako detetova vokalizacija izostaje ili naglo prestane, ako ne reaguje na zvukove iz okoline, ako se ne okreće pozivu sagovornika koji nije u vidnom polju, ako ne reaguje na jednostavne verbalne komande, ako se tokom razgovora izrazito fokusira na lice druge osobe, ako se približava izvoru zvuka ili pokuša da pojača zvuk, kao i ako postoji nedostatak socijalizacije sa članovima porodice. Rani tretman dece sa oštećenjem sluha podrazumeva niz stimulativnih aktivnosti koje imaju za cilj unapređenje razvoja deteta, posebno razvoja govora i slušne pažnje. Savremeni pristup u habilitaciji govora i jezika stavlja veliki naglasak na razvoj verbalne komunikacije, što je ključno za zajednički život dece sa slušnim oštećenjima i dece koja čuju, naročito u periodu kada deca žele da se druže sa vršnjacima. Rana intervencija je od ključne važnosti jer se mozak deteta u periodu od začeća do treće godine života razvija brže nego ikada kasnije u životu. Deca koja su uključena u proces ugradnje kohlearnog implanta pre prve godine imaju veće šanse da ostvare svoj puni potencijal u odnosu na decu kojoj je implantat ugrađen oko treće godine.

Ključne reči: rana intervencija, habilitacija govora, deca oštećenog sluha

Uvod

Sluh je čulo koje nam omogućava da percipiramo zvukove iz našeg okruženja. Omogućava nam da analiziramo našu okolinu, da komuniciramo, izražavamo svoje misli i stičemo znanje. Ako se gubitak sluha ne otkrije rano u životu, može imati značajne posledice i za tu osobu i za porodicu. Ove posledice uključuju negativne uticaje na razvoj govora i jezika, psihosocijalno blagostanje, kvalitet života, obrazovna postignuća i ekonomsku nezavisnost u različitim fazama života (1).

Zvuci koje čujemo se prenose kroz uho preko nervnih vlakana do cerebralnog korteksa u roku od milisekunde. Bilo kakav poremećaj na tom putu dovodi do poteškoća sa obradom zvuka. Sluh je neophodan za komunikaciju jer igra ključnu ulogu u usvajanju govora i samokontroli artikulacije. Čak i manji poremećaji u obradi zvuka mogu da

ometaju interpersonalnu komunikaciju, s obzirom da značenje rečenice takođe zavisi od intonacije. Govor se obično percipira u opsegu od 30 do 60 decibela, a oštećenje sluha u ovom opsegu može da učini i sam govor i razumevanje govora izazovnim. Kada dođe do devijacija u ovom procesu, rehabilitacija sluha i govora postaje neophodna (2).

Govorne i jezičke sposobnosti spadaju u naj-složenije funkcije ljudskog tela, koje služe ne samo kao sredstvo komunikacije već i kao sredstvo za upoznavanje sveta. S obzirom da su govor, jezik i sluh međusobno zavisni, gubitak sluha može dovesti do oštećenja ili čak odsustva verbalne komunikacije. Ovo može dovesti do socijalne izolacije i povlačenja, posebno kod dece koja izgube sluh u prelingvalnom periodu tj. kod one koja izgube sluh pre nego što počnu da govore (3).

THE ROLE OF THE SPEECH THERAPIST IN THE TREATMENT OF HEARING IMPAIRED CHILDREN - THE IMPORTANCE OF EARLY INTERVENTION

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SUMMARY

The aim of this review is to present the relationship between early intervention in speech rehabilitation and the success of speech therapists in speech habilitation in hearing impaired children. Proper hearing is one of the most important prerequisites for the proper development of speech, because speech is learned by listening. It is necessary for parents to turn to a speech therapist for help if the child's vocalization is absent or stops suddenly, if he does not respond to sounds from the environment, if he does not turn to the call of the interlocutor who is not in his field of vision, if he does not respond to simple verbal commands, if during the conversation he focuses strongly on the face of another person, if he approaches the sound source or tries to amplify the sound, as well as if there is a lack of socialization with to family members. Early treatment of children with hearing impairment involves a series of stimulating activities aimed at improving the child's development, especially the development of speech and auditory attention. The modern approach to speech and language habilitation places great emphasis on the development of verbal communication, which is crucial for the common life of children with hearing impairments and hearing children, especially in the period when children want to socialize with their peers. Early intervention is critical because a child's brain develops faster from conception to age three than at any time later in life. Children who are involved in the process of installing a cochlear implant before the age of one have a greater chance of achieving their full potential compared to children who are implanted around the age of three.

Key words: early intervention, speech habilitation, hearing impaired children

Introduction

Hearing is the sense that allows us to perceive sounds from our environment. It allows us to analyze our surroundings, communicate, express our thoughts, and acquire knowledge. If hearing loss is not detected early in life, it can have significant consequences for both the individual and their family. These consequences include negative impacts on speech and language development, psychosocial well-being, quality of life, educational attainment, and economic independence at various stages of life (1).

The sounds we hear are transmitted through the ear via nerve fibers to the cerebral cortex within milliseconds. Any disruption along this pathway results in difficulties with sound pro-

cessing. Hearing is essential for communication, as it plays a crucial role in speech acquisition and self-monitoring of articulation. Even minor disturbances in sound processing can hinder interpersonal communication, as sentence meaning also relies on intonation. Speech is typically perceived within 30-60 decibel range, and hearing impairments in this range can make both speech comprehension and production challenging. When deviations occur in this process, hearing and speech rehabilitation becomes necessary (2).

Speech and language abilities are among the most complex functions of the human body, serving not only a means of communication but also as a tool for learning about the world. Because

Od rođenja, bebe prolaze kroz pripremne faze za usvajanje zvukova i reči, što je proces koji počinje spontano u prvom mesecu života. Zvuk ljudskog glasa podstiče decu koja čuju da gledaju u usta sagovornika i da pokušaju da imitiraju pokrete usana. Ovo je prvi pokazatelj da dete sluša i pokušava da proizvede zvukove. Međutim, kod dece oštećenog sluha, ova spontana glasovna imitacija izostaje (4).

Otrprilike u trećem mesecu života, bebe počinju da proizvode svoje prve nefiziološke zvukove, što podstiče vokalnu igru. Ako dete ne može da čuje, ono postepeno prestaje da proizvodi glasove. Ovo se dešava zato što je dete koje čuje motivisano sopstvenim glasovnim povratnim informacijama, dok detetu sa oštećenjem sluha nedostaje ovaj podsticaj. Odsustvo brbljanja i ponavljanja slogova može biti prvi znak upozorenja za roditelje da postoji problem sa sluhom. Ako dete ne proizvodi zvukove kao njegovi vršnjaci, njegov govorni razvoj odstupa od tipičnog (5). Cilj ove studije je da predstavi vezu između rane intervencije u rehabilitaciji govora i uspeha logopeda u habilitaciji govora kod dece oštećenog sluha.

Metode

U ovom preglednom radu koristili smo Pub Med bazu podataka. Pretraživanje smo sprovedli za poslednjih dvadesetpet godina korišćenjem sledećih ključnih reči: rana intervencija, habilitacija govora i deca oštećenog sluha. Uključeni su rezultati samo onih studija koje su bile na engleskom jeziku.

Razvojne faze govora

Dete koje čuje spontano razvija govor i jezik uz kognitivne sposobnosti u sredini u kojoj odrasta. S druge strane, dete sa oštećenim sluhom nema zvučnu stimulaciju iz okoline i ne može spontano da razvija govor bez stručne podrške. Da bi komuniciralo, takvo dete se često oslanja na gestikulaciju i izraze lica. Ako okolina prihvati ovaj neverbalni oblik komunikacije, dete može da izgubi interesovanje za verbalnu komunikaciju (7).

Razumevanje faza razvoja govora je od ključne važnosti za podržavanje usvajanja jezika i govora kod dece oštećenog sluha. Govor i jezik se razvijaju progresivno, a svako dete se rađa sa sposobnošću da usvoji jezik svog okruženja (8).

Prva razvojna faza govora je plač. Prva vokalizacija novorođenčeta je plač, koji služi kao refleksivni odgovor na prilagođavanje novom okruženju.

Ova početna fonacija predstavlja najraniju manifestaciju govora.

Druga faza je gukanje. Otrprilike u drugoj polovini prvog meseca, počinje faza gukanja, u kojoj dete proizvodi zvukove različitih tonova i nijansi. Ova vokalizacija napreduje paralelno sa razvojem sluha i drugih čula. U početku se pojavljuju samoglasnici (a, e, u), a zatim nazalni suglasnici (m, n) i plozivi (g, b, d). Na ove prve vokalizacije utiče muskulatura usana, koja se jača sisanjem. Deca sa oštećenim sluhom takođe ulaze u fazu gukanja, ali na kraju prestaju da vokalizuju zbog odsustva slušne povratne informacije – ne čuju majčin glas kao odgovor na svoje zvukove.

Treća faza je brbljanje. Brbljanje se javlja između četvrtog i devetog meseca ili dok se ne pojavi prva reč koja ima značenje. Tokom ove faze, dete stiče kontrolu nad svojim glasom, modulira zvuk i koristi brbljanje za društveni kontakt. Pošto je ova faza ključna za razvoj govora i jezika, rana dijagnoza oštećenja sluha je od suštinskog značaja za obezbeđivanje pravovremene intervencije i za kontinuirano izlaganje zvuku.

Četvrta faza je govor. Između devetog meseca i druge godine života, dete počinje da proizvodi prve smislene reči i kratke govorne jedinice koje liče na rečenice. Ovaj period je posebno značajan za formiranje govora i jezika.

Peta faza je ekspanzija jezika. Od druge do četvrte godine, jezik se brzo razvija u svim oblastima. Ako dete izgubi pristup zvuku tokom ove faze, njegovo vraćanje je ključno da bi se obezbedio kontinuirani razvoj govora - jezika.

Šesta faza je razvoj gramatike i vokabulara. Između četvrte i sedme godine, dete usavršava gramatičke strukture i značajno proširuje rečnik. Dok deca sa normalnim sluhom i kognitivnim sposobnostima savladavaju govor do pete godine, puni jezički razvoj se obično postiže do sedme godine života.

Važnost rane intervencije

Cilj rane intervencije i otkrivanja oštećenja sluha ja da se obezbedi pravovremena podrška detetu i roditeljima, obezbeđujući uspešnu integraciju u zajednicu. Dok se deca sa oštećenim sluhom ne razlikuju suštinski od njihovih vršnjaka koji čuju, nedijagnostifikovan ili nelečen gubitak sluha može dovesti do izraženih razvojnih izazova tokom vremena (9).

speech, language, and hearing are interdependent, hearing loss can lead to impaired or even absent verbal communication. This can result in social isolation and withdrawal, particularly in children with prelingual hearing loss - those who lose their hearing before acquiring speech (3).

From birth, babies go through preparatory stages for acquiring sounds and words, a process that begins spontaneously within the first month of life. The sound of a human voice encourages hearing infants to look at the speaker's mouth and attempt to imitate the lip movements. This is the first indication that the child is listening and trying to produce sounds. However, in hearing-impaired children, this spontaneous vocal imitation is absent (4).

Around the third month of life, babies begin producing their first non-physiological sounds, which encourage vocal play. If the child cannot hear, they gradually stop vocalizing. This happens because a hearing child is motivated by their own vocal feedback, whereas a child with hearing loss lacks this reinforcement. The absence of babbling and syllable repetition may be the early warning sign for parents that there is a hearing problem. If a child does not produce sounds like their peers, their speech development deviates from the typical trajectory (5). This study aims to present the relationship between early intervention in speech rehabilitation and the success of speech therapists in speech habilitation in hearing-impaired children.

Methods

In this review paper, we used the Pub Med database. We conducted a search for the last twenty-five years using the following key words: early intervention, speech habilitation and hearing-impaired children. The results of only those studies that were in English were included.

Stages in Speech Development

A hearing child spontaneously develops speech and language alongside cognitive abilities in the environment where they grow up. On the other hand, a hearing-impaired child lacks sound stimulation from their surroundings and cannot develop speech spontaneously without professional support. To communicate, such a child often relies on gestures and facial expressions. If the environment accepts this non-verbal form of com-

munication, the child may lose interest in verbal communication (7).

Understanding the stages of speech development is crucial for supporting language and speech acquisition in hearing-impaired children. Speech and language develop progressively, and every child is born with the ability to adopt the language of their environment (8).

The first stage is crying. The newborn's first vocalization is crying, which serves as a reflexive response to adapting to a new environment. This initial phonation represents the earliest manifestation of speech.

The second phase is cooing. Around the second half of the first month, the cooing phase begins, where the child makes sounds with varied tones and shades. This vocalization progresses in parallel with the development of hearing and other senses. Initially, vowels (a, e, u) emerge, followed by nasal sounds (m, n) and plosive sounds (g, b, d). These early vocalizations are influenced by the musculature of the lips, which is strengthened through sucking. Hearing-impaired children also enter the cooing phase, but eventually stop vocalizing due to absence of auditory feedback – they do not hear their mother's voice in response to their sounds.

The third stage is babbling. Babbling occurs between the fourth and the ninth months or until the first meaningful word appears. During this stage, the child gains control over their voice, modulates volume and uses babbling for social contact. Since this stage is crucial for speech-language development, early diagnosis of hearing impairment is essential to ensure timely intervention and continued exposure to sound.

The fourth stage is speaking. Between the ninth month and the second year of life, the child begins producing their first meaningful words and short speech units resembling sentences. This period is particularly significant for speech and language formation.

The fifth stage is language expansion. From ages two to four, language develops rapidly in all areas. If a child loses access to sound during this stage, restoring it is critical to ensure uninterrupted speech-language development.

Sixth stage is grammar and vocabulary growth. Between ages four to seven, the child refines grammatical structures and significantly expands their vocabulary. While children with normal hear-

Deca koja čuju se prirodno igraju zvucima od ranog uzrasta i uživaju da ih proizvode. Nasuprot tome, deca sa oštećenjem sluha zahtevaju dodatnu podršku kada pokušavaju da se uključe u glasovnu igru i imitaciju zvukova. Ovakva podrška pomaže razvijanju pokreta govornih organa, što je važno za kasniji rad sa roditeljima i terapeutima (2).

Rano prepoznavanje ili sumnja roditelja da dete ima problem sa sluhom je od ključne važnosti za ranu intervenciju. Što pre počne stručni tretman, veće su šanse za uspešnu terapiju i integraciju deteta u zajednicu koja čuje. Vreme intervencije zavisi od toga kada roditelji primete da razvoj govora njihovog deteta ne napreduje istom brzinom kao kod vršnjaka, kao i od različitih porodičnih, društvenih i ekonomskih faktora (6).

Rehabilitacija govora kod dece sa oštećenjem sluha

Primarni cilj logopedске terapije za decu oštećenog sluha je da podrži normalan razvoj govora i jezika, bez obzira na uzrok, vrstu ili težinu oštećenja (10). Da bi to postigli, logopedi koriste specijalizovane vežbe koje podstiču verbalnu komunikaciju integracijom govora i jezika. Ovaj pristup se ne fokusira samo na fizičku proizvodnju glasova, već i podstiče kognitivnu organizaciju kroz unutrašnji govor, što je od ključne važnosti za razvoj jezika. Logoped ima zadatak da olakša razvoj govora kao sredstva emocionalnog i afektivnog izražavanja, čime se podstiče spontanost izražavanja i razumevanje dubljih lingvističkih značenja. Da bi to postigao, logoped prilagođava svaku vežbu jedinstvenim karakteristikama deteta, uzimajući u obzir njegova interesovanja, uzrast i trenutni nivo razvoja govora i jezika (11). Uspešna terapija se oslanja na jaku emotivnu vezu između deteta i logopeda. Na kraju, cilj je da deca mogu da komuniciraju i da se integrišu u okruženje, u vrtićima i redovnim školama, kako bi mogli da učestvuju jednako u društvenoj i obrazovnoj sredini (12).

Ključni principi u rehabilitaciji govora dece oštećenog sluha su:

1. Individualni pristup – prilagođavanje sadržaja, metoda i sredstava da bi se zadovoljile specifične potrebe svakog deteta, uz poštovanje njegove ličnosti.

2. Prvo poznate reči – korišćenje rečnika koji se odnosi na neposredno okruženje deteta pre nego što se proširi na šire koncepte.

3. Konkretno učenje – istovremeno imenovanje i pokazivanje stvari, igračaka i predmeta iz stvarnog života da bi se podstakao razvoj govora.

4. Multisenzorno angažovanje – stimulisanje svih čula kroz interaktivne metode učenja.

5. Kontekst iz stvarnog života i vizuelni kontekst – predstavljanje govornih aktivnosti na realističan i vizuelno zanimljiv način.

6. Postepeno uvođenje zvukova – davanje prioriteta zvukovima koji zahtevaju minimalan napor, prateći prirodni razvoj artikulacije.

7. Igra koja se zasniva na govoru – uključivanje strukturiranih govornih igara za podsticanje verbalnog izražavanja od prve sesije pa nadalje.

Ovi principi su optimalni za razvoj govora i jezika, i time olakšavaju deci sa oštećenim sluhom komunikaciju i integraciju u zajednice koje čuju (13).

Logopedске tehnike i rane vežbe

Tokom prvih časova terapije, od ključne važnosti je pažljivo posmatranje interakcije deteta sa terapeutom i vršnjacima. Vežbe se izvode kroz igru, a primarni fokus je na razvijanju govora. Sve terapijske aktivnosti moraju biti individualno prilagođene, uzimajući u obzir slušnu, govornu, hronološku i psihološku zrelost deteta. Cilj je da se stvori okruženje koje motiviše dete da se verbalno izražava. Ovo se postiže uz pomoć igara koje su napravljene tako da izazovu emocionalnu reakciju i da podstaknu dete da imitira terapeuta (14).

Jedna od prvih govornih vežbi uključuje onomatopeju, gde deca imitiraju prirodne zvukove (npr. zvukove životinja) ili zvukove igračaka koje variraju po intenzitetu i frekvenciji. Ove aktivnosti podstiču vokalizaciju i imitaciju zvuka, što je od ključne važnosti za razvoj govora. Osim govora, terapija takođe podržava sveukupni razvoj ličnosti deteta (15).

Savremena govorno-jezička habilitacija daje prednost verbalnoj komunikaciji, koja je od ključne važnosti za decu oštećenog sluha, dok komuniciraju sa svojim vršnjacima (16). Ovaj pristup je koristan ne samo za decu koja imaju problem sa razvojem govora, već i za širu društvenu zajednicu. Pažljivo planirana i razvojno adekvatna logopedska terapija značajno poboljšava ishode. Preduslovi za uspešnu govorno-jezičku terapiju su postupnost, metod i strpljenje terapeuta (13).

Vežbe ranog govora obuhvataju nekoliko ključnih aktivnosti koje pomažu razvoju govora i jezika dece (17):

ing and cognitive abilities master speech by the age of five, full language development is typically achieved by the age of seven.

The Importance of Early Intervention

The goal of early intervention and hearing impairment detection is to provide timely support for both the child and parents, ensuring successful integration into the community. While hearing-impaired children are not inherently different from their hearing peers, undiagnosed or untreated hearing loss can lead to pronounced developmental challenges over time (9).

Hearing children naturally play with sounds from an early age and enjoy producing them. In contrast, children with hearing loss require additional support when attempting to engage in vocal play with and sound imitation. Such support helps develop the movement of speech organs, which is important for the later work with parents and therapists (2).

Early recognition or parents' suspicion that the child has hearing problems is crucial for effective intervention. The sooner professional treatment begins, the greater the chances of successful therapy and integration of the child into the hearing community. The timing of intervention depends on when the parents notice that their child's speech development is not progressing at the same rate as their peers, as well as various family, social, and economic factors (6).

Speech Rehabilitation for Children with Hearing Impairment

The primary goal of speech therapy for hearing/impaired children is to support normal speech and language development, regardless of the cause, type, or severity of impairment (10). To achieve this, speech therapists use specialized exercises that encourage verbal communication by integrating speech and language. This approach not only focuses on the physical production of speech sounds but also fosters cognitive organization through inner speech, which is crucial for language development. Speech therapist has the task of facilitating the development of speech as a means of emotional and affective expression, which encourages spontaneity of expression and understanding of deeper linguistic meanings. To achieve this, the speech therapist tailors each exercise to the child's unique characteristics, con-

sidering their interests, age, and current level of speech and language development (11). Successful therapy relies on strong emotional bond between child and therapist. Ultimately, the goal is to enable children to communicate effectively and integrate into hearing environments, such as kindergartens and mainstream schools, to enable them to participate equally in the social and educational environment (12).

Key Principles in Speech Rehabilitation for Hearing-impaired Children are:

1. Individualized Approach - Adapting content, methods, and tools to meet the specific needs of each child, while respecting his personality.
2. Familiar Words First - Using vocabulary related to the child's immediate environment before expanding to broader concepts
3. Concrete Learning - Simultaneously naming and showing objects, toys, and real-life items to reinforce speech development.
4. Multisensory Engagement - Stimulating all senses through interactive learning methods.
5. Real-Life and Visual Contexts – Presenting speech activities in realistic and visually engaging ways.
6. Gradual Introduction of Sounds - Prioritizing sounds that require minimal effort while following natural articulation development.
7. Speech-Based Play - Incorporating structured speech games to encourage verbal expression from the first session onward.

These principles optimize speech and language development, making it easier for hearing-impaired children to communicate and integrate into hearing communities (13).

Speech Therapy Techniques and Early Exercises

During the initial therapy sessions, careful observation of the child's interaction with the therapist and peers is crucial. Exercises are conducted through play, with a primary focus on speech sound development. All therapeutic activities must be individually tailored, considering child's auditory, speech, chronological, and psychological maturity. The goal is to create an environment that motivates the child to express themselves verbally. This is achieved through engaging games designed to elicit emotional reactions and encourage imitation of the therapist (14).

- Imitacije – služe kao podsticaj za vokalizaciju, naročito u procesu dupliranja slogova.
- Praćenje osnovnih verbalnih naredbi – pomaže deci da razviju razumevanje izgovorenih uputstava i reakciju na njih.
- Rano imenovanje – uključuje uvođenje imenica, glagola i prideva kako bi se omogućilo deci da povežu reči sa predmetima i radnjama.
- Svest o šemi tela – podstiče razumevanje sopstvenog tela i njegove funkcije u prostoru.
- Vežbe vizuelne percepcije – pomažu u prepoznavanju i tumačenju slika, predmeta i njihovih karakteristika.
- Vežbe slušne percepcije – fokusiraju se na razvijanje sposobnosti prepoznavanja zvukova i obrade slušnih informacija.

Zašto je važna rana intervencija?

Rana intervencija je suštinski važna zato što se dečiji mozak razvija mnogo brže od začeca do treće godine nego u bilo kom periodu života. Do treće godine, razvije se oko 90% moždane mase. Tokom ovog perioda, neuroni stvaraju veze neverovatnom brzinom – 700 do 1000 veza u sekundi – što daleko prevazilazi kasnije razvojne faze. Mozak trogodišnjeg deteta je dvostruko aktivniji od odraslog čoveka. Svako čulno iskustvo u ranom životu doprinosi oblikovanju sposobnosti mozga da misli, oseća i uči (18).

Rehabilitacija govora i sluha je složen proces na koji utiču različiti faktori. Najvažniji faktor je rano otkrivanje i strukturalna stručna intervencija kako u specijalizovanim ustanovama, tako i u kućnom okruženju. Istraživanja pokazuju da intenzivna logopedska terapija između druge i četvrte godine ima dugoročne pozitivne efekte na ukupan razvoj deteta. Rana intervencija pomaže da se ublaži kašnjenje u razvoju i uticaj tog kašnjenja na dete i njegovu porodicu (19).

Istraživanja takođe potvrđuju da odložena ugradnja kohlearnog implanta ometa razvoj slušnih, kognitivnih i jezičkih veština, što može značajno uticati na napredak u ovim oblastima (20,21,22).

Rani znaci da detetu treba logopedska terapija

Roditelji treba da potraže stručnu pomoć ako primete: odsustvo ili naglo smanjenje vokalizacije; izostanak reakcije na zvukove iz okoline; izostanak

reakcije na govorne pozive osim ako je sagovornik u vidnom polju; poteškoće u praćenju jednostavnih verbalnih instrukcija; preterano fokusiranje na lice sagovornika, što ukazuje na moguće oslanjanje na čitanje sa usana; pokušaji da se približe izvoru zvuka ili da ga pojačaju; i smanjena društvena interakcija sa članovima porodice. Rano prepoznavanje ovih znakova omogućava pravovremenu intervenciju, što maksimalno povećava sposobnost deteta da razvije govor i da se integriše u svet koji čuje.

Zaključak

Rana stimulacija slušnih puteva igra ključnu ulogu u razvoju slušnih, govornih i jezičkih sposobnosti. Pravovremeno otkrivanje gubitka sluha i rana intervencija su od suštinskog značaja za uspešnu slušnu rehabilitaciju i habilitaciju govora. Deca koja dobiju kohlearne implante pre svog prvog rođendana imaju znatno veće šanse da dostignu svoj puni potencijal u poređenju sa onima kojima je implant ugrađen sa tri godine. Rana logopedska terapija dalje podstiče razvoj verbalne komunikacije.

Konflikt interesa

Autori su izjavili da nema konflikta interesa.

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One of the first speech exercises involves onomatopoeia, where children imitate natural sounds (e.g. animal noises) or sounds from toys that vary in intensity and frequency. These activities encourage vocalization and sound imitation, essential for speech development. Beyond speech, therapy also supports the overall development of the child's personality (15).

Modern speech and language habilitation prioritizes verbal communication, which is critical for hearing-impaired children, as they interact with their peers (16). This approach benefits not only children with speech development problems, but also the broader social community. Carefully planned and developmentally appropriate speech therapy significantly improves outcomes. The prerequisites for successful speech and language therapy include the gradualness, method, and patience of the therapist (13).

Early speech exercises include several key activities that help children's speech and language development (17):

- Imitations - serve as stimulus for vocalization, especially in the process of doubling syllables.
- Following basic verbal commands - helps children develop comprehension and responsiveness to spoken instructions.
- Early naming – involves introducing nouns, verbs and adjectives to enable the child to associate words with objects and actions.
- Body schema awareness – encourages an understanding of one's own body and its function in space.
- Visual perception exercises – aid in recognizing and interpreting the images, objects and their characteristics.
- Auditory perception exercises – focus on developing of the ability to recognize sounds and process auditory information.

Why is early intervention important?

Early intervention is crucial because a child's brain develops more rapidly from conception to age three than at any other time in life. By the age of three, approximately 90% of brain mass is developed. During this period, neurons form connections at an extraordinary rate - 700-1000 connections per second – far exceeding later developmental stages. The brain of a three-year-old is twice as active as an adult. Every sensory experi-

ence in early life contributes to shaping the brain's capability for thinking, feeling, and learning (18).

Speech and hearing rehabilitation is a complex process influenced by various factors. The most important factor is early detection and structural professional intervention in both specialized institutions and home environments. Studies indicate that intensive speech therapy between the ages of two and four has long-term positive effects on the overall child development. Early intervention helps mitigate developmental delays and their impact on both the child and their family (19).

Research also confirm that delayed cochlear implantation hinders the development of auditory, cognitive, and language skills, which can significantly impact progress in these areas (20, 21, 22).

Early Signs That a Child May Need Speech Therapy

Parents should seek professional help if they notice: absence or sudden reduction in vocalization; lack of response to environmental sounds; no reaction to spoken calls unless the speaker is in direct view; difficulty following simple verbal instructions; excessive focus on the speaker's face, indicating possible reliance on lip-reading; attempts to move closer to sound sources or amplify them; and reduced social interaction with family members. Recognizing these signs early allows for timely intervention, maximizing a child's ability to develop speech and integrate into the hearing world.

Conclusion

Early stimulation of auditory pathways plays a crucial role in the development of auditory, speech and language abilities. Timely hearing loss detection and early intervention are essential for successful auditory rehabilitation and speech habilitation. Children who receive cochlear implants before their first birthday have a significantly higher chance of reaching their full potential compared to those implanted at age three. Early speech therapy further supports verbal communication development.

Competing interests

The authors declared no competing interests.

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ZNAČAJ PASTEROVOG ZAVODA U NOVOM SADU ZA PREVENCIJU I SUZBIJANJE BESNILA U REPUBLICI SRBIJI

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SAŽETAK

Besnilo je smrtonosna zoonotska bolest, koja se javlja u više od 150 zemalja i predstavlja javnozdravstveni problem za više od tri milijarde ljudi u svetu. U Evropi je besnilo kod životinja prisutno u Ukrajini, Belorusiji, Poljskoj, Moldaviji, Rusiji i Rumuniji, a pojedinačni slučajevi su prisutni i u drugim zemljama. Najveći broj slučajeva humanog besnila je prisutan u Aziji i Africi. Cilj ovog preglednog rada je bio da se predstavi značaj Pasterovog zavoda u Novom Sadu za suzbijanje i prevenciju besnila u Republici Srbiji. Podaci za ovaj rad su prikupljeni iz različitih baza podataka (*Web of Science*, *PubMed*, *Google Scholar*), biltena itd. Pasterov zavod u Novom Sadu je Nacionalna referentna zdravstvena ustanova za besnilo u Republici Srbiji. Sve delatnosti potrebne u borbi protiv besnila su zastupljene u okviru ove ustanove: pružanje antirabične zaštite ljudima ugroženim od besnila primenom vakcine protiv besnila sa kulture ćelija i humanog antirabičnog imunoglobulina (HRIG), preventivna imunizacija visokorizične populacije, pružanje stručno-metodološke pomoći i stručni nadzor nad radom 27 antirabičnih stanica (ARS) u Republici Srbiji, snabdevanje HRIG-om i vakcinom protiv besnila svih ARS, utvrđivanje doktrinskih i stručno-medicinskih stavova iz oblasti antirabične zaštite, praćenje kretanja besnila, izrada izveštaja i obaveštavanje ARS i organa vlasti o svakom registrovanom slučaju besnila u zemlji, predlaganje i sprovođenje mera za njegovo suzbijanje, dijagnostika besnila u okviru nacionalne referentne laboratorije za besnilo, kontrola postignutog imuniteta nakon imunizacije ljudi i životinja. Regionalni projekat oralne vakcinacije lisica protiv besnila se od 2010. godine sprovodi na teritoriji Republike Srbije, a od 2011. godine monitoring uspešnosti vakcinacije. U Republici Srbiji, urbano besnilo je eliminisano 1980. godine, kao i poslednji slučaj humanog besnila na teritoriji pokrajine Kosovo i Metohija, dok je poslednji slučaj silvatičnog besnila lisica u Srbiji registrovan 2018. godine. U cilju eradikacije besnila neophodna je sinhronizovana aktivnost zdravstvene i veterinarske službe, kao i saradnja na lokalnom, nacionalnom i internacionalnom nivou.

Ključne reči: Pasterov zavod, besnilo, istorija, epidemiologija, javno zdravlje

Uvod

Prvi Pasterov zavod u Srbiji i na Balkanu je osnovan 1900. godine u Nišu, i to 12 godina nakon osnivanja Pasterovog Instituta u Parizu (1). Odlukom Vojnog ministarstva, dana 25. 12. 1900. godine, novi zavod u Nišu dobija ime „Kraljevski vojni Pasterov zavod” i zvanično biva otvoren za javnost 1. 1. 1901. godine. Za prvog stalnog upravnika imenovan je dr Dragutin Petković. Vakcinacija ljudi protiv

besnila u Srbiji je uvedena još 1890. godine. Prema direktivi kraljevske vlade, sve do otvaranja zavoda u Nišu, ljudi ujedeni od strane besnih životinja su bili upućivani u Budimpeštu na lečenje (2). Stoga je doprinos novootvorenog zavoda u preventivnoj medicini bio velik, naročito nakon započete proizvodnje vakcina protiv besnila i velikih boginja (1).

THE IMPORTANCE OF THE PASTEUR INSTITUTE IN NOVI SAD FOR THE PREVENTION AND CONTROL OF RABIES IN THE REPUBLIC OF SERBIA

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SUMMARY

Rabies is a deadly zoonotic disease that occurs in more than 150 countries and represents a public health issue for over three billion people worldwide. In Europe, rabies in animals is present in Ukraine, Belarus, Poland, Moldova, Russia, and Romania, with isolated cases reported in other countries as well. The highest number of human rabies cases is found in Asia and Africa. The aim of this review paper is to present the significance of the Pasteur Institute in Novi Sad in the control and prevention of rabies in the Republic of Serbia. Data for this paper were collected from various databases (Web of Science, PubMed, Google Scholar), bulletins, etc. The Pasteur Institute in Novi Sad is the National Reference Health Institution for rabies in the Republic of Serbia. All activities necessary in the fight against rabies are covered within this institution: providing anti-rabies protection to people at risk of rabies through the administration of cell culture rabies vaccines and human rabies immunoglobulin (HRIG); preventive immunization of high-risk populations; providing expert methodological assistance and professional supervision of the work of 27 anti-rabies stations (ARS) in the Republic of Serbia; supplying HRIG and rabies vaccines to all ARS; establishing doctrinal and professional medical guidelines in the field of anti-rabies protection; monitoring the occurrence of rabies; preparing reports and informing ARS and government authorities about every registered case of rabies in the country; proposing and implementing measures for its control; diagnosing rabies within the national reference laboratory for rabies; and controlling the achieved immunity following the immunization of people and animals. The regional project of oral vaccination of foxes against rabies has been implemented in the territory of the Republic of Serbia since 2010, and monitoring of vaccination effectiveness has been conducted since 2011. In the Republic of Serbia, urban rabies was eliminated in 1980, as was the last case of human rabies in the territory of the province of Kosovo and Metohija, while the last case of sylvatic rabies in foxes in Serbia was registered in 2018. In order to eradicate rabies, synchronized activities of the health and veterinary services are necessary, as well as cooperation at the local, national, and international levels.

Ključne reči: Pasteur Institute, rabies, history, epidemiology, public health

Introduction

The first Pasteur Institute in Serbia and the Balkans was founded in Niš in 1900, 12 years after the Pasteur Institute in Paris had been founded (1). According to the decision of the Ministry of Defense, the new institute in Niš was named the “Royal

Military Pasteur Institute” on December 25th, 1900, and it was officially opened to public on January 1st, 1901. Dr Dragutin Petković was appointed as the first permanent director. Vaccination of people against rabies in Serbia was introduced as early as 1890.

Dvadesetak godina kasnije, 1921. godine se osniva Pasterov zavod u Novom Sadu, koji će već 1928. godine preuzeti sve poslove ostalih zavoda u Kraljevini Srba, Hrvata i Slovenaca i do danas ostati centralna ustanova za borbu protiv besnila (2,3). Od samog osnivanja, pa sve do danas, osim preventivno-medicinskim radom, Pasterov zavod u Novom Sadu se bavio i istraživanjima, kao i praćenjem kretanja besnila i drugih zoonoza. Značajni naučni rezultati istraživanja su publikovani u brojnim stranim i domaćim časopisima (3). Prvi direktor Pasterovog zavoda u Novom Sadu je bio dr Adolf Hempt, koji je razvio inaktivisanu tj. mrtvu vakcinu protiv besnila, koja je po njemu i dobila ime, i bila u upotrebi od 1925. pa sve do 1989. godine (3). Hemptova vakcina se izvozila u Austriju, Nemačku, Mađarsku i Čehoslovačku, kao i u neke afričke zemlje (3). Posle Drugog svetskog rata, Hemptov rad je nasledio i nastavio njegov učenik dr Milan Nikolić. Jedan od njegovih najznačajnijih radova je bila izolacija virusa besnila iz slepih miševa (3).

Na poziv dr Nikolića, na odeljenje za virusologiju Pasterovog zavoda, u aprilu 1960. godine iz Veterinarskog instituta Novi Sad dolazi dr Miloš Petrović. U tom periodu je u okviru zavoda osnovano nekoliko odeljenja: Odeljenje virusologije životinja, Odeljenje za humanu virusologiju, Odeljenje virusologije insekata, Odeljenje virusologije biljaka i Odeljenje histologije, koje je radilo dijagnostiku besnila. Dr Petrović je postavljen za direktora Pasterovog zavoda u Novom Sadu 1973. godine, gde je najpre učestvovao, a kasnije i rukovodio proizvodnjom vakcine protiv besnila za humanu upotrebu po tehnologiji dr Hempta. Uveo je direktni imunofluorescentni test u dijagnostiku besnila, unapredio rad na kulturi ćelija i rad u vivarijumu, kao i izvođenje bioloških oglada na miševima. Zaslugama dr Petrovića i zaposlenih, u januaru 1975. godine Savezni komitet za zdravstvo i socijalnu zaštitu u Beogradu proglašava Pasterov zavod za Nacionalnu referentnu laboratoriju za besnilo (3). Radi zajedničke proizvodnje humanog imunoglobulina protiv besnila Pasterov zavod 1988. godine sklapa ugovor sa Zavodom za transfuziju krvi iz Beograda (3). Danas, Nacionalna referentna laboratorija za besnilo Pasterovog zavoda u Novom Sadu već niz godina sertifikuje glavne dijagnostičke metode u ANSES laboratoriji u Francuskoj, koja je referentna laboratorija za besnilo Evropske Unije. Zahvaljujući svojoj bogatoj i vrednoj istoriji Pasterov zavod u Novom Sadu je 2001. godine proglašen i zaštićenim spomenikom kulture (3).

Cilj ovog preglednog rada je bio da se predstavi značaj Pasterovog zavoda u Novom Sadu za suzbijanje i prevenciju besnila u Republici Srbiji.

Metode

U cilju pisanja rada korišćeni su podaci iz baze podataka: *Web of Science*, *PubMed*, *Google Scholar*, *WHO Rabies Bulletin*, publikacija izdata povodom 95 godina rada Pasterovog zavoda u Novom Sadu i Međunarodnog naučnog simpozijuma "Istorija besnila u Srbiji" pod nazivom "95 godina Pasterovog zavoda u Novom Sadu". Ključne reči pretrage uključivale su: "Pasterov zavod", "besnilo", "istorija", "epidemiologija", "javno zdravlje" i "imunizacija". Ova literatura je obuhvatila različite vrste studija, kao što su sistematski pregledi, meta-analize, eksperimentalne randomizovane studije, biografije, istorijske članke, prikaze slučaja i tekstove sa zvaničnih internet sajtova.

Nacionalna referentna ustanova za besnilo u Republici Srbiji

Pasterov zavod u Novom Sadu je Nacionalna referentna zdravstvena ustanova za besnilo u Republici Srbiji, i kada je reč o prevenciji ove zoonoze, vodeća institucija u našoj zemlji, kao i u jugoistočnoj Evropi. Saradnja sa veterinarskom službom predstavlja ključ uspeha u borbi protiv besnila, kako na nacionalnom, tako i na internacionalnom nivou. Sve delatnosti potrebne u borbi protiv besnila su zastupljene u okviru ove ustanove: pružanje antirabične zaštite ljudima ugroženim od besnila primenom vakcine protiv besnila sa kulture ćelija i humanog antirabičnog imunoglobulina (HRIG), preventivna imunizacija visokorizične populacije, pružanje stručnometodološke pomoći i stručni nadzor nad radom 27 antirabičnih stanica (ARS) u Republici Srbiji, snabdevanje HRIG-om i vakcinom protiv besnila svih ARS, utvrđivanje doktrinskih i stručno-medicinskih stavova iz oblasti antirabične zaštite, praćenje kretanja besnila, izrada izveštaja i obaveštavanje ARS i organa vlasti o svakom registrovanom slučaju besnila u zemlji, predlaganje i sprovođenje mera za njegovo suzbijanje, dijagnostika besnila u okviru nacionalne referentne laboratorije za besnilo, kontrola postignutog imuniteta nakon imunizacije ljudi i životinja (3).

Postekpoziciona antirabična zaštita

U Službi za prevenciju i sprečavanje širenja besnila i drugih zaraznih bolesti Pasterovog zavoda

According to the directive of the royal government, people bitten by rabid animals had been sent to Budapest for treatment until the institute was opened in Niš. Therefore, the contribution of the newly opened institute in preventive medicine was great, especially after the production of vaccines against rabies and smallpox started (1).

About twenty years later, in 1921, the Pasteur Institute was founded in Novi Sad, which in 1928 took over all the work of other institutes in the Kingdom of Serbs, Croats and Slovenes and which has remained the central institution for the fight against rabies to this day (2,3). From the moment of its foundation to this day, the Pasteur Institute in Novi Sad has also been engaged in research, as well as monitoring trends in rabies and other zoonoses, in addition to preventive and medical work. Significant scientific research results have been published in numerous foreign and domestic journals (3). The first director of the Pasteur Institute in Novi Sad was Dr Adolf Hempt, who developed the inactivated, that is the dead vaccine against rabies, which was named after him, and which was in use from 1925 to 1989 (3). Hempt's vaccine was exported to Austria, Germany, Hungary and Czechoslovakia, as well as to some African countries (3). After the Second World War, Hempt's work was inherited and continued by his student, dr Milan Nikolić. One of his most important works was the isolation of the rabies virus from bats (3).

At the invitation of dr Nikolić, dr Miloš Petrović from the Veterinary Institute of Novi Sad came to the Department of Virology of the Pasteur Institute in April 1960. During that period, several departments were founded within the institute: the Department of Animal Virology, the Department of Human Virology, the Department of Insect Virology, the Department of Plant Virology and the Department of Histology, which was engaged in the diagnostics of rabies. Dr Petrović was appointed director of the Pasteur Institute in Novi Sad in 1973, where he first participated and later managed the production of rabies vaccines for human use based on dr Hempt's technology. He introduced a direct immunofluorescence technique in the diagnosis of rabies, improved the work on cell culture and the work in the vivarium, as well as biological experiments performed on mice. Thanks to dr Petrović and his employees, the Federal Committee for Health and Social Protection

in Belgrade declared the Pasteur Institute to be the National Reference Laboratory for Rabies in January 1975 (3). The Pasteur Institute signed an agreement with the Institute for Blood Transfusion from Belgrade in 1988 to jointly produce human immunoglobulin against rabies (3). Today, the National Reference Laboratory for Rabies of the Pasteur Institute in Novi Sad has certified the main diagnostic methods in the ANSES laboratory in France for several years, which is the reference laboratory for rabies in the European Union. Thanks to its rich and valuable history, the Pasteur Institute in Novi Sad was declared to be a protected cultural monument in 2001 (3).

The aim of this review article was to present the significance of the Pasteur Institute in Novi Sad for the control and prevention of rabies in the Republic of Serbia.

Methods

In order to write this article, data from the following databases were used: Web of Science, PubMed, Google Scholar, WHO Rabies Bulletin, the publication which was published on the occasion of 95 years of work of the Pasteur Institute in Novi Sad and the International Scientific Symposium "History of Rabies in Serbia" under the title "95 years of the Pasteur Institute in Novi Sad". The key words included the following: Pasteur Institute, rabies, history, epidemiology, public health and immunization. This literature included different types of studies, such as systematic reviews, meta-analyses, experimental randomized studies, biographies, historical articles, case reports and texts from official websites.

The National Reference Health Institution for Rabies in the Republic of Serbia

The Pasteur Institute in Novi Sad is the National Reference Health Institution for rabies in the Republic of Serbia, and when it comes to the prevention of this zoonosis, it is the leading institution in our country and in the Southeast Europe. Cooperation with the veterinary service is the key to success in the fight against rabies, both at the national and international level. All the activities necessary in the fight against rabies are covered within this institute: providing anti-rabies protection to people at risk of rabies through the administration of cell culture rabies vaccines and human rabies immunoglobulin (HRIG), preventive

pruža se antirabična zaštita nakon III kategorije izloženosti u urbanom okruženju, prema Svetskoj zdravstvenoj organizaciji (SZO), koja podrazumeva transdermalno ozleđene sa krvavim ranama, one kod kojih je bilo samo kontakta sa sluzokožom sumnjive životinje, ili ako životinja koja je pokazala agresivno ponašanje i nanela ozledu ne može da se prati, ili uginu tokom 10 dana praćenja (3,4). Besnilo je bolest koja se može sprečiti, kontrolisati i eliminisati vakcinacijom (5). Postekspoziciona profilaksa (PEP) je od ključnog značaja za sprečavanje kliničkih znakova besnila. Ona u Srbiji podrazumeva ispiranje rane, infiltraciju rane humanim imunoglobulinom protiv besnila (HRIG) i davanje vakcina u 4 doze po skraćenom *Essen* protokolu, ili Zagreb šemi (4). Ovaj protokol je zasnovan na preporuci stručnog komiteta iz Centra za kontrolu bolesti (ACIP) u SAD-u, koji je smanjio režim od 5 doza vakcina protiv besnila na 4 doze koje se daju na dane: 0, 3, 7 i 14, u kombinaciji sa imunoglobulinom protiv besnila koji se daje nultog dana (5). Ovo smanjenje broja doza vakcine je zasnovano na kliničkim studijama, epidemiološkom nadzoru i eksperimentalnim radovima na životinjama (6). Od 2018. godine SZO je dodatno smanjila režim vakcinacije na 3 doze (na dane 0, 3, 7 ili 0, 3, 21), dok Američki savetodavni odbor za praksu imunizacije (engl. *U.S. Advisory Committee on Immunization Practices*) i dalje preporučuje 4 doze vakcine u PEP (4).

Uvidom u izveštaje koje ARS u Republici Srbiji šalju u Pasterov zavod, došlo se do podataka da je u periodu od 2015. do 2024. godine vakcinisano ukupno 7580 pacijenata, pri čemu je utrošeno 17.183 doza vakcina i 4.744.644 lJ seruma. Kao izvor podataka korišćeni su Obrasci broj 5 – pojedinačna prijava kojom se prijavljuje mogućnost infekcije virusom besnila, u skladu sa važećim Zakonom (7).

Preekspoziciona antirabična zaštita

Sa druge strane, preventivna (preekspoziciona) imunizacija se sprovodi u okviru visokorizične populacije, kao što su poljoprivrednici, ljudi koji žive u oblastima gde je besnilo endemsko, kod ljudi profesijom izloženih riziku od obolevanja (lovci, veterinari, zaposleni u javno komunalnim službama, čuvari u zoološkim vrtovima, biolozi koji rade sa slepim miševima, zaposleni u laboratorijama za dijagnostiku besnila) i turisti (7). Potreba za preventivnom imunizacijom protiv besnila je naročito

naglašena u slučaju rada sa slepim miševima koje nikada ne bi trebalo da diraju neobučene i nevakcinisane osobe (8). Preventivne mere podrazumevaju vakcinaciju ljudi davanjem intramuskularnih ili intradermalnih vakcina protiv besnila tri doze na dane 0, 7, 21 prema stručno-metodološkom uputstvu, što omogućava brzu aktivaciju imunološkog odgovora kad osoba ponovo dođe u kontakt sa virusom (9).

U Laboratoriji za serološku dijagnostiku Pasterovog zavoda, kod prethodno imunizovanih pacijenata određuje se titar antitela na besnilo u serumu brzim testom inhibicije fluorescentnih fokusa na antirabična antitela (RFFIT – *Rapid fluorescent focus inhibition test*) (3). Njegova pogodnost za profilaksu besnila se ogleda u tome što pouzdano utvrđuje zadovoljavajući nivo antitela od 0,5 IU/ml (internacionalnih jedinica po mililitru) i što pokazuje zadovoljavajuću tačnost, 100% specifičnost, varijabilnost između testova od 21%, varijabilnost unutar testa od 14%, linearnost u opsegu do oko 60 IU/ml (10). U okviru Laboratorije za serološku dijagnostiku određuje se i titar antitela na besnilo u serumu kućnih ljubimaca, vakcinisanih protiv besnila, fluorescentnim testom na neutrališuća antitela na besnilo (FAVN – *Fluorescent antibody virus neutralization*) (3). Ovaj test se izvodi na kulturi ćelija sa živim virusom besnila i zbog toga može da ga izvodi samo laboratorija koju odobri Evropska Unija. Sertifikacija i validacija RFFIT i FAVN testa se vrši jednom godišnje kod referentne laboratorije za besnilo Evropske Unije (11).

Za otkrivanje virusa besnila pre razvoja kliničke slike kod pacijenta nema dostupnih dijagnostičkih testova, zato su dalja istraživanja o dijagnostičkim tehnikama u oblasti besnila od velike važnosti (12). Jedina moguća dijagnostika besnila kod životinja i ljudi je *post mortem* i ona se u Pasterovom zavodu vrši u okviru Laboratorije za dijagnostiku besnila tehnikom direktne imunofluorescencije (FAT – *fluorescent antibody technique*), biološkim ogleđom na miševima (MIT – *mouse inoculation test*) i primenom molekularne tehnike - testom lančane reakcije polimeraze (RT-PCR) (3). FAT se smatra brzim dijagnostičkom metodom i zlatnim standardom u ispitivanju moždanog tkiva na prisustvo virusa besnila uz upotrebu fluorescentnih antitela, a kao potvrdni test se radi izolacija virusa besnila biološkim ogleđom na miševima (MIT) (13). U laboratoriji za dijagnostiku besnila se vrši i ispitivanje potentnosti inaktivisanih vakcina protiv besnila za

immunization of high-risk populations, providing expert methodological assistance and professional supervision of the work of 27 anti-rabies stations (ARS) in the Republic of Serbia, supplying HRIG and rabies vaccines to all ARS, establishing doctrinal and professional medical guidelines in the field of anti-rabies protection, monitoring the occurrence of rabies, preparing reports and informing ARS and government authorities about every registered case of rabies in the country, proposing and implementing measures for its control, diagnosing rabies within the national reference laboratory for rabies, and controlling the achieved immunity following the immunization of people and animals (3).

Post-exposure anti-rabies protection

In the service for the control and prevention of rabies and other infectious diseases of the Pasteur Institute, anti-rabies protection is provided after category III exposure in the urban environment, which according to the World Health Organization (WHO), includes transdermally injured persons with open wounds, persons who only had contact with the mucous membrane of suspected animals, or if the animal which showed aggressive behavior and caused injury cannot be monitored, or dies during 10 days of monitoring (3,4). Rabies is a disease that can be prevented, controlled and eliminated by vaccination (5). Post-exposure prophylaxis (PEP) is of utmost importance to prevent clinical signs of rabies. In Serbia, it involves washing the wound, infiltrating the wound with human anti-rabies immunoglobulin (HRIG), in order to neutralize the virus at the wound site, and implementing vaccines in 4 doses according to the abbreviated Essen protocol, or Zagreb scheme (4). This protocol is based on the recommendation of an expert committee from the Centers for Disease Control (ACIP) in the USA, which reduced the 5-dose regimen of rabies vaccines to 4 doses administered on the following days: 0, 3, 7 and 14, in combination with rabies immunoglobulin administered on day zero (5). This reduction in the number of vaccine doses is based on clinical studies, epidemiological surveillance, and experimental work on animals (6). Since 2018, the WHO has further reduced the vaccination regimen to 3 doses (on days 0, 3, 7 or 0, 3, 21), while the U.S. Advisory Committee on Immunization Practices still recommends 4 doses of vaccine in PEP (4).

According to the reports, which are in the Republic of Serbia sent by ARS to the Pasteur Institute, a total of 7, 580 patients were vaccinated from 2015 to 2024, with 17,183 doses of vaccines and 4,744,644 IU of serum used. Forms number 5 – individual reports on the possibility of infection with the rabies virus were used as a source of data, in accordance with the current Law (7).

Pre-exposure anti-rabies protection

On the other hand, preventive (pre-exposure) immunization is implemented in the high-risk populations, such as farmers, people living in regions where rabies is endemic, and people who are exposed to the risk of this disease due to their professions (hunters, veterinarians, employees in public utility services, zoo keepers, biologists who work with bats, employees who work in laboratories that deal with rabies diagnostics), and tourists (7). The need for preventive immunization against rabies is particularly emphasized when one works with bats, which should never be touched by untrained and unvaccinated persons (8). Preventive measures include vaccination of people with intramuscular or intradermal rabies vaccines in three doses on days 0, 7, 21 according to the professional-methodological instructions, which enables the rapid activation of immune response when a person comes into contact with the virus again (9).

Rabies diagnostics

In the Laboratory for Serological Diagnostics of the Pasteur Institute, in previously immunized patients, the titer of rabies antibodies in the serum is determined by the rapid fluorescent focus inhibition test (RFFIT) (3). Its suitability for the prophylaxis of rabies is reflected in the fact that it reliably detects the satisfactory level of antibodies of 0.5 IU/ml (international units per milliliter) and that it shows satisfactory accuracy, 100% specificity, inter-assay variability of 21%, intra-assay variability of 14%, linearity up to about 60 IU/ml (10). Within the Laboratory for Serological Diagnostics, the titer of antibodies to rabies in the serum of pets, vaccinated against rabies, is determined by the fluorescent test for neutralizing antibodies to rabies (FAVN – Fluorescent antibody virus neutralization) (3). This test is performed in cell culture with live rabies virus and therefore, it can only be conducted by the laboratory approved

ljude i životinje NIH testom (NIH – *National Institutes of Health*) (3), dok se u Vivarijumu Zavoda obavlja uzgoj i rad sa laboratorijskim životinjama koje se koriste u pomenutom testu, u biološkim ogledima, kao i za izolaciju i proveru patogenosti pojedinih sojeva virusa besnila (3).

Epidemiološke i kliničke karakteristike besnila

Besnilo je smrtonosna zoonotska bolest koja se može preneti sa životinja na ljude i od koje u svetu svake godine umre oko 50.000 ljudi (4,7). Naziv bolesti potiče od latinske reči „*rabere*”, što znači „biti lud”, ili od reči *Rabbahs*, što na staroin-dijskom jeziku znači „nasilan” (14). Prvi put je prepoznato u Egiptu, oko 2300 godina pre nove ere, i u antičkoj Grčkoj (15). Demokrit je 500 godina pre Hrista opisao simptome besnila životinja, Aristotel je opisao besnilo kod pasa 322. godine pre nove ere, a Celzije je utvrdio povezanost hidrofobije kod čoveka sa besnilom životinja 100 godina pre nove ere. Mogućnost prenošenja besnila preko pljuvačke, sa bolesnog na zdravog psa, dokazivali su Cinke 1804. godine i Gruner i Salm-Rejferšajt 1813. godine. U Brazilu je 1907. godine prvi put opisano da slepi miševi mogu biti rezervoari i vektori virusa besnila (16).

Epidemiološki posmatrano, besnilo se javlja u više od 150 zemalja i predstavlja javnozdravstveni problem za više od tri milijarde ljudi u svetu. (5). U Evropi je besnilo životinja prisutno u Ukrajini, Belorusiji, Poljskoj, Moldaviji, Rusiji i Rumuniji, a pojedinačni slučajevi su zabeleženi i u drugim zemljama. Najveći broj slučajeva besnila ljudi je prisutan u Aziji i Africi (4). Prenosi se najčešće ujedom zaražene životinje, uglavnom ujedom besnih pasa. Virus ne može da prodre kroz netaknutu kožu, ali kontakt zaražene pljuvačke sa sluzokožom ili ranom može dovesti do infekcije. Virus se može preneti transplacentarno ili aerosolom. Prenos sa jednog čoveka na drugog zabeležen je u Etiopiji, a transplacentarni u Turskoj (14). Prosečni period inkubacije traje 20-60 dana, do pojave prvih simptoma. Prosečno vreme, od izlaganja virusu do smrti je 30-90 dana, a može biti i nekoliko dana, do godinu i više dana (17). Prva generacija vakcina protiv besnila je počela sa Luj Pasterom 1885. godine koji je za pravljenje vakcine koristio zaraženu kičmenu moždinu zeca. Vremenom je vakcina unapređena, i danas, u savremenom

svetu, se koriste modifikovana živa vakcina, inaktivirana vakcina protiv besnila i adjuvantna vakcina protiv besnila (7). Više od 15 miliona ljudi širom sveta svake godine primi postekspozicionu zaštitu za koju se procenjuje da sprečava milione smrtnih slučajeva od besnila (18).

Suzbijanje i prevencija besnila

U cilju eliminacije smrtnih slučajeva ljudi uzrokovanih besnilom pasa, 2018. godine je usvojen Globalni strateški plan, napravljen za period do 2030. godine od strane Svetske zdravstvene organizacije (WHO), Organizacije za hranu i poljoprivredu Ujedinjenih nacija (FAO) i Svetske organizacije za zdravlje životinja (WOAH), koji je podrazumevao godišnju vakcinaciju minimum 70% populacije pasa (19). Međutim, u više od 150 zemalja sveta u kojima se besnilo održava endemski ovaj plan još uvek nije ispunjen. Razlozi su višestruki, uključuju pre svega ograničena finansijska sredstva za nabavku vakcine i RIG-a, kao i nedovoljnu obuku zdravstvenih radnika i veterinarara. Suština uspešnog „Jedno zdravlje” pristupa je angažovanje cele zajednice, kao i nadzor nad besnilom (20,21).

Glavni rezervoari besnila u Evropi su crvena lisica i rakunasti pas. Jedini efikasan način za kontrolu besnila u Evropi je oralna vakcinacija ovih životinja putem distribucije vakcinalnih mamaca u njihova staništa. Ovaj program je započet u Švajcarskoj 1978. godine, a od 2001. godine i u drugim evropskim zemljama (22). Regionalni projekat oralne vakcinacije lisica protiv besnila se od 2010. godine sprovodi na teritoriji Republike Srbije. Od 2011. godine započet je monitoring uspešnosti vakcinacije (23). Projekat oralne vakcinacije je doveo do poboljšanja epizootiološke situacije kako u Srbiji, tako i u zemljama u okruženju (7). U Srbiji, urbano besnilo je eliminisano 1980. godine, kao i poslednji slučaj besnila čoveka na teritoriji pokrajine Kosovo i Metohija, dok je poslednji slučaj silvatičnog besnila lisica u Srbiji registrovan 2018. godine (24). U cilju eradikacije besnila neophodna je sinhronizovana aktivnost zdravstvene i veterinarske službe. U prepoznavanju globalnog značaja bolesti neophodna je saradnja na lokalnom, nacionalnom i internacionalnom nivou u cilju prikupljanja i obrade podataka. Pravilno prikupljeni podaci, omogućili bi kvalitetnija epizootiološko-epidemiološka razmatranja (16).

Kretanje besnila u Srbiji je povezano sa situaci-

by the European Union. The certification and validation of the RFFIT and FAVN test is conducted once a year by the reference laboratory for rabies of the European Union (11).

There are no available diagnostic tests that can detect the rabies virus before the development of clinical picture in a patient, and therefore, further research on diagnostic techniques in the field of rabies is of great importance (12). The only possible diagnosis of rabies in animals and humans is post-mortem and it is conducted at the Pasteur Institute within the Laboratory for Rabies Diagnostics by direct immunofluorescence technique (FAT – Fluorescent Antibody Technique), biological experiment on mice (MIT – Mouse Inoculation Test), and application of molecular technique – Polymerase Chain Reaction test (RT-PCR) (3). FAT is considered to be a rapid diagnostic method and gold standard in examining brain tissue for the presence of rabies virus with the use of fluorescent antibodies, and as a confirmatory test, the isolation of rabies virus is conducted by biological assay on mice (MIT) (13). In the laboratory for the diagnostics of rabies, the potency of inactivated rabies vaccines for humans and animals is tested using the NIH test (NIH – National Institutes of Health) (3), while in the Institute's vivarium, laboratory animals are bred and they are used in the above mentioned test, in biological experiments, as well as for the isolation and testing of pathogenicity of certain strains of the rabies virus (3).

Epidemiological and clinical characteristics of rabies

Rabies is a deadly zoonotic disease that can be transmitted from animals to humans and it causes 50,000 deaths in the world every year (4,7). The name of the disease originates from the Latin word 'rabere', which means "to be mad", or from the word 'Rabbahs', which in Old Indian means "violent" (14). It was first recognized in Egypt around 2300 BC, and in ancient Greece (15). Democritus described the symptoms of rabies in animals 500 years BC; Aristotle described rabies in dogs in 322 BC, and Celsius established the connection between hydrophobia in humans with rabies in animals 100 years before Christ. The possibility of transmission of rabies via saliva, from a sick to a healthy dog, was proven by Zinke in 1804 and Gruner and Salm-Reifferscheidt in 1813.

In Brazil, in 1907 it was first described how bats can be reservoirs and vectors of rabies virus (16).

From the epidemiological perspective, rabies occurs in more than 150 countries and it represents a public health problem for more than three billion people in the world (5). In Europe, animal rabies is present in Ukraine, Belarus, Poland, Moldova, Russia and Romania, while individual cases have been recorded in other countries, as well. The largest number of cases of human rabies is present in Asia and Africa (4). It is transmitted most often by the bite of an infected animal, mainly by the bite of rabid dogs. The virus cannot penetrate intact skin, but the contact of infected saliva with a mucous membrane or wound can lead to infection. The virus can be transmitted by the transplacental route or through aerosols. Human-to-human transmission was reported in Ethiopia, and transplacental transmission in Turkey (14). The average incubation period lasts 20-60 days, until the appearance of first symptoms. The average time from the exposure to this virus to death is 30-90 days, and it can be several days to one year or more (17). The first generation of vaccines against rabies began in 1885 with Louis Pasteur who used an infected spinal cord of a rabbit to make the vaccine. The vaccine has been updated over time, and today, in the contemporary world, modified live vaccine, inactivated rabies vaccine and adjuvant for rabies vaccines are used (7). More than 15 million people worldwide receive post-exposure prophylaxis every year, which is estimated to prevent millions of deaths caused by rabies (18).

The control and prevention of rabies

In order to eliminate human deaths caused by dog rabies, a Global Strategic Plan was adopted in 2018, and it was created by the World Health Organization (WHO), the Food and Agriculture Organization of the United Nations (FAO) and the World Organization for Animal Health (WOAH) for the period until 2030, and meant the annual vaccination of at least 70% of dog population (19). However, in more than 150 countries of the world, where rabies is endemic, this plan has not been fulfilled yet. The reasons are multiple, including, first of all, limited financial resources for the procurement of vaccine and RIG, as well as insufficient training of health professionals and veterinaries. The essence of a successful "One-

jom u zemljama sa kojima se naša zemlja graniči: Crna Gora, Bosna i Hercegovina, Hrvatska, Makedonija, Mađarska, Rumunija i Bugarska (23). U zemljama u okruženju, prema izveštaju WHO Rabies Bulletin (25), besnila ima u Mađarskoj, kod 12 domaćih i 24 divlje životinje i u Rumuniji, kod 19 domaćih i 9 divljih životinja. U Crnoj Gori, poslednji slučaj besnila kod životinja zabeležen je 2012. godine, u Bosni i Hercegovini 2020. godine, kod leša lovačkog psa, u Hrvatskoj 2014. godine, a u Makedoniji 2012. godine (25).

U cilju suzbijanja besnila primenjuje se jedan od glavnih principa pod nazivom "Jedno zdravlje", baziran na multidisciplinarnoj saradnji istraživača iz oblasti medicinskih, veterinarskih i bazičnih ekoloških nauka na lokalnom, nacionalnom i globalnom nivou, da bi se obezbedilo optimalno zdravlje za ljude, životinje i životnu sredinu (26). Izazovi podrazumevaju nedovoljno obrazovanje i svest javnosti, kao i ekonomske prepreke za postekspozicionu profilaksu. U cilju uspešne strategije iskorenjivanja besnila, neophodna su isplativa rešenja i kampanje podizanja svesti javnosti (7). Prema istraživanju sprovedenom u Pasterovom zavodu 2023. godine, većina zaposlenih smatra da su njihove funkcije jasno utvrđene, ciljevi konkretni, odgovornosti u organizaciji precizno definisane, te da je radna atmosfera motivišuća, što doprinosi uspešnosti Pasterovog zavoda (27).

Zaključak

Da bi se besnilo iskorenilo neophodna je stalna politička i finansijska angažovanost ugroženih zemalja, politička i finansijska podrška Evropske Unije i bliska saradnja susednih zemalja. Veoma je važno kontinuirano podizati svest stručne javnosti i građana o značaju i opasnosti od ove bolesti zbog mogućnosti širenja bolesti putem trgovine životinjama. Aktivnosti Pasterovog zavoda u Novom Sadu su brojne, a posebno su važne one koje su usmerene na prevenciju i suzbijanje besnila na teritoriji Republike Srbije

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Konflikt interesa

Autori su izjavili da nema konflikta interesa.

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health” approach is the engagement of whole community, as well as the community based rabies surveillance (20,21).

The main reservoirs of rabies in Europe are the red fox and the raccoon dog. The only effective way to control rabies in Europe is oral vaccination of these animals through distribution of vaccine baits in their habitats. This program was started in Switzerland in 1978, and since 2001 in other European countries (22). The regional project of oral vaccination of foxes against rabies has been implemented on the territory of the Republic of Serbia since 2010. Since 2011, monitoring of the success of vaccination has started (23). The project of oral vaccination led to the improvement of the epizootiological situation both in Serbia and in the surrounding countries (7). In Serbia, urban rabies was eliminated in 1980, as well as the last case of human rabies in the territory of the province of Kosovo and Metohija, while the last case of sylvatic fox rabies in Serbia was registered in 2018 (24). In order to eradicate rabies, synchronized activity of health and veterinary services is necessary. The cooperation at the local, national and international level, which is aimed at collecting and analyzing data, is necessary for the recognition of global importance of this disease. Properly collected data would enable better epizootiological-epidemiological considerations (16).

The trends of rabies in Serbia are connected with the situation in neighboring countries: Montenegro, Bosnia and Herzegovina, Croatia, Macedonia, Hungary, Romania and Bulgaria (23). In neighboring countries, according to the report of the WHO Rabies Bulletin (25), rabies is present in Hungary in 12 domestic and 24 wild animals and in Romania, in 19 domestic and 9 wild animals. In Montenegro, the last case of rabies in animals was recorded in 2012, in Bosnia and Herzegovina in 2020, in the carcass of a hunting dog in Croatia in 2014, and in Macedonia in 2012 (25).

In order to control rabies, one of the main principles called “One Health” is applied, based on the multidisciplinary cooperation of researchers from the fields of medical, veterinary and basic environmental sciences at the local, national and global level, in order to ensure the optimal health for people, animals and the environment (26). Challenges include insufficient public education and awareness, as well as economic barriers to post-exposure prophylaxis. In order to achieve

a successful rabies eradication strategy, cost-effective solutions and campaigns that raise public awareness are necessary (7). According to research conducted at the Pasteur Institute in 2023, most employees believe that their functions are clearly defined, goals are specific, duties in the organization are precisely defined, and therefore, the working atmosphere is motivating, which contributes to the success of the Pasteur Institute (27).

Conclusion

In order to eradicate rabies, the constant political and financial involvement of countries at risk, the political and financial support of the European Union and the close cooperation of neighboring countries are necessary. It is of great importance to continuously raise awareness of the professional public and citizens about the importance and danger of this disease due to the possibility of spreading the disease through animal trafficking. The activities of the Pasteur Institute in Novi Sad are numerous, with those aimed at the prevention and control of rabies in the territory of the Republic of Serbia being particularly important.

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Competing interests

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