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SAŽETAK

Uvod/Cilj: Procenjuje se da je 2017. godine izvršeno 139.024 transplantacija solidnih organa (bubreg, jetra, srce, pluća, pankreas i tanko crevo), što je samo 10% globalnih potreba. Cilj ove deskriptivne studije je bio da analizira učestalost doniranja i transplantacija solidnih organa (bubrega, jetre i srca) u Republici Srbiji za period 2010-2016. godine.

Metode: Podaci o broju donora i broju transplantiranih organa u Republici Srbiji, za period 2010-2016. godine, dobijeni su iz godišnjih izveštaja Ministarstva zdravlja Republike Srbije - Uprave za biomedicinu. Podaci o broju stanovnika Republike Srbije preuzeti su iz popisa stanovništva za 2011. godinu. U analizi dobijenih podataka korišćene su proporcije i stope.

Rezultati: U Srbiji je prosečna stopa doniranja, za period 2010-2016. godine bila 3,7 na milion stanovnika. Tokom poslednjih sedam godina među svim obavljenim transplantacijama organa sa umrlih davalaca, najveći procenat su činile transplantacije bubrega (78,3%), a zatim jetre (16,9%) i srca (4,8%). U transplantacionim centrima u Srbiji, za period 2010-2016. godine, obavljeno je 537 transplantacija bubrega, i to 328 sa preminulih i 209 sa živih davalaca. Prosečna stopa transplantacija bubrega (na milion stanovnika), za sedmogodišnji period iznosila je 10,6, odnosno 4,1 kada su u pitanju živi davaoci i 6,5 sa preminulih davalaca. U istom periodu izvršena je 71 transplantacija jetre i 20 transplantacija srca sa preminulih davalaca, a prosečne stope transplantacija su bile 1,4 i 0,4 na milion stanovnika.

Zaključak: U posmatranom periodu, u Srbiji su zabeležene najniže stope transplantacija bubrega sa živih i preminulih davalaca, kao i jetre i srca sa preminulih davalaca, u odnosu na sve druge zemlje Evrope. Oblast transplantacije ljudskih organa u Republici Srbiji pravno je regulisana Zakonom o presađivanju ljudskih organa. Zakonom su utvrđeni i obezbeđeni uslovi za postizanje standarda kvaliteta i bezbednosti ljudskih organa za transplantaciju, uslovi rada i načina organizacije zdravstvenog sistema u cilju obezbeđivanja optimalne dovoljnosti organa za transplantaciju i obezbeđivanje visokog nivoa zaštite ljudskog zdravlja, kao i uvažavanja prioritetnih interesa za očuvanje života i zdravlja i zaštite osnovnih ljudskih prava i dostojanstva davaoca i primaoca ljudskih organa. Poseban akcenat treba staviti na edukaciju stanovništva i zdravstvenih radnika o važnosti doniranja ljudskih organa.

Ključne reči: transplantacija, doniranje, bubreg, srce, jetra

Uvod

Transplantacija ljudskih organa ili delova organa je medicinski postupak uzimanja organa, odnosno delova organa, sa živog ili umrlog lica, zbog presađivanja u telo drugog lica radi lečenja, uključujući sve procedure za pripremu, obradu, očuvanje, praćenje ozbiljnih neželjenih pojava i ozbiljnih neželjenih reakcija, kao i distribuciju organa, odnosno delova organa. Doniranje organa je postupak davanja ljudskih organa sa živog ili umrlog lica radi presađivanja u telo drugog lica radi lečenja, bez novčane naknade (1). Kadaverična donaci-

ja ljudskih organa predstavlja uzimanje organa od nedavno preminulog davaoca. Živa donacija ljudskih organa predstavlja doniranje jednog parnog organa (bubreg) ili dela organa (režanj jetre ili pluća) od živog davaoca. Živi davaoci organa su uglavnom u rodbinskoj vezi sa primaocem organa (2).

Danas transplantacija predstavlja najefikasniji oblik lečenja terminalnog stadijuma renalne insuficijencije, kao i jedini dostupan oblik lečenja terminalnog stadijuma obolevanja srca, jetre i pluća (3). Više od milion ljudi širom sveta osetilo je dobrobit nakon uspešno obavljene transplant-

KIDNEY, LIVER AND HEART DONATION AND TRANSPLANTATION IN THE REPUBLIC OF SERBIA FOR THE PERIOD 2010-2016

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SUMMARY

Introduction/aim: It is estimated that in 2017, 139,024 solid organ transplants (kidney, liver, heart, lungs, pancreas, small intestine) were performed, which is only 10% of global needs. The aim of this descriptive study was to analyze the frequency of donation and transplantation of solid organs (kidney, liver and heart) in Republic of Serbia for the period 2010-2016.

Methods: Data on the number of donors and the number of transplanted organs in Serbia, for the period 2010-2016, were obtained from the Annual reports of the Ministry of Health Republic of Serbia -Directorate of Biomedicine. Data on the population of Serbia were taken from the 2011 census. Proportions and rates were used in the analysis of the obtained data.

Results: In Republic of Serbia, average donation rate, for the period 2010-2016, was 3.7 pmp. During the last seven years, among all performed transplants from deceased donors, the largest percentage were transplants of kidneys (78.3%), followed by liver (16.9%) and heart (4.8%). In transplant centers in Serbia, for the period 2010-2016, 537 kidney transplants were performed, 328 from deceased and 209 from living donors. The average rate of kidney transplants for the seven-year period was 10.6 pmp, or 4.1 pmp for living donors and 6.5 pmp for deceased donors. In the same period, 71 liver transplants and 20 heart transplants from deceased donors were performed, and the average transplant rates were 1.4 pmp and 0.4 pmp.

Conclusion: In the observed period, the lowest rates of kidney transplantation from living and deceased donors, as well as liver and heart from deceased donors, were recorded in Serbia, in relation to all other European countries. The field of organ transplantation in Serbia is legally regulated by the Law on Human Organ Transplantation. Conditions for achieving quality standards and safety of human organs for transplantation have been determined by this law, as well as working conditions and ways of organizing the health system to ensure optimal organ transplantation and provision, high level of protection of human health, as well as respect priority interests for the preservation of life and health and protection of basic human rights and dignity of organ donors and recipients. Special emphasis should be placed on educating the population and health care workers about the importance of organ donation.

Keywords: transplantation, donation, kidney, heart, liver

Introduction

Human organ transplantation is a medical procedure, in which an organ or parts of organs are removed from the body of a living or deceased person and placed in the body of a recipient for the treatment, and it includes all the procedures for the preparation, preservation, observation of serious side effects and adverse effects, as well as distribution of organs, that is, parts of organs. Donation of organs is a procedure of removing an organ from a living or deceased person and placing it in another person, which is used for the medical

treatment, without financial compensation (1). Cadaveric donation of human organs means that organs are taken from the recently dead donor. Living donation of human organs comprises donation of one paired organ (kidney) or one part of an organ (liver or lung lobe) from the living donor. Living donors are usually the members of recipient's family (2).

Today, transplantation presents the most efficient form of therapy for end-stage renal insufficiency, as well as the only available form of therapy for terminal heart, liver and lung disease (3).

acije organa. Zahvaljujući modernim tehnikama očuvanja organa i unapređenju imunosupresije, mnogi pacijenti imaju dug i veoma kvalitetan život (4,5).

Procenjuje se da je 2017. godine obavljeno 139.024 transplantacija solidnih organa (90.306 transplantacija bubrega, 34.348 jetre, 7.881 srca, 6.084 pluća, 2.243 pankreasa i 163 tankog creva), što je samo 10% globalnih potreba (6). Najveći broj obavljenih transplantacija solidnih organa odnosio se na bubrege (65%) i jetru (23%). Dugo čekanje na transplantaciju doprinosi pogoršanju zdravstvenog stanja pacijenta ili smrtnom ishodu. Procene su da je dnevno u Evropi, tokom 2016. godine, umiralo 19 pacijenata koji su bili na listama čekanja za transplantaciju ljudskih organa, jer za njih nije bilo dostupnih organa (7).

Postignuti rezultati u evropskim zemljama iz oblasti doniranja i transplantacije ljudskih organa su različiti i pored činjenice da u svakoj od zemalja postoji jasno definisan zakonodavni okvir. Broj donacija organa od kadaveričnih donora na milion stanovnika (engl. *per million population* - pmp), nejednako je raspoređen unutar Evropske unije (EU). Tokom 2015. godine broj donora i stope doniranja su se kretale od 0 do 34,4 donora na milion stanovnika na nacionalnom nivou (8). Epidemija dijabetesa i arterijske hipertenzije, kao i opšti trend starenja stanovništva, rezultirali su povećanim potrebama za transplantacijom organa. Nesrazmera između ponude i potražnje ljudskih organa ukazuje na potrebu razmatranja različitih nacionalnih strategija za povećanje dostupnosti ljudskih organa za transplantaciju (8).

Svetska zdravstvena organizacija (SZO) pozvala je na usvajanje novih opštih pravila kojima bi vlade država preuzele nacionalni nivo odgovornosti u ispunjavanju potreba stanovništva za ljudskim organima za transplantaciju, pristupom resursima u okviru sopstvene populacije. Ovaj koncept je nazvan „nacionalna samodovoljnost”. Vlade, odnosno nacionalni autoriteti treba sistemski da zadovolje svoje nacionalne potrebe u skladu sa nacionalnim pravnim okvirom. S tim u vezi, potrebno je implementirati medicinske strategije koje bi sprečile terminalne faze obolevanja i otkazivanja organa. Za postizanje nacionalne dovoljnosti u doniranju i transplantaciji organa, neophodan je sveobuhvatan nacionalni Program koji sadrži zakonodavni okvir sa politikom nadzora, program kadaverične donacije integrisan u zdravstveni

sistem, etičku praksu žive donacije i transplantacije u skladu sa svetskim standardima, kao i program preventivne medicine za sprečavanje terminalnih stadijuma obolevanja organa (9).

Oblast transplantacije ljudskih organa u Republici Srbiji pravno je regulisana Zakonom o presađivanju ljudskih organa (10). Ovim Zakonom, oblast transplantacije ljudskih organa sistemski je potpuno uređena. Osim toga, utvrđeni su i obezbeđeni uslovi za postizanje standarda kvaliteta i bezbednosti ljudskih organa za transplantaciju, kao i uslovi rada i načina organizacije zdravstvenog sistema, u cilju obezbeđivanja optimalne dovoljnosti organa za transplantaciju i obezbeđivanja visokog nivoa zaštite ljudskog zdravlja, kao i uvažavanja prioritarnih interesa za očuvanje života i zdravlja i zaštite osnovnih ljudskih prava i dostojanstva davaoca i primaoca organa.

Pored toga, Zakon je u potpunosti usaglašen sa direktivama Evropske unije, i to: Direktivom 2010/53/EU Evropskog Parlamenta i Saveta od 7. jula 2010. godine o standardima kvaliteta i bezbednosti ljudskih organa koji su namenjeni transplantaciji, Direktivom 2012/25/EU od 9. oktobra 2012. godine kojom se utvrđuju procedure informisanja za razmenu ljudskih organa namenjenih za transplantaciju između država članica, kao i Zakonom o potvrđivanju konvencije o zaštiti ljudskih prava i dostojanstva ljudskog bića u pogledu primene biologije i medicine: Konvencija o ljudskim pravima i biomedicini (11).

Međunarodnim sporazumima i nacionalnim zakonima postavljen je pravni okvir za transplantaciju ljudskih organa koja se obavlja u svakoj od zemalja. Bitno je ustanoviti protokole za dijagnostikovanje smrti, razmenu informacija, davanje saglasnosti za uzimanje organa za transplantaciju, kao i za alokacione modele. Istanbulska Deklaracija je pozvala vlade da obezbede zaštitu i bezbednost živim davaocima ljudskih organa, dok se bore protiv transplantacionog turizma, trgovine ljudskim organima i transplantacione komercijalizacije. Vlade treba da odvrću od putovanja u strane destinacije u cilju odlaska na transplantaciju bubrega od živih davalaca koji su nepoznati primaocima (9,12).

Cilj ove deskriptivne studije je da se analizira učestalost doniranja i transplantacije bubrega, jetre i srca u Republici Srbiji za period 2010-2016. godine.

More than million people around the world experienced benefits after the well-performed organ transplantation. Thanks to modern techniques of organ preservation and the improvement of immunosuppression, a lot of patients have a long and good quality life (4,5).

It is estimated that in 2017, 139.024 solid organ transplants were performed (90.306 kidney transplantations, 34.348 liver, 7.881 heart, 6.084 lungs, 2.234 pancreas and 163 small intestine transplantations), which is only 10% of global needs (6). The largest numbers of solid organ transplantations were kidney (65%) and liver transplantations (23%). Long waiting lists contribute to a further worsening of patient's health condition or deathly outcome. It is estimated that in Europe in 2016, 19 patients, who were on these waiting lists for the transplantation, died every day because there were no available organs for them (7).

Achieved results in the field of human organ donation and transplantation were different in European countries, although in each of these countries legislation is clearly defined. The number of donations from cadaveric donors per million inhabitants was unequally distributed within the European Union. In 2015, the number of donors and donation rates ranged from 0 to 34.4 donors per million population (pmp) at the national level (8). An epidemic of diabetes and arterial hypertension, as well as the general trend of population ageing, resulted in the increased need for organ transplantation. A disproportion in human organ supply and demand points to the fact that different national strategies for the increase in availability of human organs for transplantation should be considered (8).

The World Health Organization (WHO) called for the adoption of new guiding principles on the accountability of governments to fulfill their inhabitants' needs for organs for transplantation, by making resources accessible to their population. This concept was called the "national self-sufficiency". Governments, that is, national authorities should satisfy their national needs systematically, in accordance with the national legislation. Thus, medical strategies that would prevent terminal stages of disease and organ failure should be implemented. In order to achieve the national self-sufficiency regarding organ donation and transplantation, it is necessary to develop the comprehensive national program which would

contain the legal framework with the policy of supervision, cadaveric donation program that would be integrated in the health system, ethical practice of living donation and transplantation in accordance with the world standards, as well as the preventive medicine program for the prevention of terminal stages of disease (9).

In the Republic of Serbia, the field of organ transplantation was legally regulated by the Law on human organ transplantation (10). With this law, the field of organ transplantation was systematically regulated. In addition to this, the conditions for achieving the standards of quality and safety of human organs intended for transplantation were determined and provided, as well as the conditions necessary for the operation and organization of the health care system aimed at providing optimal sufficiency in organs intended for transplantation and securing the high level of health care, and considering priorities for the preservation of life and health and protection of basic human rights and the dignity of donors and recipients.

In addition to this, the Law was completely in accordance with the European Union directives: Directive 2010/53/EU of the European Parliament and Council of 7 July 2010 on standards of the quality and safety of human organs intended for transplantation, Directive 2012/25/EU of 9 October 2012, which established the information procedures for the exchange of human organs intended for transplantation between member states, and the Law on confirming the Convention on human rights and dignity with regard to the application of Biology and Medicine (Convention on human rights and biomedicine) (11).

International treaties and national laws set the legal framework for organ transplantation, which is performed in each of these countries. It is important to establish protocols for the determination of death, exchange of information, consent to organ donation, as well as for allocation models. The Istanbul Declaration called governments to provide protection and safety for living donors, while they combated transplant tourism, organ trafficking and commercialism. Governments should dissuade people from traveling to foreign countries to undergo kidney transplantation from living donors who are not known to the recipients (9,12).

The aim of this descriptive study is to analyze the frequency of kidney, liver and heart donation

Metode

U okviru ove deskriptivne studije, analiziran je broj donora i solidnih transplantiranih ljudskih organa u Republici Srbiji za period 2010-2016. godine.

Podaci o broju donora i transplantiranih ljudskih organa u Srbiji, za period 2010-2016. godine, dobijeni su iz godišnjih izveštaja Ministarstva zdravlja Republike Srbije - Uprave za biomedicinu. Podaci o broju stanovnika Srbije preuzeti su iz popisa stanovništva za 2011. godinu.

U analizi dobijenih podataka korišćene su proporcije i stope. Godišnja stopa transplantacija izračunata je tako što je za brojilac uzet broj transplantacija za posmatranu godinu, a za imenilac broj stanovnika Republike Srbije sredinom posmatrane godine. Sve prikazane stope su nestandardizovane i izražene na milion stanovnika.

Rezultati

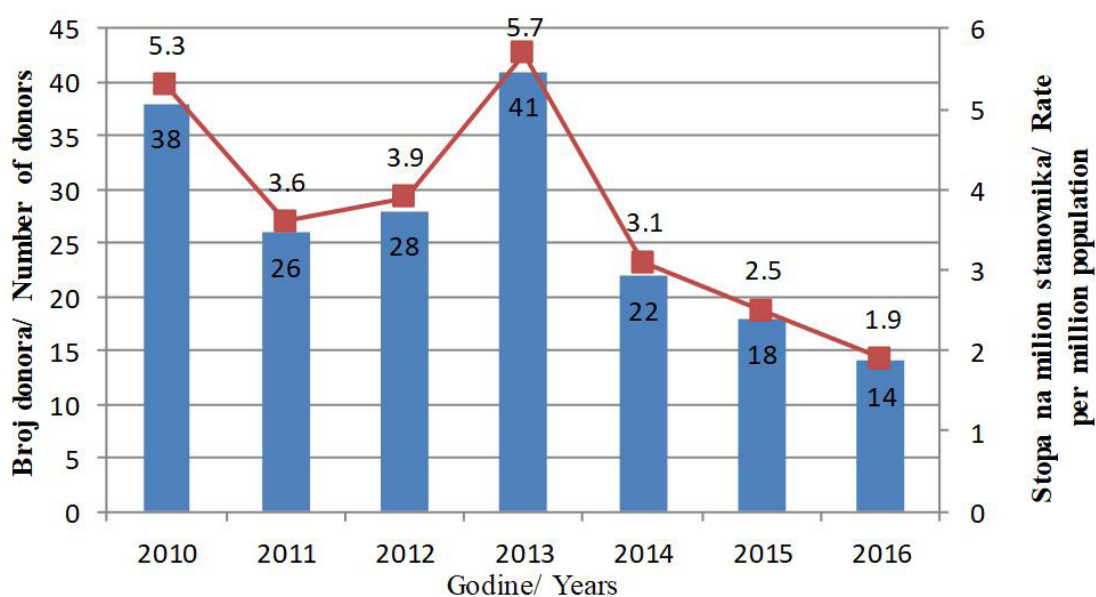
U periodu od 2010. do 2016. godine, u Republici Srbiji, najveća stopa doniranja zabeležena je 2013. godine (5,3 na milion stanovnika) i 2010. godine (5,7 na milion stanovnika), a najmanja 2016. godine (1,9 na milion stanovnika) (grafikon 1). U posmatranom periodu prosečan godišnji broj donora je bio 27, a prosečna stopa doniranja 3,7 na milion stanovnika.

Tokom poslednjih sedam godina, među svim izvedenim transplantacijama sa umrlih davalaca u Republici Srbiji, najveći procenat su činile trans-

plantacije bubrega (78,3%), a zatim jetre (16,9%) i srca (4,8%) (grafikon 2).

U transplantacionim centrima u Republici Srbiji, tokom perioda 2010-2016. godine, obavljeno je 537 transplantacija bubrega, i to 328 transplantacija bubrega sa umrlih i 209 sa živih davalaca (tabela 1). Stopa transplantacija bubrega sa umrlih davalaca na milion stanovnika kretala se od 3,1 u 2016. godini do 10,3 u 2013. godini, a sa živih davalaca od 3,2 u 2016. godini do 4,9 u 2012. godini. U svim posmatranim godinama stopa transplantacija bubrega je bila veća sa umrlih nego sa živih davalaca. Prosečna stopa transplantacija bubrega za sedmogodišnji period iznosila je 10,6 na milion stanovnika, odnosno 4,1 na milion stanovnika kada su u pitanju živi davaoci i 6,5 na milion stanovnika kada su u pitanju umrli davaoci. Od 2014-2016. godine dolazi do izrazitog opadanja ukupne stope transplantacija bubrega (sa 14,0 na milion u 2010. godini na 6,3 na milion u 2016. godini).

U istom periodu obavljena je 71 transplantacija jetre i 20 transplantacija srca sa umrlih davalaca (tabela 2). Prosečna stopa transplantacija jetre sa umrlih davalaca iznosila je 1,4 na milion stanovnika, a za srce 0,4 na milion stanovnika. Stopa transplantacija jetre (na milion stanovnika) je opadala od 2010. do 2016. godine sa 2,6 na 1,1, a rasla za srce od 0,6 na milion stanovnika u 2013. godini, na 0,8 na milion stanovnika u 2016. godini. U posmatranom periodu, broj realizovanih transplantacija svih organa sa umrlih davalaca, za period od 2010.



Grafikon 1. Broj donora i stope doniranja (na milion stanovnika) za period 2010-2016. godine u Republici Srbiji

and transplantation in the Republic of Serbia for the period 2010-2016.

Methods

The number of donors and solid transplant organs in the Republic of Serbia for the period 2010-2016 was analyzed in this descriptive study.

Data on the number of donors and transplant organs in Serbia for the period 2010-2016 were obtained from the annual reports of the Ministry of Health of the Republic of Serbia – Directorate of Biomedicine. Data on the population of Serbia were taken from the 2011 census.

Rates and proportions were used for the analysis of the obtained data. The annual transplantation rate was calculated by taking the number of transplantations for the observed year as the numerator, and the number of inhabitants of the Republic of Serbia in the middle of the observed year as the denominator. All rates shown are non-standardized and expressed per million population.

Results

In the period 2010-2016, in the Republic of Serbia, the highest donation rates were registered in 2013 (5.3 pmp) and in 2010 (5.7 pmp), while the lowest rate was in 2016 (1.9 pmp) (Figure 1). The average annual number of donors was 27, while the average rate of donations was 3.7 pmp in the observed period.

During the last seven years, of all performed transplantations from deceased donors in the Republic of Serbia, the highest percentages had kidney transplants (78.3%), followed by liver (16.9%) and heart transplants (4.8%) (Figure 2).

In transplant centers in Serbia, during the period 2010-2016, 537 kidney transplants were performed, that is, 328 kidney transplants from deceased and 209 from living donors (Table 1). The rate of kidney transplants from deceased donors ranged from 3.1 pmp in 2016 to 10.3 pmp in 2013, while from living donors this rate was 3.2 pmp in 2016 and 4.9 pmp in 2012. In all the observed years, the rate of kidney transplants was higher for deceased than for living donors. The average rate of kidney transplantations for the seven-year period amounted to 10.6 pmp, that is, 4.1 pmp for living donors and 6.5 pmp for deceased donors. There came to the significant decrease in the total rate of kidney transplants from 2010 to 2016 (from 14.0 pmp in 2010 to 6.3 pmp in 2016).

In the same period, 71 liver transplantations and 20 heart transplantations were performed from deceased donors (Table 2). The average rate of liver transplants from deceased donors was 1.4 pmp, whereas the rate of heart transplants amounted to 0.4 pmp. The liver transplantation rate declined from 2.6 pmp in 2010 to 1.1 pmp in 2016, while it increased in case of heart transplantations from 0.6 pmp in 2013 to 0.8 pmp in 2016. In the observed period from 2010 to 2016, the

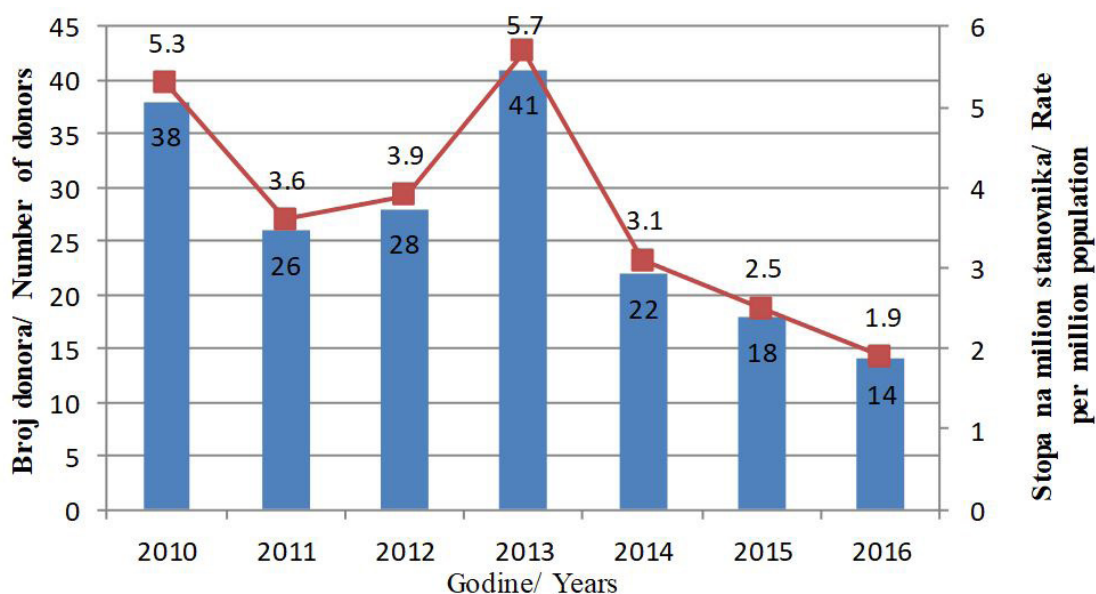
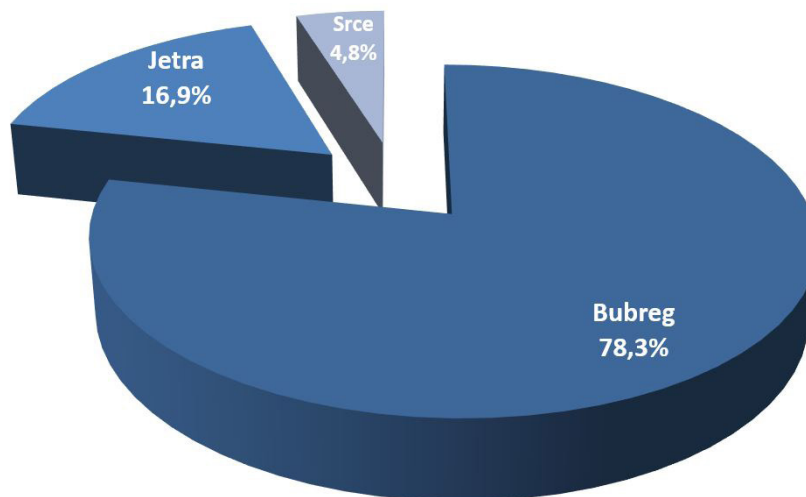


Figure 1. Number of donors and donation rates (pmp) for the period 2010-2016 in the Republic of Serbia



Grafikon 2. Procentualno učešće transplantacija bubrega, srca i jetre među svim transplantacijama sa umrlih davalaca za period 2010-2016. godine u Republici Srbiji

do 2016. godine, je bio 419. Stopa transplantacija svih organa je opala sa 11,9 na milion stanovnika u 2010. godini na 5,0 na milion stanovnika u 2016. godini.

Diskusija

Prosečna stopa doniranja u Republici Srbiji, za period 2010-2016. godine, je bila 3,7 na milion stanovnika. U poređenju sa drugim zemljama Evrope, stopa doniranja u Republici Srbiji je ekstrem-

no niska. Manjak donora je glavni problem kako za Srbiju, tako i za sve evropske države u vezi sa transplantacijom ljudskih organa. U Evropi postoje značajne razlike u stopi doniranja organa, koje su u 2017. godini varirale od 46,9 donora na milion stanovnika u Španiji, 33,0 u Hrvatskoj, 23,1 u Velikoj Britaniji, do 5,5 u Grčkoj i 3,3 u Rumuniji (13,14). Ove razlike se ne mogu objasniti samo razlikama u stopama mortaliteta. Procenjuje se da se liste čekanja za transplantaciju ljudskih organa proširu-

Tabela 1. Broj i stopa transplantacija bubrega (na milion stanovnika) sa živih i preminulih davalaca, kao i ukupno, za period 2010-2016. godine u Republici Srbiji

Godina	Broj živih davalaca (Stopa na milion)	Broj umrlih davalaca (Stopa na million)	Ukupan broj davalaca (Stopa na million)
2010.	33 (4,7)	67 (9,4)	100 (14,0)
2011.	34 (4,8)	49 (6,9)	83 (11,7)
2012.	35 (4,9)	47 (6,6)	82 (11,5)
2013.	30 (4,2)	74 (10,4)	104 (14,6)
2014.	26 (3,7)	37 (5,2)	63 (8,9)
2015.	28 (3,9)	32 (4,5)	60 (8,4)
2016.	23 (3,2)	22 (3,1)	45 (6,3)
2010- 2016.	209 (4,1)	328 (6,5)	537 (10,6)

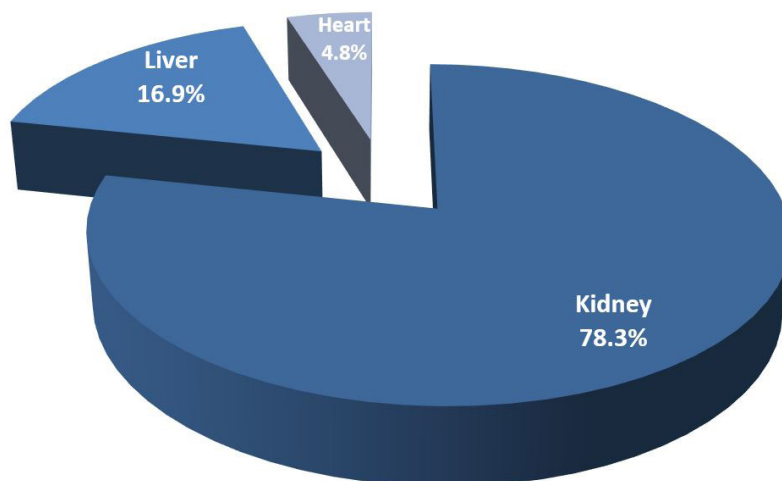


Figure 2. Percentage share of kidney, heart and liver transplants among all transplants from deceased donors for the period 2010-2016 in the Republic of Serbia

number of all performed transplantations from deceased donors was 419. The rate of all transplantations decreased from 11.9 pmp in 2010 to 5.0 pmp in 2016.

Discussion

The average rate of donation in the Republic of Serbia for the period 2010-2016 was 3.7 pmp. In comparison to other European countries, the rate of donation is extremely low. The lack of donors is

the main problem in relation to human organ transplantation not only in Serbia, but in all European countries, as well. There is significant difference in the rate of organ donation in Europe, which in 2017 ranged from 46.9 donors pmp in Spain, 33.0 in Croatia, 23.1 in Great Britain to 5.5 in Greece and 3.3 in Romania (13,14). This difference cannot be explained only by difference in mortality rates. It is estimated that waiting lists for human organ transplants are expanded every 10 minutes with

Table 1. Number and rate of kidney transplants (pmp) from living and deceased donors, as well as total, for the period 2010-2016 in the Republic of Serbia

Year	No of living donors (rate pmp)	No of deceased donors (rate pmp)	No of total donors (rate pmp)
2010	33 (4.7)	67 (9.4)	100 (14.0)
2011	34 (4.8)	49 (6.9)	83 (11.7)
2012	35 (4.9)	47 (6.6)	82 (11.5)
2013	30 (4.2)	74 (10.4)	104 (14.6)
2014	26 (3.7)	37 (5.2)	63 (8.9)
2015	28 (3.9)	32 (4.5)	60 (8.4)
2016	23 (3.2)	22 (3.1)	45 (6.3)
2010- 2016	209 (4.1)	328 (6.5)	537 (10.6)

Tabela 2. Broj i stope svih transplantacija (na milion stanovnika), kao i jetre i srca, sa preminulih davalaca za period 2010-2016. godine u Republici Srbiji

Godine	2010.	2011.	2012.	2013.	2014.	2015.	2016.	2010-2016.
Karakteristike								
Broj (%) transplantacija jetre sa preminulih davalaca	19 (26,8)	9 (12,7)	7 (9,9)	17 (23,9)	4 (5,6)	7 (9,9)	8 (11,3)	71 (100,0)
Stopa transplantacija jetre sa preminulih davalaca na million stanovnika	2,6	1,3	1,0	2,4	0,6	1,0	1,1	1,4
Broj (%) transplantacija srca sa preminulih davalaca	-	-	-	4 (20,0)	5 (25,0)	5 (25,0)	6 (30,0)	20 (100,0)
Stopa transplantacija srca sa preminulih davalaca na milion stanovnika	-	-	-	0,6	0,7	0,7	0,8	0,4
Ukupan broj (%) svih transplantacija sa preminulih davalaca	86 (20,5)	58 (13,8)	54 (12,9)	95 (22,7)	46 (11,0)	44 (10,5)	36 (8,6)	419 (100,0)
Stopa svih transplantacija sa preminulih davalaca na milion stanovnika	11,9	8,1	7,5	13,2	6,4	6,1	5,0	8,3

ju na svakih 10 minuta sa jednom novom osobom kojoj je neophodna transplantacija (15).

Broj ljudskih organa dostupnih za presađivanje ni približno ne prati stvarne potrebe, te nedostatak organa predstavlja globalni problem, dilemu i izazov transplantacionih sistema. Jedan od razloga leži delimično u činjenici da je prikupljanje organa sa umrlih lica uglavnom bazirano na doniranju nakon moždane smrti, pri čemu se mora naglasiti da tek oko 1% umrlih, te ne više od 3% umrlih u bolnici, podleže toj situaciji (16,17). Globalni manjak raspoloživih organa za transplantaciju otvara mnoga bioetička pitanja, uključujući i dileme kako da se alociraju ograničeni resursi neograničenom broju potreba i na taj način ponudi fer i ravnopravan pristup transplantaciji organa svim pacijentima (18).

U Republici Srbiji dolazi do izrazitog opadanja ukupne stope transplantacija bubrega sa 14,0 na milion u 2010. godini na 6,3 na milion u 2016. godini. Prosečna stopa transplantacija bubrega (na milion stanovnika), za sedmogodišnji period, iznosila je 10,6, odnosno 4,1 na milion stanovnika

kada su u pitanju živi davaoci i 6,5 na milion stanovnika kada su u pitanju umrli davaoci.

Prva uspešna transplantacija organa je transplantacija bubrega između identičnih blizanaca koja je izvršena u Bostonu 23. decembra 1954. godine (19). Ona je predstavljala jedan novi početak za sve bolesnike sa ireverzibilnim oštećenjem bubrega. Istraživanje sprovedeno na 46.164 pacijenata, koji su bili na listama čekanja za transplantaciju ljudskih organa u SAD-a, između 1991-1997. godine, pokazala je da je smrtnost niža za 68% kod pacijenata koji su bili podvrgnuti transplantaciji nego kod osoba koje su ostale na listi čekanja za transplantaciju bubrega nakon više od tri godine praćenja (20). Takođe, procenjeno je da pacijenti uzrasta 20-39 godina kod kojih je obavljena transplantacija žive 17 godina duže nego osobe koje ostanu na listama čekanja za transplantaciju ljudskih organa, što je posebno bilo izraženo kod osoba sa dijabetesom (20).

Prema podacima Eurotransplanta, u 2019. godini Španija je imala najveću stopu transplantacija bubrega (73,8 na milion stanovnika) u Evropi i

Table 2. Number and rate of all transplantations (pmp), as well for liver and heart, from deceased donors for the period 2010-2016 in the Republic of Serbia

Years	2010	2011	2012	2013	2014	2015	2016	2010-2016
Characteristics								
No (%) of liver transplants from deceased donors	19 (26.8)	9 (12.7)	7 (9.9)	17 (23.9)	4 (5.6)	7 (9.9)	8 (11.3)	71 (100.0)
Liver transplantation rate from deceased donors pmp	2.6	1.3	1.0	2.4	0.6	1.0	1.1	1.4
No (%) of heart transplants from deceased donors	-	-	-	4 (20,0)	5 (25,0)	5 (25,0)	6 (30,0)	20 (100,0)
Heart transplantation rate from deceased donors pmp	-	-	-	0.6	0.7	0.7	0.8	0.4
Total no (%) of transplants from deceased donors	86 (20.5)	58 (13.8)	54 (12.9)	95 (22.7)	46 (11.0)	44 (10.5)	36 (8.6)	419 (100.0)
Total rate of transplants from deceased donors pmp	11.9	8.1	7.5	13.2	6.4	6,1	5.0	8.3

one new person who needs transplantation (15).

The number of human organs available for transplantation does not meet the real needs, not even closely, and therefore, the lack of organs presents a global problem, dilemma and challenge for transplant systems. One of the reasons is partly in the fact that taking organs from deceased persons is mainly based on donations after brain death, while it should be emphasized that only 1% of deceased, not more than 3% of those who died in hospitals, are subject to this situation (16,17). A global lack of available organs intended for transplantation opens many bioethical questions and dilemmas how to allocate limited resources to the unlimited number of needs, and thus offer the fair and equal access to organ transplantations to all patients (18).

In the Republic of Serbia, there came to the significant decrease in the total rate of kidney transplants from 14.0 pmp in 2010 to 6.3 pmp in 2016. The average rate of kidney transplantation for the seven-year period amounted to 10.6 pmp, that is, 4.1 pmp for living donors, and 6.5 pmp for deceased donors.

The first successful kidney transplantation between identical twins was performed in Boston,

on December 23rd, 1954 (19). It represented a new beginning for all patients with the irreversible kidney damage. The research, which was conducted on 46.164 patients who were on the list waiting for human organ transplantation in the USA between 1991 and 1997, showed that mortality was lower for 68% in patients who underwent transplantation than in persons who remained on the waiting list for kidney transplantation after three years of follow-up (20). Also, it was estimated that patients aged 20-39 who underwent transplantation, lived 17 years longer than people who stayed on the waiting lists for human organ transplantation, which was particularly pronounced in persons with diabetes (20).

According to the data of Eurotransplant, in 2019 Spain had the highest rate of kidney transplantations (73.8 pmp) in Europe and it was higher than in 2018 (71.4 pmp) (21). The next two countries with the largest number of performed kidney transplantations were France (55.6 pmp) and Finland (52.3 pmp), whereas the lowest rate of kidney transplantations was registered in Serbia. Eurotransplant is an international, non-profit organization that was founded by professor van Rod in Leiden, Netherlands in 1967. This inter-

ona je bila veća nego 2018. godine (71,4 na million stanovnika) (21). Sledeće dve zemlje sa najvećim brojem obavljenih transplantacija bubrega su Francuska (55,6 transplantacija bubrega na milion stanovnika) i Finska (52,3 na milion stanovnika), dok se najniža stopa transplantacija bubrega beleži u Srbiji. Eurotransplant je međunarodna neprofitna organizacija koju je osnovao prof. dr van Rood 1967. godine u Lajdenu, u Holandiji. Ova međunarodna organizacija obuhvata osam zemalja Evrope: Austriju, Belgiju, Hrvatsku, Nemačku, Luksemburg, Holandiju, Sloveniju i Mađarsku u kojima živi približno 137 miliona stanovnika. Sve zemlje članice ovog udruženja dele zajedničku listu čekanja organa za transplantaciju. Eurotransplant obezbeđuje saradnju svih transplantacionih centara, laboratorija za tipizaciju tkiva i donorskih bolnica, koje su uključene u transplantacioni proces. Prednost članstva i saradnje je jedan donorski identifikacioni sistem i jedinstvena međunarodna Lista čekanja, što zemljama članicama obezbeđuje bržu i veću dostupnost organa, čime bi se povećao broj uspešno obavljenih transplantacija ljudskih organa, smanjila dužina čekanja na transplantaciju i smanjila smrtnost na listama čekanja.

U zemljama u našem okruženju, takođe su mnogo veće stope transplantacija bubrega (na milion stanovnika), kao što su u Hrvatskoj (32,9), Mađarskoj (27,4), Poljskoj (25,9), Sloveniji (18,1) i Grčkoj (16), nego što su u našoj zemlji. Takođe, podaci govore da je u Evropi stopa transplantacija bubrega sa umrlih davalaca dvostruko veća od stope transplantacija bubrega sa živih davalaca (22 pmp naspram 9 pmp) (22), što je dobijeno i u našem istraživanju (6,5 na milion kada su u pitanju umrli davaoci i 4,1 na milion kada su u pitanju živi davaoci). Najveće stope transplantacija bubrega sa umrlih davalaca zabeležene su u nekim regionima Španije (>70 pmp), a najveća stopa transplantacija bubrega sa živih davalaca je u Severnoj Irskoj (38 pmp), Holandiji (33 pmp) i Turskoj (33 pmp).

U Republici Srbiji prosečna stopa transplantacija jetre sa umrlih davalaca iznosila je 1,4 na milion stanovnika, a za srce 0,4 na milion stanovnika. Ove stope su daleko niže od drugih zabeleženih u Evropi. U 2019. godini Hrvatska je imala najveću stopu transplantacija jetre koja je iznosila 30 na milion stanovnika (21). Zemlje sa najvećim stopama transplantacija jetre, iza Hrvatske, su bile Španija (26,4 transplantacija jetre na milion stanovnika) i Danska (11 na milion stanovnika). Na-

jniža stopa transplantacija jetre u Evropi je bila u Grčkoj (tri na milion) i Bugarskoj (dva na milion).

U Evropi je u 2019. godini Slovenija imala najveću stopu transplantacija srca (10,5 na milion stanovnika), a zatim Hrvatska (9,3 na milion stanovnika) i Norveška (8 na milion stanovnika) (21). Srce za transplantaciju se uzima od zdravog davaoca (donora) kod kojeg je dijagnostikovana i potvrđena moždana smrt. Kako transplantacija srca zahteva uzimanje organa sa nedavno preminulog davaoca kod kojeg je utvrđena moždana smrt, neophodno je pre uzimanja organa izvršiti proveru identiteta davaoca i uslove pristanka, odnosno nepostojanje protivljenja za doniranje organa, kao i detaljne medicinske analize kojima se proverava da li je srce zdravo i očuvano, odnosno pogodno za transplantaciju. Ukoliko se umrlo lice za života nije izjasnilo da ne želi da donira svoje organe, obavezno se razgovara sa porodicom umrlog lica radi dobijanja saglasnosti za doniranje organa njihovog umrlog člana. U Irskoj je 2016. godine, 50% porodica odbilo da pristane na to da se organi umrlih članova njihove porodice koriste za potrebe transplantacije nakon smrti. Ovo je bila najviša stopa odbijanja u Evropi između 2015. i 2017. godine. Slovenija je imala stopu odbijanja porodice od oko 16% u 2017. godini. Nažalost, postoje mnogi slučajevi gde bolesnici ne uspevaju da prežive dovoljno dugo na listama čekanja za transplantaciju srca da bi dobili novo srce. U 2019. godini, najveći broj umrlih među bolesnicima koji su čekali transplantaciju srca je bio u Nemačkoj (107), a zatim u Poljskoj (93) i u Francuskoj (61).

Na osnovu niskih prosečnih stopa doniranja, transplantacija bubrega, jetre i srca u našoj zemlji, jasno je da su transplantacioni centri iz Republičkog programa za presađivanje ljudskih organa u manjoj ili većoj meri suočeni sa manjkom ljudskih organa. Jedan od razloga za niske stope doniranja može biti i izostanak dovoljno jasnih i preciznih procedura u Zakonu o presađivanju ljudskih organa, i pratećim pravilnicima koji se odnose na pristanak/protivljenje davanja organa sa umrle osobe u svrhe presađivanja, jer dovode do nepoverenja kod većine stanovnika. Pored toga, ne postoji funkcionalni Registar lica kod kojih je izvršena transplantacija (organa, tkiva, ćelija), koji bi imao i registrovane donore organa koji su dali svoj pristanak tokom života (kao evropski Registri). Niskim stopama doniranja doprinosi nesprovođenje kampanja, koje bi za cilj imale edukaciju,

national organization includes eight countries in Europe: Austria, Belgium, Croatia, Germany, Luxembourg, Netherlands, Slovenia, Hungary, with approximately 137 million inhabitants. All member states of this association share a common waiting list for organs intended for transplantation. Eurotransplant provides cooperation of all transplant centers, laboratories for tissue typing and donor hospitals that are involved in the transplantation process. The advantage of membership and cooperation is one donor identification system and unique international waiting list, which provides faster and greater availability of organs to member states, and which would increase the number of successfully performed human organ transplantations, reduce the time spent waiting for transplantation and reduce mortality on the waiting lists.

Rates of kidney transplantations were greater in neighboring countries, such as Croatia (32.9 pmp), Hungary (27.4 pmp), Poland (25.9 pmp), Slovenia (18.1 pmp) and Greece (16 pmp) than in our country. Also, data showed that in Europe the rate of kidney transplantations from deceased donors was twofold higher than the rate of kidney transplantations from living persons (22 pmp vs. 9 pmp) (22), which was obtained in our research, as well (6.5 pmp for deceased donors and 4.1 pmp for living donors). The highest kidney transplantation rates from deceased persons were registered in some regions in Spain (>70 pmp), while the highest rates of kidney transplantation from living donors were in North Ireland (38 pmp), Holland (33 pmp) and Turkey (33 pmp).

In the Republic of Serbia, the average rate of liver transplantation from deceased donors amounted to 1.4 pmp, while the rate of heart transplantation was 0.4 pmp. These rates were quite lower than other registered rates in Europe. In 2019, Croatia had the highest liver transplantation rate which amounted to 30 pmp (21). Countries with the highest liver transplantation rates, behind Croatia, were the following: Spain (26.4 pmp) and Denmark (11 pmp). The lowest liver transplantation rate in Europe was in Greece (3 pmp) and Bulgaria (2 pmp).

In Europe, in 2019, the highest rate of heart transplantation (10.5 pmp) was in Slovenia, and then in Croatia (9.3 pmp) and Norway (8 pmp) (21). Heart intended for transplantation is taken from a healthy donor, when brain death is diagnosed and confirmed. Since heart transplantation demands

taking organs from the brain dead person, the identity of donor and conditions of consent should necessarily be checked before the procedure, that is, the absence of refusal of organ donation, and detailed medical analyses should be performed to check whether the heart is healthy and preserved, that is, suitable for transplantation. If a person did not state during their lifetime that they did not want to donate their organs, one should necessarily talk to the family of deceased in order to get consent to organ donation of their family member who passed away. In Ireland in 2016, 50% of families refused to give consent to use organs of deceased family members for transplantation. This was the highest rate of refusal in Europe between 2015 and 2017. The rate of family refusal or organ donation was around 16% in Slovenia in 2017. Unfortunately, there were numerous cases when patients were on the waiting lists for transplantation, but they did not live long enough to get a new heart. In 2019, the largest number of deceased who waited for heart transplantation was in Germany (107), and then in Poland (93) and France (61).

According to the low average rates of donation, kidney, liver and heart transplantations in our country, it is clear that transplant centers from the National Program for human organ transplantation are faced more or less with the lack of human organs. One of the reasons for the low donation rates there may also be a lack of sufficiently clear and precise procedure in the Law on Human Organ Transplantation, and accompanying regulations relating to consent/opposition to organ donation from the deceased persons for the purpose of transplantation because they lead to mistrust in most residents. Besides, no there is a functional Register of persons with whom it was performed transplantation (organs, tissues, cells), which would also have registered organ donors who gave its lifelong consent (as European Registers). Non-implementation contributes to low donation rates campaigns aimed at education, motivation, and promotion of transplantation.

National authorities are trying to find successful models and strategies for the increase in the number of realized donors and donation rates, that is, to provide the national self-sufficiency, and therefore, the organizational structure is the key structure in the systems of human organ donation and transplantation. Without the active program

motivaciju i promociju transplantacije.

Nacionalni autoriteti pokušavaju da pronađu uspešne modele i strategije za povećanje broja realizovanih donora i stope doniranja, odnosno obezbeđenje samodovoljnosti za sopstveno stanovništvo, imajući u vidu da je organizaciona struktura ključ u sistemima donacije i transplantacije ljudskih organa. Bez aktivnog programa identifikacije davalaca ljudskih organa (donora) i programa za upućivanje koji treba da bude uspostavljen u svakoj donor bolnici, mogućnost dobijanja, odnosno doniranja organa od umrlih davalaca će biti izgubljena. Neprepoznavanje potencijalnih davalaca organa je najvažniji razlog koji objašnjava razlike u prosečnim stopama doniranja u različitim transplantacionim centrima i donor bolnicama. U svakoj zdravstvenoj ustanovi, odnosno transplantacionom centru potrebno je uspostaviti posebne protokole i standardne operative procedure sa određenim kliničkim parametrima kako bi se olakšala blagovremena identifikacija davalaca ljudskih organa.

Bolnički koordinatori za transplantaciju organa imaju ključnu ulogu u obezbeđivanju kvaliteta detekcije, odnosno otkrivanja donora i algoritama upućivanja donora. Potrebno je uložiti napore da se obezbedi adekvatna edukacija i obuka svih zdravstvenih radnika koji leče pacijente sa razornim povredama mozga u jedinicama intenzivnog lečenja, odeljenjima za hitno zbrinjavanje i odeljenjima za neurologiju, odnosno neurohirurgiju. Procedura doniranja ljudskih organa mora biti sastavni deo kontinuiranog nastavka lečenja i u osnovi prakse rutinskog upućivanja od strane lekara iz jedinica intenzivnog lečenja čija je osnovna dužnost očuvanje života prilikom zbrinjavanja pacijenata sa razornom povredom mozga.

Zaključak

U Republici Srbiji su veoma niske stope doniranja, kao i stope transplantacija bubrega, jetre i srca, u odnosu na zemlje u okruženju, a pogotovo u odnosu na zemlje zapadne Evrope, što zahteva snažne udružene aktivnosti svih pripadnika društva, prvenstveno države, Ministarstva zdravlja - Uprave za biomedicinu, drugih institucija, zdravstvenog sistema, nevladinog sektora, religijskih zajednica i svakog pojedinca ponaosob, u cilju unapređenja i što je moguće efikasnijeg sistema transplantacije ljudskih organa u Republici Srbiji, što je preduslov za

saradnju i zaključivanje međunarodnih sporazuma.

Dobrom organizacijom zdravstvene službe i uspostavljenim efikasnim sistemom za identifikaciju i realizaciju potencijalnih donora ljudskih organa, kao i unapređenjem kvaliteta i bezbednosti transplantacije ljudskih organa, može se postići povećanje stope doniranja, odnosno smanjenje razlike između ponude i potražnje za organima za transplantaciju u Republici Srbiji.

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for the identification of human organ donors and programs for referral which should be established in all donor hospitals, the possibility of getting organs from deceased donors will be lost. Not recognizing potential donors is the main reason which explains the difference in average donation rates in different transplant centers and donor hospitals. Specific protocols and standards of operational procedures with specific clinical parameters should be established in all health care institutions, that is, transplant centers in order to facilitate timely identification of donors of human organs.

Hospital coordinators of organ transplantation have a key role in providing the quality of detection of donors and algorithms of referral of possible organ donors. Efforts should be made to provide adequate education and training of health care workers who treat patients with devastating brain injuries in intensive care units, emergency departments, neurology and neurosurgery departments. The procedure of human organ donation should be an integral part of continuous treatment and it should be part of doctor's practice and routine referral from intensive care units, while preservation of life is the basic responsibility of doctors who treat patients with devastating brain injuries.

Conclusion

The rate of donation is very low in the Republic of Serbia, as well as rates of kidney, liver and heart transplantations in comparison to countries of western Europe, which demands strong associated activities of all members of one society, first of all, of state, Directorate for Biomedicine, other institutions, health system, non-governmental sector, religious communities and all individuals aimed at promoting the most efficient possible system of human organ transplantation in the Republic of Serbia, which is a precondition for cooperation and conclusion of international contracts.

The increase in donation rates and the decrease of the difference between supply and demand of human organ transplantation in Republic of Serbia can be achieved by good organization of health care service and establishment of efficient systems for the identification and realization of possible human organ donors, as well as by the promotion of quality and safety of organ transplantation.

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ZLOUPOTREBA PSIHOAKTIVNIH SUPSTANCI OD STRANE MLADIH UZRASTA 15-24 GODINE U REPUBLICI SRBIJI

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SAŽETAK

Uvod/Cilj: Zloupotreba psihoaktivnih supstanci među mladima predstavlja globalni javnozdravstveni problem. Cilj studije je bio da se ispita učestalost korišćenja psihoaktivnih supstanci u populaciji mladih uzrasta 15-24 godine u Republici Srbiji.

Metode: U okviru ove sekundarne analize podataka korišćeni su podaci iz dela Istraživanja zdravlja stanovništva Srbije iz 2013. godine, koju su sprovedeli Ministarstvo zdravlja Republike Srbije i Institut za javno zdravlje Srbije. Ovom studijom preseka, sprovedenom na reprezentativnom uzorku populacije Srbije, bilo je obuhvaćeno 1722 ispitanika (49% žena i 51% muškaraca) uzrasta 15 do 24 godine.

Rezultati: Od ukupnog broja mladih uzrasta 15-24 godine, 1/3 njih se izjasnila po pitanju konzumiranja cigareta na sledeći način: 52,1% da konzumira cigarete svakodnevno, a 20,8% povremeno. Među ispitanicima 41,3% je bilo izloženo duvanskom dimu jedan i više sati dnevno u zatvorenom prostoru, a 49,4% je bilo zabrinuto zbog štetnih posledica pušenja po svoje zdravlje. Samo se trećina mladih izjasnila da alkohol nikada nisu konzumirali ili da su popili samo nekoliko gutljaja alkohola u svom životu. Muškarci su nešto češće svakodnevno pušili (52,2%) i češće konzumirali alkohol (svaki dan ili skoro svaki dan 0,7%, 5-6 dana u nedelji 0,7%, 3-4 dana u nedelji 4,5%, 1-2 dana u nedelji 15,7%, kao i 2-3 dana mesečno 16,8%) nego žene (0,3%; 0,2%; 1,7%; 7,8%; 12%). Tokom poslednjih 12 meseci, oko 1/4 adolescenata je koristilo 6 i više alkoholnih pića 1-3 dana mesečno, 20,2% samonicijativno je koristilo sredstva protiv bolova, 1,7% sredstva za umirenje i 2,3% sredstva za spavanje. Korisnika nedozvoljenih psihoaktivnih supstanci (kao što su kanabis, kokain i lepak) je bilo 0,7%.

Zaključak: Rezultati studije zloupotrebe psihoaktivnih supstanci među mladima uzrasta od 15 do 24 godine u Srbiji ukazuju na neophodnost rada na prevenciji rizičnog ponašanja.

Gljučne reči: zavisnost od psihoaktivnih supstanci, cigarete, alkohol, analgetici, sedativi, lekovi za spavanje, mladi, populaciono istraživanje

Uvod

Zloupotreba psihoaktivnih supstanci predstavlja značajan problem pojedinca, porodice i društva, jer kao posledicu ostavlja štetne efekte na mentalno i fizičko zdravlje (1), porodične odnose, radnu sposobnost i društvenu delatnost (2). Takođe, značajni su troškovi koje snosi društvo zbog direktnih i indirektnih posledica zavisnosti od određenih supstanci (3).

Problem zloupotrebe i zavisnosti od psihoaktivnih supstanci najčešće se posmatra sa individualnog aspekta problema ličnosti, dok je socijalni kontekst često zanemaren. Kako bi se preduzele mere prevencije koje bi dale zadovoljavajuće rezultate, neophodno je napraviti odgovarajuće strategije za borbu protiv zloupotrebe psihoaktivnih supstanci koje treba da budu u skladu sa demografskim i socioekonomskim karakteristikama

ABUSE OF PSYCHOACTIVE SUBSTANCES BY YOUNG PEOPLE AGED 15-24 IN SERBIA

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SUMMARY

Introduction/Aim: The abuse of psychoactive substances among young people is a significant global public health problem. The aim of the study was to examine the prevalence of psychoactive substances use among adolescents in Republic of Serbia.

Methods: In this secondary analysis of data, we used data from the Serbian national survey of population health from 2013, which was conducted by the Ministry of Health of the Republic of Serbia and Institute of Public Health of Serbia. This cross-sectional study, which was conducted on a representative sample of the population of Serbia, included 1722 respondents aged 15 to 24 years (49% of women and 51% of men).

Results: Out of the total number of young people aged 15-24, 1/3 of them declared themselves on the issue of cigarette consumption in the following way: 52.1% consumed cigarettes daily and 20.8% occasionally. Among the respondents, 41.3% were exposed to the indoor tobacco smoke for 1 hour or more daily, while 49.4% were concerned about the harmful effects of smoking on their health. Only a third said that they had never consumed alcohol or had only taken a few sips of alcohol in their lifetime. Men smoked slightly more often (52.2%) and consumed alcohol more often (every day or almost every day 0.7%, 5-6 days a week 0.7%, 3-4 days a week 4.5%, 1-2 days a week 15.7%, as well as 2-3 days a month 16.8%) than women (0.3%; 0.2%; 1.7%; 7.8%; 12%). About 1/4 adolescents used 6 or more alcoholic beverages 1-3 days a month for the last 12 months. During the last 12 months, the respondents most often consumed painkillers (20.2%), sedatives (1.7%) and sleeping aids (2.3%) on their own initiative. There were 0.7% of users of illicit psychoactive substances (cannabis, cocaine, and glue).

Conclusion: The results of the study of psychoactive substances abuse among young people in Serbia point to the necessity to work on the prevention of risky behavior.

Key words: addiction to psychoactive substances, cigarettes, alcohol, painkillers, sedatives, sleeping aids, young people, population survey

Introduction

The abuse of psychoactive substances presents a significant problem of the individual, family, and society, because it has harmful effects on mental and physical health (1), family relations, work ability and social activity (2). Also, costs which are paid by the society are significant, due to direct and indirect consequences of the addiction caused by certain substances (3).

The problem of abuse and addiction caused by psychoactive substances is often perceived from the individual perspective of personality-related problems, while the social context is often neglected. In order to take preventive measures, which would give satisfactory results, adequate strategies should necessarily be made for the fight against the abuse of psychoactive substances, which should be in accordance with the demo-

zajednice. Psihoaktivne supstance predstavljaju veliki javnozdravstveni izazov širom sveta, posebno u pogledu ugroženosti adolescenta (4).

Upotreba psihoaktivnih supstanci od strane adolescenata predstavlja ozbiljan zdravstveni problem, jer ih izlaže riziku i opasnosti po zdravlje i može ih na kraju dovesti do zavisnosti. To nije problem samo jedne zemlje ili jednog segmenta društva, nego je globalni problem i tiče se adolescenata širom sveta (5).

Cilj ove sekundarne analize podataka je bio da se ispita učestalost korišćenja različitih psihoaktivnih supstanci u populaciji mladih uzrasta 15 do 24 godine u Srbiji.

Metode

Ovom sekundarnom analizom podataka bilo je obuhvaćeno 1722 ispitanika (49% žena i 51% muškaraca) uzrasta 15 do 24 godine u Republici Srbiji. Kao osnova za analizu učestalosti korišćenja psihoaktivnih supstanci među mladima uzrasta 15 do 24 godine u Republici Srbiji korišćeni su podaci iz trećeg nacionalnog Istraživanja zdravlja stanovništva, sprovedenog od 7. oktobra do 30. decembra 2013. godine, na reprezentativnom uzorku stanovništva Republike Srbije. Nacionalno istraživanje je urađeno po tipu studije preseka i njime nije bila obuhvaćena populacija koja živi na teritoriji Autonomne pokrajine Kosovo i Metohija. Istraživanje je sprovedeno u skladu sa metodologijom i instrumentima Evropskog istraživanja zdravlja – drugi talas (engl. *EHIS-wave 2*) (6). Realizovali su ga Ministarstvo zdravlja Republike Srbije i Institut za javno zdravlje Srbije, u 2013. godini.

Za potrebe ovog istraživanja korišćeni su podaci o domaćinstvima i stanovništvu starosti od 15 do 24 godine, ukupno 1722 ispitanika. Podaci o konzumiranju cigareta, alkohola, psihoaktivnih supstanci i drugih lekova, dobijeni su putem upitnika za samopopunjavanje, a u skladu sa metodologijom i instrumentima Evropskog istraživanja zdravlja – drugi talas (engl. *EHIS-wave 2*). Na pitanje „Da li sada pušite?“ ispitanici su odgovarali sa: da, svakodnevno; da, povremeno, ne i bez odgovora. Na pitanje da li su izloženi duvanskom dimu u zatvorenom prostoru, ispitanici su imali ponuđene sledeće odgovore: nikad ili skoro nikad; manje od jedan sat dnevno; jedan sat i više dnevno; bez odgovora. Na pitanje koje se odnosilo na zabrinutost zbog štetnih posledica pušenja po svoje zdravlje, ponuđeni

odgovori su bili: da, veoma; da, po malo; ne previše; ne, nimalo; bez odgovora. Na pitanje „Da li Vam je tokom prethodnih 12 meseci lekar ili drugi zdravstveni radnik savetovao da prestanete da pušite?“, mogući odgovori su bili: da i ne. Ispitanici su, takođe, pitani o vrsti cigareta koje konzumiraju, kao i o pokušaju da prestanu sa pušenjem. Unos alkohola je procenjen na osnovu odgovora na pitanje: „Koliko često ste tokom prethodnih 12 meseci pili alkoholna pića (pivo, vino, žestoka pića, koktele, likere, alkoholna pića iz kućne/domaće proizvodnje i dr.)?“ Ponuđeni odgovori su bili sledeći: svaki dan ili skoro svaki dan; 5-6 dana u nedelji; 3-4 dana u nedelji; 1-2 dana u nedelji; 2-3 dana mesečno; jednom mesečno; ne u proteklih 12 meseci jer više ne pijem; nikad ili nekoliko gutljaja u svom životu; bez odgovora. Na pitanje „Da li konzumirate 6 i više alkoholnih pića po jednoj prilici?“, mogući odgovori su bili: 5-6 dana u nedelji; 3-4 dana u nedelji; 1-2 dana u nedelji; 2-3 dana u mesecu; jednom mesečno; manje od jednom mesečno; ne u prethodnih 12 meseci; nikada u životu; bez odgovora. Učestalost korišćenja drugih psihoaktivnih supstanci (lekova i ilegalnih droga) tokom prethodnih 12 meseci odnosila se na sredstva za spavanje, sredstva za umirenje, sredstva protiv bolova, kanabis (marihuana ili hašiš), kokain, isparljive supstance (lepak), ništa od navedenog i bez odgovora.

Hi-kvadrat (χ^2) test je korišćen za upoređivanje razlika u učestalosti kategorijskih varijabli. Statistički značajnim smatrali su se svi rezultati gde je verovatnoća greške tipa I (alfa-nivo značajnosti) bila manja od 5% ($p < 0,05$). Statistička analiza podataka urađena je korišćenjem komercijalnog, standardnog programskog paketa SPSS, verzija 20.0.

Rezultati

Od ukupnog broja mladih uzrasta 15-24 godine, $\frac{1}{3}$ njih se izjasnila po pitanju konzumiranja cigareta na sledeći način: da konzumira cigarete svakodnevno 52,1% i povremeno 20,8%, dok se svaki peti izjasnio da to ne čini (19,4%). Odgovor na ovo pitanje izbeglo je 7,7% mladih (Tabela 1). Ne postoji statistički značajna razlika u pušačkim navikama između muškaraca i žena ($p > 0,05$). Među ispitanicima koji su se izjasnili da konzumiraju cigarete svakodnevno više je bilo muškaraca (52,2%) nego žena (51,9%), dok je među onima koji puše povre-

graphic and socioeconomic characteristics of one society. Psychoactive substances present a global public health challenge across the world, especially as far as adolescents are concerned (4).

The use of psychoactive substances by adolescents presents a serious health problem, because they are exposed to the risk which is harmful for their health, and it can finally lead them to addiction. It is not only a problem of one country or one segment of society; it is a global problem which concerns adolescents across the globe (5).

The aim of this secondary analysis of data was to examine the frequency of use of different psychoactive substances in the population of young people aged 15 to 24 in Serbia.

Methods

The secondary analysis of data included 1722 respondents (49% of women and 51% of men) aged 15 to 24 in The Republic of Serbia. Data from the third National survey of population health, which was conducted from 7th October to 30th December, 2013 on the representative sample of the population of The Republic of Serbia, were used as the base for the analysis of frequency of psychoactive substances use among young people aged 15 to 24 in The Republic of Serbia. The Serbian national survey was a cross-sectional study and it did not include population that lived in the territory of the Autonomous Province of Kosovo and Metohija. The survey was conducted in accordance with the methodology and instruments of the European Health Interview Survey (EHIS – wave 2) (6). It was realized by the Ministry of Health of The Republic of Serbia and the Institute of Public Health of Serbia in 2013. Data about households and population aged 15 to 24, that is 1722 respondents in total, were used for the needs of this survey. Data about cigarettes and alcohol consumption, psychoactive substances and other drugs were gained with the help of a Self-Assessment Questionnaire, in accordance with the methodology and instruments of The European Health Interview Survey - wave 2 (EHIS – wave 2). In answer to the question “Are you smoking now?” the respondents replied with: yes, every day; yes, occasionally, no, and no answer. The respondents could opt for one of the following answers to the question that related their exposure to the indoor tobacco smoke: never or almost never; less than one hour a day; 1

hour and more per day; no answer. The question regarding the concerns about harmful effects of smoking on their health included the following answers: yes, very; yes, a little bit; not too much; no, not at all; no answer. Possible answers to the question “Have you been advised by your doctor or any other health care worker to stop smoking during the last 12 months?” were: yes and no. Respondents were also asked about the type of cigarettes they consumed, as well as whether they tried to stop smoking. The alcohol intake was estimated according to the answer to the question: “How often have you consumed alcoholic drinks during the last 12 months (beer, wine, strong drinks, cocktails, liqueurs, homemade alcoholic drinks, and drinks from domestic production, etc.)?” The listed answers were the following: every day or almost every day; 5-6 days a week; 3-4 days a week; 1-2 days a week; 2-3 days a month; once a month; not in the past 12 months because I don’t drink alcohol anymore; never or a few sips in my life; no answer. The listed answers to the question “Do you consume 6 or more alcoholic drinks per occasion?” were the following: 5-6 days a week; 3-4 days a week; 1-2 days a week; 2-3 days a month; once a month; less than once a month; not during the past 12 months; never in my life; no answer. The frequency of use of psychoactive substances (drugs and illegal drugs) during the last 12 months related to sleep agents, soothing agents, painkillers, cannabis (marijuana and hashish), cocaine, volatile substances (adhesive), none of the above and no answer.

A chi-square (χ^2) test was used to compare the difference in the frequency of categorical variables. All results, where the probability of error type I (alpha-level of significance) was less than 5% ($p < 0.05$), were deemed to be statistically significant. The statistical analysis of data was done with the help of commercial, standard, program package SPSS, version 20.0.

Results

Out of the total number of young people aged 15 to 24, 1/3 declared themselves on the issue of cigarette consumption in the following way: 52.1% consumed cigarettes every day, while 20.8% consumed cigarettes occasionally and every fifth respondent stated that they did not consume cigarettes (19.4%). 7.7% of young people avoided to

Tabela 1. Distribucija mladih 15-24 godine (N=582) prema pušačkom statusu, Srbija, 2013. godine

Konzumiranje cigareta	Da, svakodnevno Broj (%)	Da, povremeno Broj (%)	Ne Broj (%)	Bez odgovora Broj (%)
Muškarci (N=295)	154 (52.2)	60 (20.3)	60 (20.3)	21 (7.2)
Žene (N=287)	149 (51.9)	61 (21.3)	53 (18.5)	24 (8.3)
Ukupno (N=582)	303 (52.1)	121 (20.8)	113 (19.4)	45 (7.7)

p vrednost prema $\chi^2 < 0,001$

meno bilo neznatno više žena (21,3%) nego muškaraca (20,3%).

Posmatrano prema vrsti cigareta koje konzumiraju, 84,2% se izjasnilo da konzumira cigarete (fabrički proizvedene ili samostalno zavijene), a od njih jedna trećina je pokušala da prestane da puši. Svaki peti korisnik duvana (19,4%) se izjasnio da je dobio savet od lekara ili drugog zdravstvenog radnika da prestane sa pušenjem.

Najveći procenat ispitanika (41,3%) je bio izložen duvanskom dimu u zatvorenom prostoru sat i više vremena dnevno, a samo 17% nikada ili skoro nikada (Grafikon 1).

Svaki drugi ispitanik je bio pomalo ili ne previše zabrinut zbog štetnih posledica pušenja po svoje zdravlje, a čak svaki peti bio je veoma zabrinut (Grafikon 2). Ni malo nije bilo zabrinuto 13,7% ispitanika. Trećina anketiranih se izjasnila da nikada nije konzumirala alkohol ili da je svega nekoliko gutljaja alkohola popila u svom životu (Tabela 2). Analiza po polu pokazala je da su muškarci češće konzumirali alkohol od žena u situacijama kada su to činili svaki dan, i više puta nedeljno, dok su žene ređe konzumirale alkohol (i to jednom mesečno 13,7% ili skoro nikada 40,6%). Razlika je bila statis-

tički značajna ($p < 0,001$).

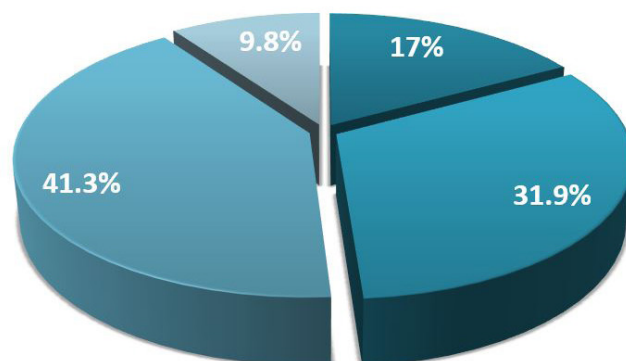
Svaki dan ili skoro svaki dan 6 i više alkoholnih pića po jednoj prilici je konzumiralo 0,3% ispitanika, 4,9% 1-2 dana u nedelji, 1,8% 3-4 dana, a 0,1% 5-6 dana u nedelji (Grafikon 3). Nikada u životu to nije činilo 18,4% ispitanika.

Među ispitanicima koji su samoinicijativno konzumirali lekove najviše je onih koji su konzumirali sredstva protiv bolova (20,2%), sredstva za spavanje (2,3%) i sredstva za umirenje (1,7%), dok je među korisnicima ilegalne droge 0,5% onih koji su konzumirali kanabis, marihuanu ili hašiš, 0,1% isparljive supstance (lepak) i 0,1% kokain (Grafikon 4).

Diskusija

U našem istraživanju čak 73% mladih uzrasta 15-24 godina je svakodnevno ili povremeno pušilo cigarete. Zabrinjava podatak da je svaki drugi ispitanik našeg istraživanja tek pomalo ili osrednje bio zabrinut, a da je tek svaki peti bio veoma zabrinut, zbog štetnih posledica pušenja po svoje zdravlje.

Prema podacima Svetske zdravstvene organizacije (SZO), alkohol i duvan su najčešće korišćene psihoaktivne supstance (7).



■ Nikad ili skoro nikad ■ Manje od 1 sat dnevno ■ 1 sat i više dnevno ■ Bez odgovora

Grafikon 1. Distribucija mladih 15-24 godine (N=1682) prema izloženosti duvanskom dimu u zatvorenom prostoru, Srbija, 2013. godine

Table1. Distribution of young people aged 15-24 (N=582) by cigarette consumption, Serbia, 2013

Cigarette consumption	Yes, every day No (%)	Yes, occasionally No (%)	No No (%)	No answer No (%)
Men (N=295)	154 (52.2)	60 (20.3)	60 (20.3)	21 (7.1)
Women (N=287)	149 (51.9)	61 (21.3)	53 (18.5)	24 (8.4)
Total (N=287)	303 (52.1)	121 (20.8)	113 (19.4)	45 (7.7)

p vrednost prema $\chi^2 < 0,001$

give answer to this question (Table 1). There was no statistically significant difference regarding smoking habits between men and women ($p > 0.05$). There were more men (52.2%) than women (51.9%) among respondents who stated that they did not consume cigarettes every day, while there were slightly more women (21.3%) than men (20.3%) among those respondents who smoked occasionally.

According to the type of cigarettes, 84.2% stated that they consumed cigarettes (manufactured in factories or rolled cigarettes), while 1/3 of them tried to stop smoking. Every fifth respondent (19.4%), who consumed cigarettes, stated that he was advised by his doctor or other health care worker to stop smoking.

The greatest percentage of respondents (41.3%) was exposed to indoor tobacco smoke one hour or more a day, and only 17% never or almost never (Figure 1).

Every other respondent was a little bit concerned, but not too much about the harmful effects of smoking on their health, and every fifth was very concerned (Figure 2). 13.7% of respondents did not worry at all. One third of respon-

dents stated that they never consumed alcohol or that they had a few sips in their lifetime (Table 2). Gender-related analysis showed that men consumed alcohol more often than women in situations when they did it every day, or more times a week, whereas women consumed alcohol less frequently (once in a month 13.7% or almost never 40.6%). The difference was statistically significant ($p < 0.001$).

Six or more alcoholic drinks per one occasion were consumed every day or almost every day by 0.3% respondents, 1-2 days a week by 4.9%, 3-4 days by 1.8%, 5-6 days a week by 0.1% (Figure 3). 18.4% respondents had never done it.

Among the respondents, who consumed drugs on their own initiative, most of them used painkillers (20.2%), sleep agents (2.3%) and soothing agents (1.7%), while among the respondents, who used illegal drugs, 0.5% consumed cannabis, marijuana and hashish, 0.1% consumed volatile substances (glue) and 0.1% cocaine (Graph 4).

Discussion

In our research, even 73% of young people aged 15-24 smoked cigarettes every day or occa-

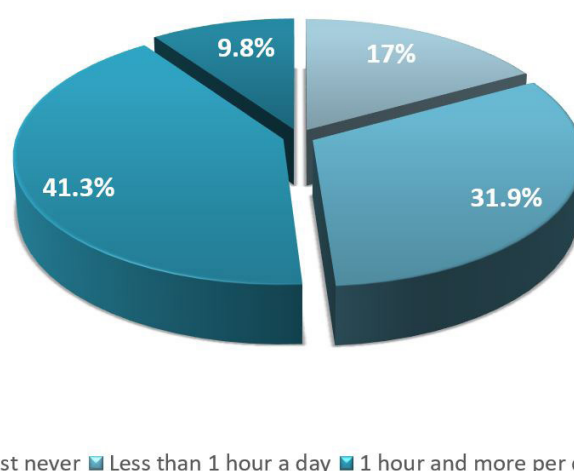
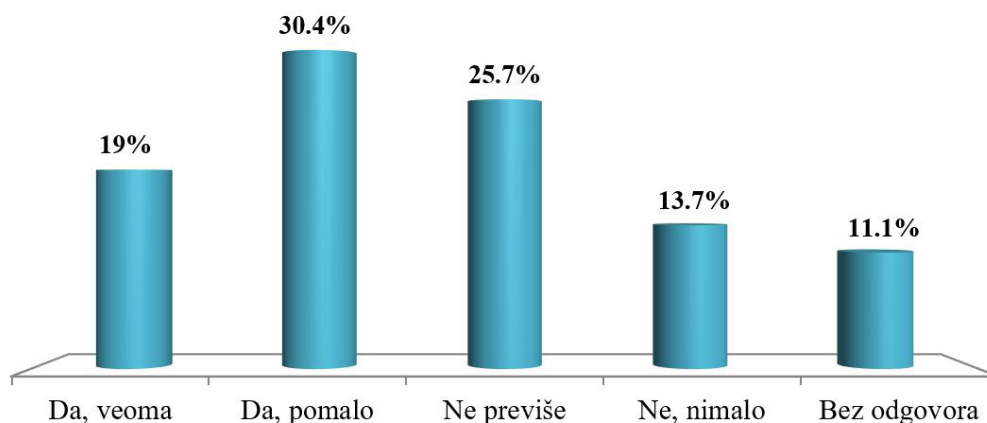


Figure 1. Distribution of young people aged 15-24 (N=1682) by exposure to indoor smoke, Serbia, 2013



Grafikon 2. Distribucija mladih 15-24 godine (N=1682) prema zabrinutosti zbog štetnih posledica pušenja po svoje zdravlje, Srbija, 2013. godine

Pušenje je najčešći pojedinačni uzrok prerane smrti za ljude savremenog sveta. Prema podacima SZO, od posledica pušenja oko pet miliona ljudi umre svake godine (8). Pušenje je takođe značajan faktor rizika za mnoge bolesti: respiratorne, maligne, gastrointestinalne, genitourinarne i hematološke (9).

Aktivno pušenje mladih je povezano sa značajnim zdravstvenim problemima u detinjstvu i adolescenciji i sa povećanim faktorima rizika za zdravstvene probleme u odraslom dobu (10).

Naši rezultati pokazuju da je 56,4% mladih uzrasta 15-24 godine konzumiralo alkohol u poslednjih 12 meseci, bilo da su to činili svakodnevno, nekoliko puta mesečno, ili pak nekoliko dana u nedelji.

Studije potrošnje alkohola među evropskim adolescentima (ESPAD) ukazuju na to da je up-

otreba alkohola među mladima u skoro svim evropskim zemljama u porastu (7,8), uprkos činjenici da su srednjoškolci dobro informisani o zdravstvenim rizicima koji proizilaze iz konzumiranja alkohola (9).

Alkohol je psihoaktivna supstanca koja se najčešće koristi i zloupotrebljava od strane adolescenta (6). To potvrđuju rezultati istraživanja o učestalosti konzumiranja alkohola među adolescentima koja su sprovedena u mnogim zemalja sveta: Rumunija i Švedska (71-74%), Crna Gora, Norveška, Albanija i Island (43-65%), Italija (63,3%), Nemačka (52,3%) i Sjedinjene Američke Države (71%) (11).

Istraživanje u Velikoj Britaniji je pokazalo da je upotreba alkohola među adolescentima češća u domaćinstvima sa većim primanjima (12).

Tabela 2. Distribucija mladih 15-24 godine (N=1682) prema učestalosti korišćenja alkohola tokom poslednjih 12 meseci, Srbija, 2013. godine

Konzumiranje alkohola Broj (%)	Svaki dan ili skoro svaki dan	5-6 dana u nedelji	3-4 dana u nedelji	1-2 dana u nedelji	2-3 dana mesečno	Jednom mesečno	Manje od jednom mesečno	Ne u proteklih 12 meseci, jer više ne pijem alkohol	Nikad ili nekoliko gutljaja u svom životu	Bez odgovora
Muškarci	6 (0.7)	6 (0.7)	37 (4.5)	129 (15.7)	138 (16.8)	114 (13.9)	94 (11.4)	29 (3.5)	224 (27.3)	45 (5.5)
Žene	3 (0.3)	2 (0.2)	15 (1.7)	67 (7.8)	103 (12.0)	118 (13.7)	118 (13.7)	38 (4.4)	349 (40.6)	47 (5.5)
Ukupno	9 (0.5)	8 (0.5)	52 (3.1)	196 (11.7)	241 (14.3)	232 (13.8)	212 (12.6)	67 (4.0)	573 (34.1)	92 (5.5)

p vrednost prema $\chi^2 < 0,001$

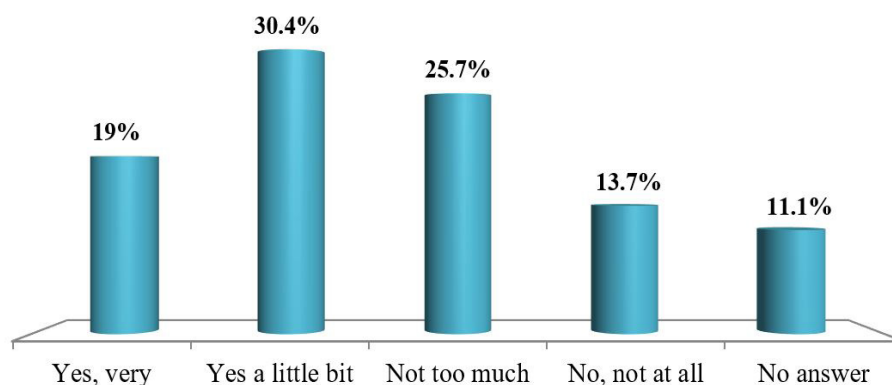


Figure 2. Distribution of young people aged 15-24 (N=1682) according to concerns about the harmful effects of smoking on their health, Serbia, 2013

sionally. It is very worrying that every other respondent was concerned only a little bit or not too much, and that only every fifth was very concerned because of harmful effects on their health.

According to the data of the World Health Organization (WHO), alcohol and tobacco are the most frequently used psychoactive substances (7).

Smoking is the most frequent individual cause of early death for the people living in the contemporary world. According to the WHO data, around five million people die of consequences of smoking every year (8). Smoking is also a significant risk factor for numerous diseases: respiratory, malign, gastrointestinal, genitourinary and hematological (9).

Active smoking among young people is connected with the significant health problems during childhood and adolescence, as well as with in-

creased risk factors relating to health problems during adulthood (10).

Our results showed that 56.4% of young people aged 15-24 consumed alcohol during the last 12 months, no matter whether they consumed it every day, a few times a month or a few times a week.

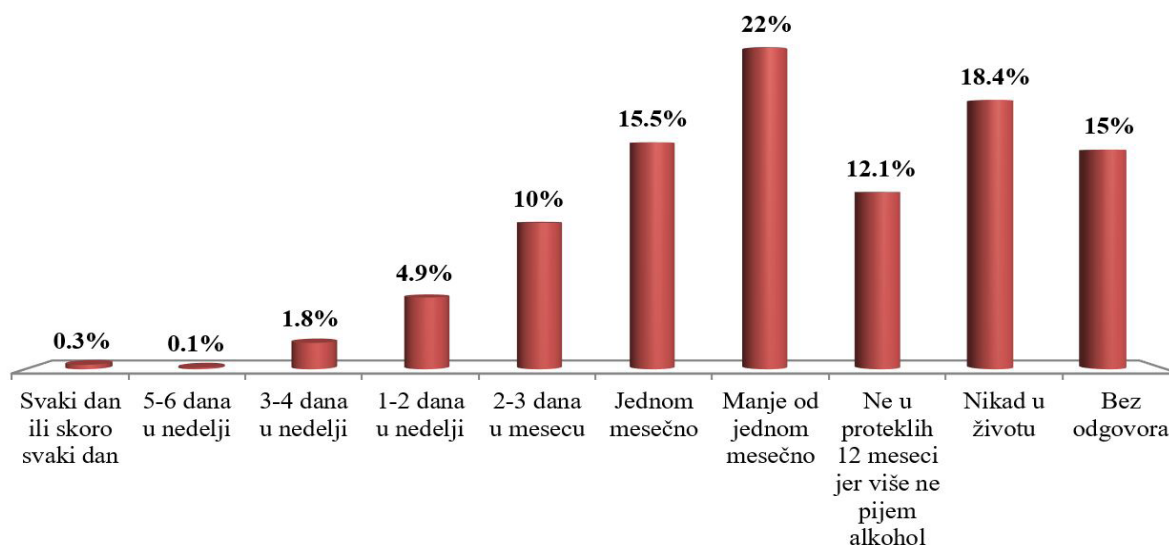
Studies dealing with alcohol consumption among European adolescents pointed to the fact that alcohol consumption among adolescents in almost all European countries was on the increase (7,8), although high school students were well informed about health risks which were caused by alcohol consumption (9).

Alcohol is a psychoactive substance which is most often used and abused by adolescents (6). This is confirmed by the results of studies on the frequency of alcohol consumption among ad-

Table 2. Frequency of alcohol use among young people aged 15-24 (N=1682) during the last 12 months, Serbia, 2013

Alcohol use No (%)	Every day or almost every day	5-6 days a week	3-4 days a week	1-2 days a week	2-3 days a month	Once a month	Less than once a month	Not in the past 12 months because don't drink alcohol anymore	Never or a few sips in my life	No answer
Men	6 (0.7)	6 (0.7)	37 (4.5)	129 (15.7)	138 (16.8)	114 (13.9)	94 (11.4)	29 (3.5)	224 (27.3)	45 (5.5)
Women	3 (0.3)	2 (0.2)	15 (1.7)	67 (7.8)	103 (12.0)	118 (13.7)	118 (13.7)	38 (4.4)	349 (40.6)	47 (5.5)
Total	9 (0.5)	8 (0.5)	52 (3.1)	196 (11.7)	241 (14.3)	232 (13.8)	212 (12.6)	67 (4.0)	573 (34.1)	92 (5.5)

p vrednost prema $\chi^2 < 0,001$



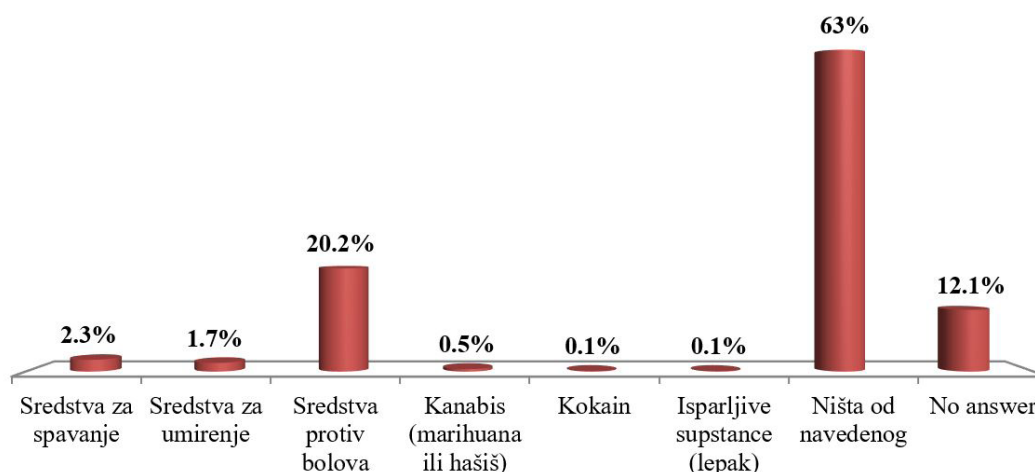
Grafikon 3. Distribucija mladih 15-24 godine (N=1042) prema korišćenju 6 i više alkoholnih pića po jednoj prilici tokom poslednjih 12 meseci, Srbija, 2013. godina

Adolescenti koji konzumiraju alkohol su više skloni drugim oblicima zdravstveno rizičnih ponašanja, kao što su vožnja sa vozačem koji je konzumirao alkohol, rizična seksualna aktivnost, pušenje cigareta, sklonost ka nasilju, samoubistava i upotreba opojnih droga. Takođe je primećeno da su adolescenti koji konzumiraju alkohol češće pušači i da su skloniji psihičkom maltretiranju, uvredama i fizičkom nasilju (tučama) (13).

Rezultati pojedinih istraživanja pokazuju da su adolescenti koji su koristili alkohol više od pet puta u životu, doživeli bar jedan problem u vezi sa upotrebom alkohola (npr. problem sa zakonom, zdravstveni problemi, izostanak iz škole, itd.) (14,15).

Rezultati našeg istraživanja ukazuju da 0,5% mladih koristi kanabis, marihuanu i hašiš, 0,1% isparljive supstance, a 0,1% kokain. Poljska studija koja je istraživala prevalenciju i faktore povezane sa upotrebom psihoaktivnih supstanci kod adolescenata pokazuje da kanabis, kokain i amfetamin zlorabljavaju 13,9% adolescenata, a da čak 16,6% konzumira dve ili tri psihoaktivne supstance istovremeno (16).

Anksioznost, nizak nivo samopoštovanja i samokontrole, kao i nizak nivo roditeljske kontrole, takođe predstavljaju rizik za zloupotrebu psihoaktivnih supstanci (17). Verovatnije je da mladi ljudi koji zloupotrebljavaju psihoaktivne supstance imaju viši nivo psihološkog stresa i obično nisu u



Grafikon 4. Distribucija mladih 15-24 godine (N=1682) prema korišćenju psihoaktivnih supstanci (lekova i ilegalnih droga) tokom poslednjih 12 meseci, Srbija, 2013. godine

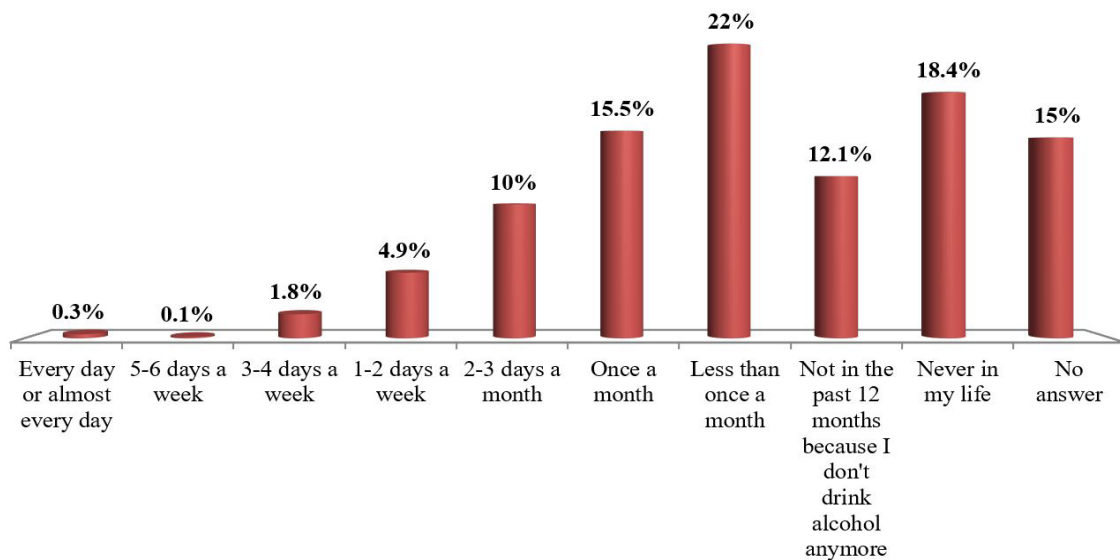


Figure 3. Distribution of young people aged 15-24 (N=1042) by using 6 or more alcoholic drinks alcohol per occasion over the last 12 months, Serbia, 2013

olescents that were conducted in many countries: Romania and Sweden (71-74%), Montenegro, Norway, Albania and Iceland (43-65%), Italy (63.35), Germany (52.35) and the United States of America (71%) (11).

The study in Great Britain showed that alcohol consumption among adolescents was more frequent in households with higher incomes (12). Adolescents who consumed alcohol were inclined to other forms of risky behavior related to health, such as driving with a driver who consumed alcohol, risky sexual activity, smoking cigarettes, tendency to violence, suicide, and use of narcotics. Also, it was noticed that adolescents who consumed alcohol smoked more often and were more

inclined to psychological harassment, insults and physical violence (fights) (13).

Results of some studies showed that adolescents who used alcohol experienced at least one problem regarding alcohol consumption more than five times in life (problems with law, problems related to health, absence from school, etc.) (14,15).

The results of our research indicate that 0.5% of young people use cannabis, marijuana and hashish, 0.1% volatile substances, and 0.1% cocaine. A study from Poland that dealt with prevalence and factors related to the use of psychoactive substances in adolescents showed that cannabis, cocaine and amphetamines were abused by 13.9%

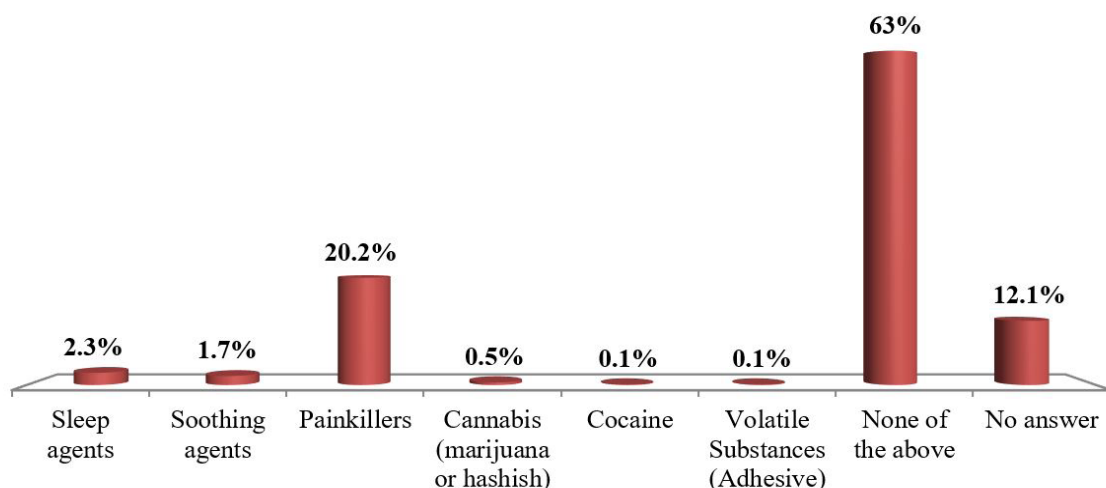


Figure 4. Distribution of young people aged 15-24 (N=1682) by using other psychoactive substances (drugs and illicit drugs) during the last 12 months, Serbia, 2013

mogućnosti da se odupru pritisku vršnjaka (18).

Primarna socijalizacija i vaspitanje u porodici imaju najvažniji uticaj na zdravstveno ponašanje adolescenata, jer su roditelji ključni za ugrađivanje ispravnih socijalnih i zdravstvenih obrazaca ponašanja kod mladih. Stavovi roditelja, koji direktno odobravaju ili indirektno podržavaju zloupotrebu psihoaktivnih supstanci, imaju veliki značaj za formiranje stavova adolescenata, posebno ako postoji slučaj zloupotrebe psihoaktivnih supstanci unutar porodice (19).

Zaključak

Rezultati ovog istraživanja o korišćenju psihoaktivnih supstanci u populaciji mladih uzrasta 15-24 godine, govore da je zloupotreba psihoaktivnih supstanci veliki javnozdravstveni problem uprkos poznavanju njihovih štetnih efekata. Koliko će mladi eksperimentisati sa psihoaktivnim supstancama zavisi, između ostalog, od njihove dostupnosti, zakonske regulative, brige i stavova roditelja, školske uprave, kao i od mogućnosti koje pruža lokalna zajednica. Važno je istaći da je i samo probanje psihoaktivnih supstanci kod mladih vrlo rizično, iako se često smatra bezazlenim neretko je osnov za kasniju zloupotrebu.

Svi podaci ukazuju da je neophodno kreirati nove promotivne intervencije i programe za suzbijanje ovog problema.

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of adolescents, and that even 16.6% of them consumed two or more psychoactive substances simultaneously (16).

Anxiety, low level of self-respect and self-control, as well as the low level of parental control also represent a risk for psychoactive substances abuse (17). It is more likely that young people who abuse psychoactive substances have a higher level of psychological stress and they are usually not able to resist the peers' influence (18).

Primary socialization and education in family have the most significant influence on health-related behavior of adolescents, because parents are key figures for creating correct social and health-related patterns of behavior in young people. Attitudes of parents, who directly permit or indirectly support the abuse of psychoactive substances, are significant for adolescents' attitude formation, especially if the abuse of psychoactive substances is present within the family (19).

Conclusion

Results of this research on the use of psychoactive substances in the population of young people aged 15-24 point to the fact that the abuse of psychoactive substances is a great public-health problem although its harmful effects are well-known. Whether young people will experiment with psychoactive substances and to what extent depends on, among other things, their availability, legal regulations, parents' care and attitudes, school system, as well as on the possibilities offered by the local community. It is important to emphasize that it is risky even to try psychoactive substances as far as young people are concerned. Although it is usually deemed to be harmless, it often becomes the basis for further abuse.

All data show that it is necessary to create new promotional interventions and programs for the eradication of this problem.

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BEZBEDNOST U ZDRAVSTVU: EVAKUACIJA DELIMIČNO POKRETNIH I NEPOKRETNIH OSOBA STARIJIH OD 70 GODINA IZ GERONTOLOŠKIH USTANOVA

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SAŽETAK

Uvod/Cilj: Gerontološke ustanove predstavljaju objekte sa prisustvom velikog broja delimično pokretnih i nepokretnih starih lica. U uslovima hitnosti, njihova evakuacija iz navedenih razloga može trajati duže, tako da je cilj istraživanja bio da se predstavi nekoliko načina za evakuaciju delimično pokretnih i nepokretnih lica starijih od 70 godina iz gerontoloških ustanova i da se proceni neophodno vreme evakuacije.

Metode: U okviru ovog istraživanja korišćen je kompjuterski softver *Pathfinder 2020* za izračunavanje vremena evakuacije i predviđanje potencijalnih situacija prilikom evakuacije lica iz gerontološke ustanove. Gerontološka ustanova, kao korišćeni model, predstavlja objekat koji ima prizemlje i četiri sprata. Svi spratovi imaju 16 soba, a u svakoj sobi su po dva pacijenta. Spratovi su povezani glavnim stepeništem, požarnim stepenicama i sa četiri lifta (dva teretna za 12 osoba i dva maloteretna za 6 osoba). Ukupan broj medicinskog i administrativnog osoblja je 44, a osoba korisnika usluga gerontološke ustanove 128. Simulacija evakuacije iz gerontološke ustanove prikazana je za četiri različita scenarija: I svi liftovi rade i sve stepenice su dostupne; II nijedan lift ne radi ali stepenište funkcioniše; III funkcioniše samo požarne stepenice; IV funkcionišu samo glavno stepenište. Svaki scenario ima četiri različite situacije koje zavise od procenjene brzine kretanja pacijenata.

Rezultati: Vreme evakuacije kada je moguće koristiti sve liftove i glavno i požarno stepenište je od 895 (14,9 minuta) (kada se osobe najbrže kreću - prva situacija) do 958 sekundi (16 minuta) (kada se osobe najsporije kreću - četvrta situacija), kada se koristi glavno i požarno stepenište od 984 do 1111,1 sekunde (16,4-18,5 minuta), samo požarno stepenište od 1997,6 do 2765,3 sekunde (33,3-46,1 minuta), a kada se koriste samo glavno stepenište od 1365 do 2342 sekundi (22,8-39,0 minuta).

Zaključak: Korišćenje kompjuterskog softvera *Pathfinder 2020* za simulaciju evakuacije predstavlja veoma važan, bezbedan i jeftin način predviđanja načina i brzine evakuacije, što može doprineti unapređenju nacionalne strategije za vanredne situacije.

Ključne reči: evakuacija, simulacija, gerontološki objekat, vanredne situacije

Uvod

Zdravstveni objekti predstavljaju veoma važne objekte za zdravlje ljudi, lečenje, rehabilitaciju i druge aktivnosti. Ovi objekti podrazumevaju prisustvo velikog broja ljudi i veoma važnu, složenu, sofisticiranu i skupu medicinsku i drugu opremu. Zdravstveni objekti, u zavisnosti od njihove namene, mogu da uključuju različite objekte poput klinika, sanatorijuma, operacionih sala, laboratorija, objekata za rehabilitaciju, gerontoloških ustanova i mnogo drugih objekata. Bez obzira na njihovu namenu, zdravstveni objekti podrazumevaju prisustvo velikog broja ljudi, od kojih jedan deo čine pacijenti, drugi medicinsko osoblje, a treći ljudi koji su se slučajno tu zatekli ili su tu iz

nekeg drugog razloga. Pacijenti u zdravstvenim objektima mogu da budu stacionirani u sobama u standardnim ili pokretnim medicinskim krevetima. Oni mogu da se kreću nezavisno ili uz nečiju pomoć. Na primer, neki pacijenti mogu sami da se kreću u kolicima ili uz pomoć jedne osobe, drugi su vezani za krevet i neohodna im je pomoć od dva do četiri zdravstvena radnika, a treći se kreću uz pomoć različitih medicinskih pomagala, poput štaka itd. (1-5).

Na osnovu navedenog, očigledno je da je evakuacija iz zdravstvenih objekata veoma težak, složen i odgovoran zadatak. Iako se zdravstveni objekti grade prema standardima koji obično uključuju jednu osnovnu rutu komunikacije koja pov-

SAFETY IN HEALTH - THE EVACUATION OF IMMOBILE PERSONS FROM GERONTOLOGY INSTITUTION

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SUMMARY

Introduction/Aim: Gerontology institutions present objects with the presence of a great number of partly mobile or immobile persons. In emergency conditions, their evacuation because of noted reasons can take longer, so the aim of the research was to present several ways for the evacuation of partly mobile and immobile persons older than 70, from gerontology institutions, and to evaluate necessary evacuation time.

Methods: For this research, the software *Pathfinder 2020* was used for the calculation of evacuation times and predicting of potential situations during evacuation. The gerontology institution, as a used model, presents an object with a basement and four floors. All floors have 16 rooms with two patients in every room. Floors are connected with main stairs, emergency stairs and with four elevators (two cargo elevators for 12 persons per elevator, and two passenger elevators for 6 persons per elevator). The total number of medical and administrative staff is 44, and the number of users of gerontological institution services is 128. The simulation of evacuation from gerontology institution was realized for four different scenarios: The first, when all the elevators are in function and all stairs are accessible; the second, when none of the elevators works but stairs are accessible; the third, when only emergency stairs are in function; the fourth, when only main stairs are in function. Each of these four scenarios has four different situations that depend on the evaluated speed of patient's movement.

Results: The evacuation time when it is possible to use all elevators and stairs is from 895 seconds (14.9 minutes) (for the fastest movement of persons - the first situation) to 958 seconds (16 minutes) (for the slowest movement of persons - the fourth situation), for main and emergency stairs from 984 to 1111.1 seconds (16.4-18.5 minutes), only for emergency stairs from 1997.6 to 2765.3 seconds (33.3-46.1 minutes), and only for main stairs from 1365 to 2342 seconds (22.8-39.0 minutes).

Conclusion: The usage of computer software *Pathfinder 2020* for the simulation of evacuation presents a very important, safe and cheap way for predicting evacuation way and speed, which can contribute to the national strategy for emergency situations.

Keywords: evacuation, simulation, gerontology object, emergency situations

Introduction

Sanitary objects present very important objects for human health, treatment, recovery and other activities. Those objects include the presence of a large number of people, as well as the presence of very important, complex, sophisticated and expensive medical and other equipment. Sanitary objects, in dependence on their purposes, can be different and can involve different objects such as clinics, sanatoriums, operating rooms, laboratories, rehabilitation objects, gerontology objects and a lot of other objects. Notwithstanding their purpose, sanitary objects include the presence of a large number of people, where one part of those

people presents patients, the second part presents medical personnel and the third part is represented by people who happened to be there by accident or with some intention. Patients in sanitary objects can be stationed in medical rooms, fixed or movable medical beds. Their movement can be independent or assisted by someone. As an example, some patients can move in wheelchairs independently or with the assistance of one person; some patients can be moved in medical beds and they need the assistance of two or four persons; some patients can move with different medical apparatuses, such as crutches, etc. (1-5).

ezuje sve sobe, uvek se javljaju problemi prilikom evakuacije, naročito kada su u pitanju nepokretne osobe. Gerontološke ustanove su, takođe, veoma problematične i složene za evakuaciju u hitnim slučajevima, što se pokazalo i tokom epidemije kovida-19.

Evakuacija može biti neophodna zbog požara, poplave, terorističkog napada ili pretnje, zemljotresa, razornih vetrova itd. Glavni problemi prilikom evakuacije iz zdravstvenih objekata sa nepokretnim osobama su usporenost, velika verovatnoća zastoja i stvaranja gužve, spora eliminacija gužve, kao i dimenzije korišćenih medicinskih pomagala. Zbog navedenih razloga, veoma je važno predvideti što je moguće više scenarija evakuacije da bi se kreirala najbolja strategija evakuacije u nekoj određenoj situaciji. Jedan od najboljih načina za predviđanje evakuacije i izračunavanje neophodnog vremena evakuacije je korišćenje odgovarajućeg kompjuterskog softvera *Pathfinder 2020* (6). Ovaj program simulacije omogućava preciznu, brzu, bezbednu i jeftinu kalkulaciju neophodnog vremena za evakuaciju u skladu sa potrebama, što posledično obezbeđuje optimalne puteve i vreme evakuacije (7-10).

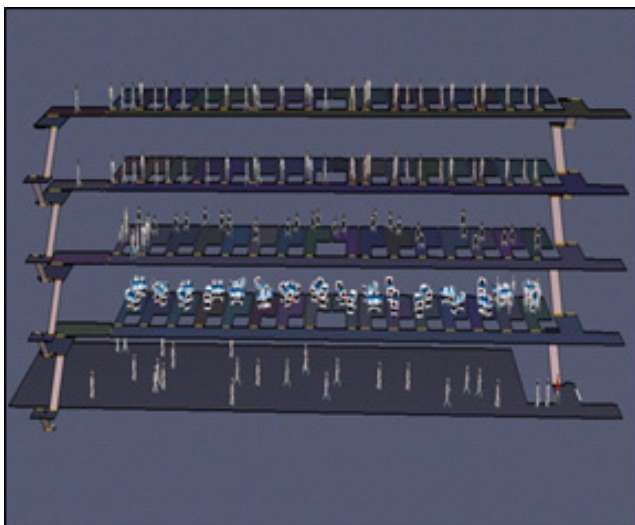
Metode

U okviru ovog istraživanja korišćen je softver *Pathfinder 2020*, koji je jedan od najpoznatijih softvera za izračunavanje vremena evakuacije i predviđenje potencijalnih situacija prilikom evakuacije lica iz bilo koje ustanove, a u našem primeru iz

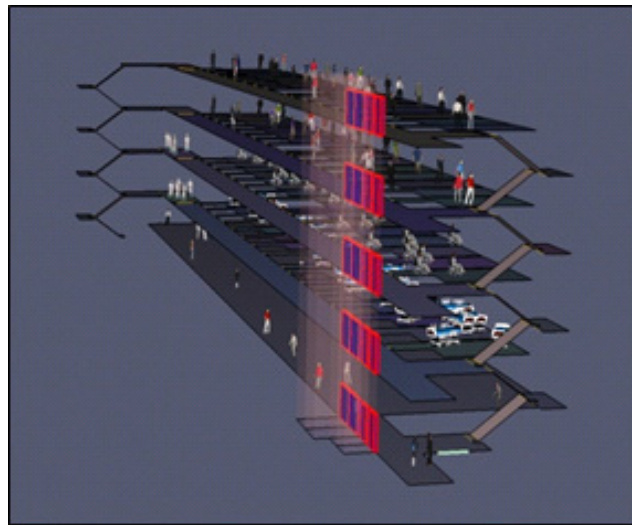
gerontološke ustanove (6). Ovaj softver predstavlja grafički korisnički interfejs za dizajn i izvršenje simulacije. On omogućava 2D i 3D vizualizaciju. Postoje dva različita modela simulacije evakuacije koji se mogu koristiti u *Pathfinder*-u („Steering“ model i „SFPE“ model evakuacije). Od ova dva modela simulacije, u radu je korišćen „SFPE“ model. Ovim programom moguće je podesiti različite brzine kretanja osoba i izračunati neophodno vreme evakuacije.

Gerontološka ustanova, kao model za simulaciju u ovom istraživanju, predstavlja objekat koji ima prizemlje i četiri sprata. U osnovi objekat je površine 80 m × 20 m. Visina svakog sprata je 3,15 m. Prva dva sprata su namenjena za nepokretne osobe, prvi za nepokretne pacijente vezane za krevet, a drugi za nepokretne pacijente u kolicima. Treći i četvrti sprat namenjeni su za pokretne osobe. Svi spratovi, osim prizemlja, imaju 16 soba za pacijente površine otprilike 16 m² i sa vratima dužine 1,2 m. Pretpostavljeno je da se nepokretne osobe vezane za krevet kreću samo uz pomoć dva zdravstvena radnika, nepokretne osobe u kolicima uz pomoć jednog, a da se sve ostale osobe mogu kretati samostalno. Dimenzije medicinskih kreveta su 200 cm × 90 cm × 75 cm, dok su dimenzije kolica 110 cm × 65 cm × 92 cm.

Spratovi su povezani glavnim stepeništem, požarnim stepenicama (stepenicama za slučaj opasnosti) i liftovima. Maksimalna širina običnih stepenica je 150 cm dok je maksimalna širina stepenica za hitne situacije 120 cm. Izlazna vrata sa



Slika 1. *Pathfinder 2020* model simulacije u gerontološkoj ustanovi sa korisnicima unutar objekta – prednji prikaz



Slika 2. *Pathfinder 2020* model simulacije u gerontološkoj ustanovi sa korisnicima unutar objekta – prikaz sa strane

According to all noted, it is obvious that evacuation of any sanitary object presents a very hard, complex and responsible task. Although the sanitary objects were built by cliché, which usually includes one basic communication route that connects all rooms, the problems with evacuation can always occur, especially in cases with immobile persons. Gerontological institutions are also very problematic and complex for the emergency evacuation, which was shown during the epidemic of Covid-19.

The evacuation may be required for a variety of different reasons: fire, floods, terrorism attacks or threats, earthquake, destructive winds etc. The main problems in the evacuation of sanitary objects with immobile persons are slowness, sluggishness, high probability of crowding and congestion, slow elimination of congestion, dimensions of used medical devices. Because of the above-mentioned reasons, it is very important to predict as many as possible evacuation scenarios in order to create the best evacuation strategy for some specific situation. One of the best ways for the prediction of evacuations and calculation of necessary evacuation times is the usage of appropriate computer software, such as *Pathfinder 2020* (6). This program enables precise, fast, safe and cheap calculation of necessary time for the evacuation in accordance with needs, which consequently enables optimal evacuation routes and evacuation times (7-10).

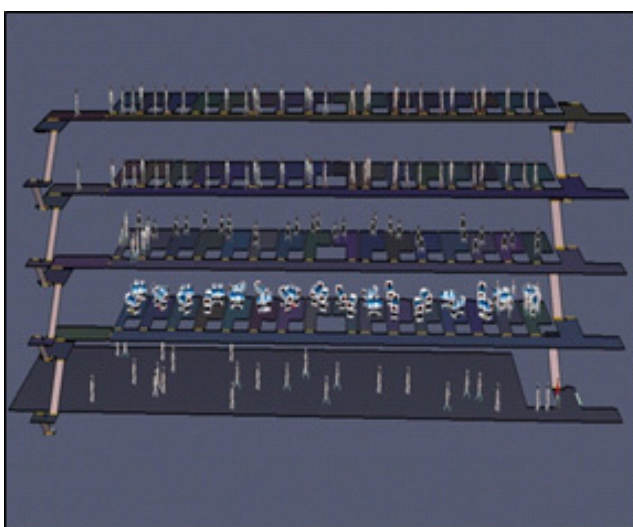
The aim of this paper is to present several evacuation ways of immobile and hard-mobile persons

older than 70 from gerontology institutions and to evaluate the necessary evacuation time with the help of proper simulation software *Pathfinder 2020*.

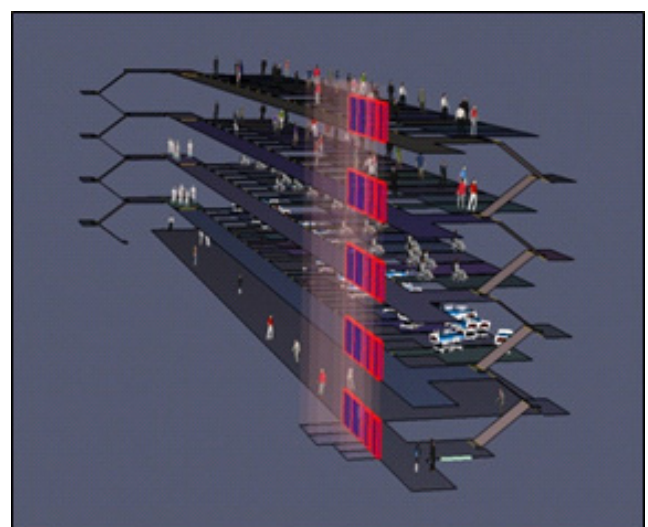
Methods

For this research, the software *Pathfinder 2020* was used, which is one of the most famous software programs for the calculation of evacuation times and predicting of potential situations during the evacuation of persons from any kind of objects, and in our example from the gerontology institution (6). This software presents a graphical user interface for the simulation design and execution. It enables 2D and 3D visualization. There are two different simulation ways that *Pathfinder* can use ("Steering" mode and "SFPE" mode). Of these two simulation models, the "SFPE" model was used in the paper. It is possible to set different moving speeds of persons and calculate the necessary evacuation time.

The gerontology institution, as a model for simulation in this research, presents an object with a basement and four floors. In its base, the area of the object was 80 m × 20 m. The height of every floor was 3.15 m. The first two floors were for immobile persons, the first for immobile patients in medical beds and the second for immobile patients in wheelchairs. The third and fourth floors were for mobile persons. Each floor except the ground floor has 16 rooms for patients with an approximate area of 16 m² and a door was 1.2 m in length. Immobile patients in medical beds were



Picture 1. Pathfinder 2020 simulation model of Gerontology institution with occupants inside-front view



Picture 2. Pathfinder simulation model of Gerontology institution with occupants inside-side view

prednje strane objekta su širine 200 cm, dok su izlazna vrata na pomoćnom stepeništu širine 130 cm. Ukupno su dva izlaza iz objekta.

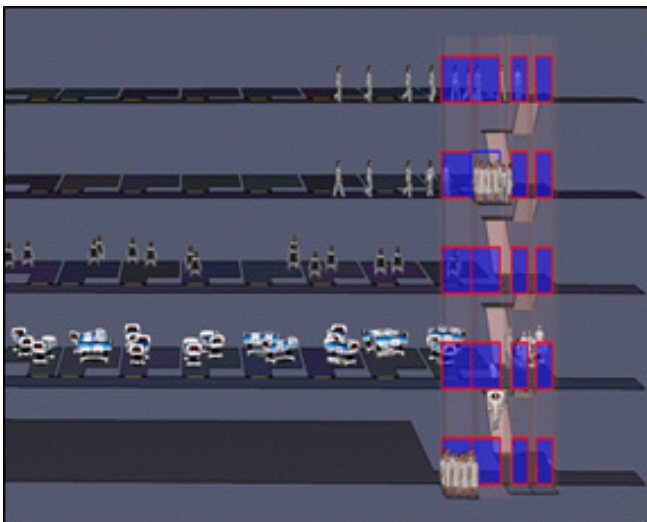
U objektu su četiri lifta. Dva lifta su teretni liftovi koji su predviđeni za 12 osoba i u njih, na osnovu dimenzija, mogu da stanu jedan medicinski krevet ili dvoja kolica, dok su ostala dva maloteretna lifta predviđena za 6 osoba.

Medicinsko osoblje i drugo zdravstveno i administrativno osoblje je stacionirano u prizemlju. Ukupan broj medicinskog i administrativnog osoblja je 44. U svakoj sobi su po dve stare osobe što znači da su na svakom spratu 32 korisnika gerontološke ustanove. To znači da je ukupan broj korisnika objekta 172, od kojih je 128 starih osoba i 44 člana medicinskog ili administrativnog osoblja.

Pathfinder model simulacije u gerontološkoj ustanovi, predstavljen je na slikama 1 i 2 koje prikazuju prednju stranu objekta i objekat prikazan sa strane sa korisnicima koji su unutar objekta.

Simulacija evakuacije iz gerontološke ustanove prikazana je u ovom radu za četiri različita scenarija. U prvom scenariju (slika 3) svi liftovi rade i sve stepenice su dostupne (glavne i požarne), u drugom (slika 4) nijedan lift ne radi ali stepenište je dostupno, u trećem (slika 5) nijedan lift ne radi i samo su dostupne požarne stepenice, i u četvrtom (slika 6) liftovi ne rade i samo su dostupne glavne stepenice.

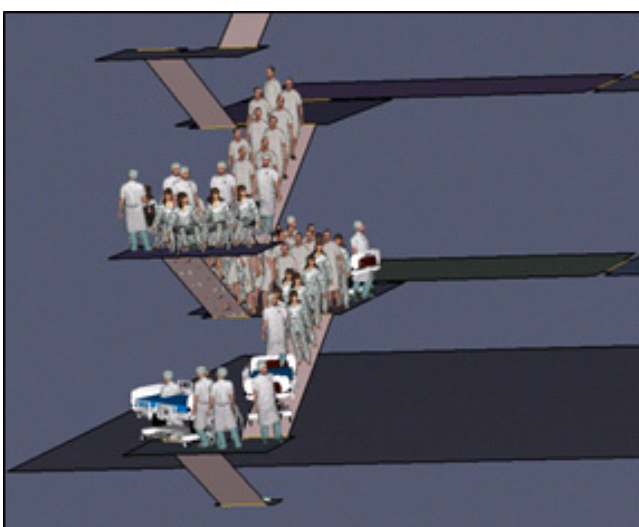
Svaki scenario imao je četiri različite situacije. U prvoj situaciji, brzina kretanja pokretnih pacijenata je 0,5 m/s, pacijenata u kolicima kojima je



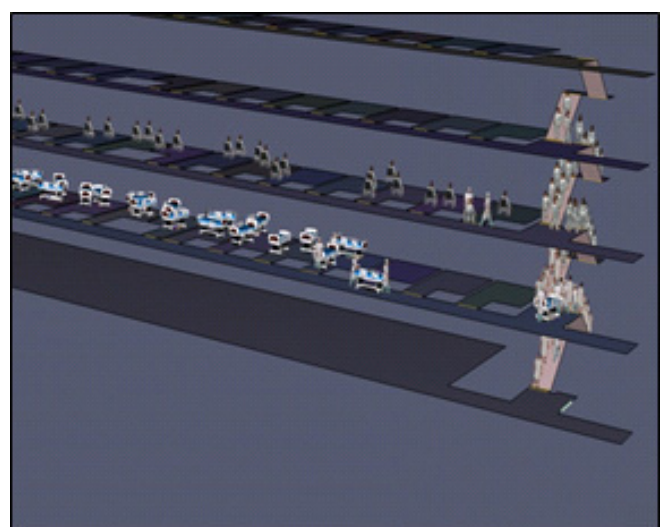
Slika 3. Trenutak simulacije za prvi scenario kada svi liftovi rade i kada su dostupne sve stepenice



Slika 4. Trenutak simulacije za drugi scenario kada nijedan lift ne radi i kada su dostupne glavne i požarne stepenice



Slika 5. Trenutak simulacije za treći scenario kada nijedan lift ne radi i kada su samo dostupne glavne stepenice



Slika 6. Trenutak simulacije za četvrti scenario kada nijedan lift ne radi i kada su dostupne samo požarne stepenice

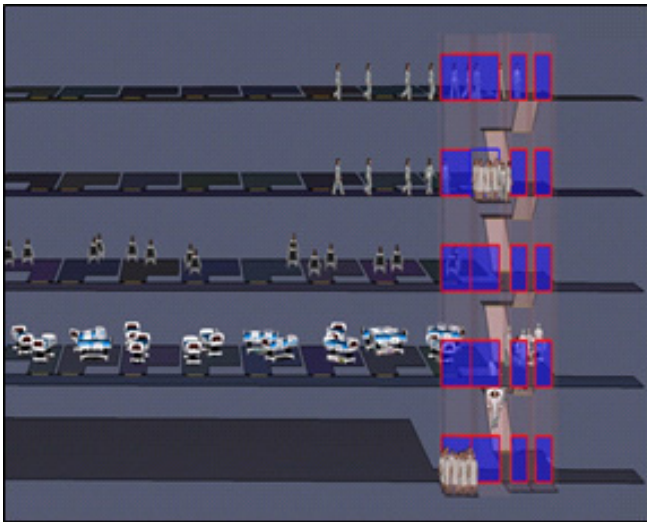
able to move only with the assistance of two medical persons, while immobile persons in wheelchairs were able to move only with the assistance of one medical person, while the other patients were able to move on their own. The dimensions of medical beds were 200 cm × 90 cm × 75 cm, while the dimensions of wheelchairs were 110 cm × 65 cm × 92 cm.

The floors were connected with ordinary stairs, emergency stairs and elevators. The maximal width of ordinary stairs was 150 cm, while maximal width of emergency stairs was 120 cm. Exit doors in the front of the object had a width of 200 cm, while exit door intended for emergency stairs had length of 130 cm. The complete number of exits from the object was 2.

There were four elevators in the object. Two elevators were cargo elevators with the capacity of 12 persons or one medical bed or two wheelchairs, while the other two elevators were with the capacity of 6 persons.

Medical staff and other medical and administrative staff were stationed on the ground floor. The total number of medical and administrative staff was 44. There were two elderly people in each room, which means that there were 32 users of the gerontology institution on each floor. This means that the total number of users of the object was 172, of which 128 were elderly and 44 were members of medical or administrative staff.

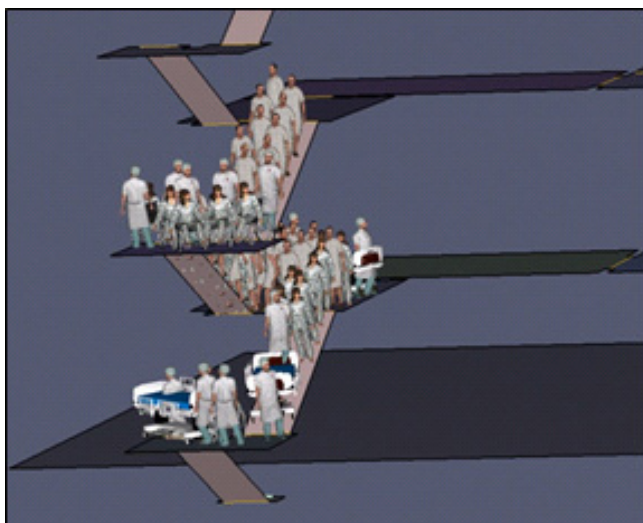
Pathfinder simulation model in the gerontology institution is presented in picture 1 and 2 that



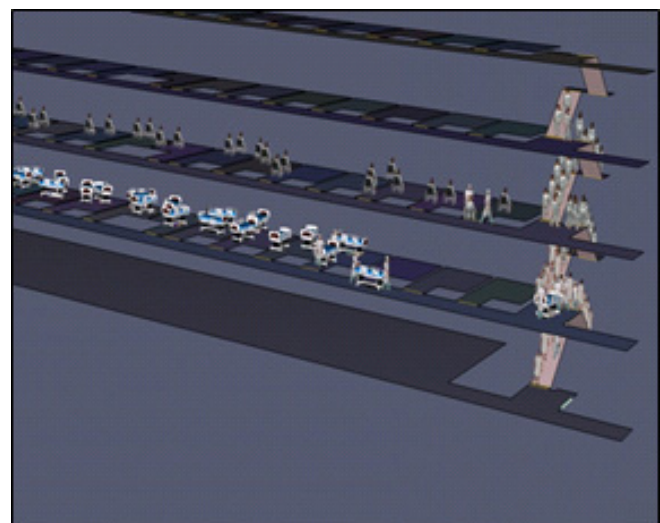
Picture 3. Simulation moment for the first scenario when all elevators are working and when all stairs are available



Picture 4. Simulation moment for the second scenario when no elevator is working and when the main and auxiliary stairs are available



Picture 5. Simulation moment for the third scenario when no elevator is working and when only the main stairs are accessible



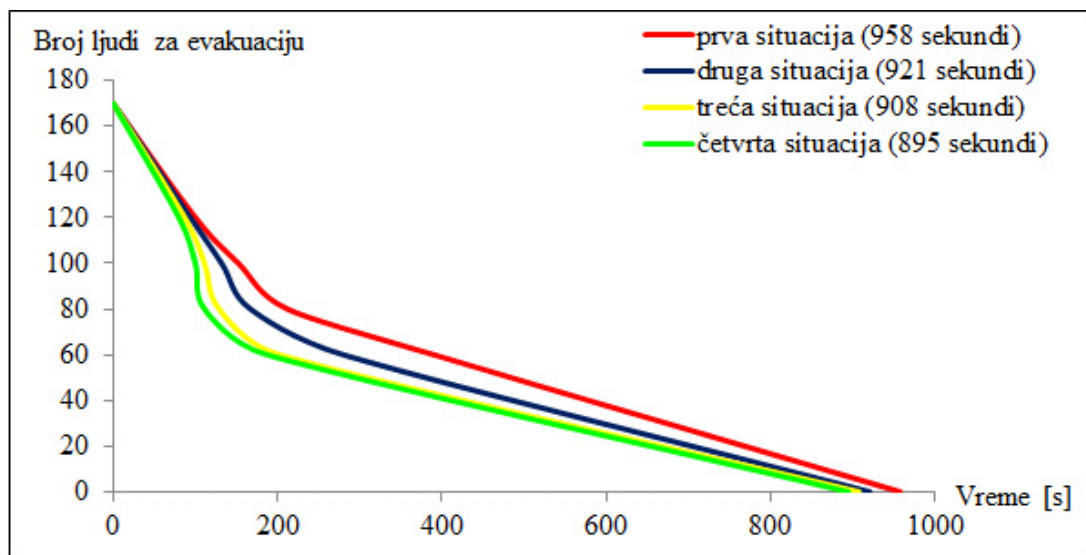
Picture 6. Simulation moment for the fourth scenario when no elevator is working and only auxiliary stairs are available

potrebna pomoć jednog zdravstvenog radnika je od 0,5 m/s do 1,3 m/s u zavisnosti od toga gde su se kretali, a pacijenata u medicinskim krevetima, kojima je bila potrebna pomoć dva zdravstvena radnika, je od 0,2 m/s do 0,9 m/s u zavisnosti od toga gde su se kretali, dok je brzina medicinskog i administrativnog osoblja 1 m/s.

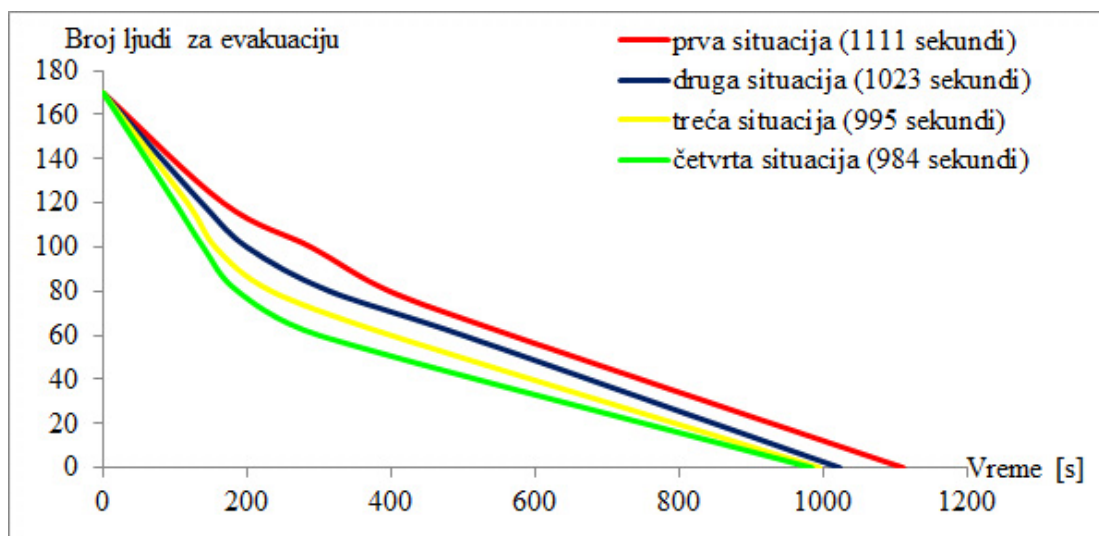
U drugoj situaciji, brzina kretanja pokretnih pacijenata je 0,6 m/s, pacijenata u kolicima kojima je potrebna pomoć jednog zdravstvenog radnika je od 0,5 m/s do 1,3 m/s u zavisnosti od toga gde su se kretali, a pacijenata u medicinskim krevetima, kojima je bila potrebna pomoć dva zdravstvena radnika, je od 0,2 m/s do 0,9 m/s u zavisnosti od toga gde su se kretali, dok je brzina medicinskog i administrativnog osoblja 1 m/s.

U trećoj situaciji, brzina kretanja pokretnih pacijenata je 0,7 m/s, pacijenata u kolicima kojima je bila potrebna pomoć jednog zdravstvenog radnika je od 0,5 m/s do 1,3 m/s u zavisnosti od toga gde su se kretali, a pacijenata u medicinskim krevetima, kojima je bila potrebna pomoć dva zdravstvena radnika, je od 0,2 m/s do 0,9 m/s u zavisnosti od toga gde su se kretali, dok je brzina medicinskog i administrativnog osoblja 1 m/s.

U četvrtoj situaciji, brzina kretanja pokretnih pacijenata je 0,8 m/s, pacijenata u kolicima kojima je bila potrebna pomoć jednog zdravstvenog radnika je od 0,5 m/s do 1,3 m/s u zavisnosti od toga gde su se kretali, a pacijenata u medicinskim krevetima, kojima je bila potrebna pomoć dva zdravstvena radnika, je od 0,2 m/s do 0,9 m/s u zavisnosti



Grafikon 1. Brzina evakuacije za prvi scenario (liftovi i stepenište) za sve četiri situacije (od najsporijeg do najbržeg kretanja)



Grafikon 2. Brzina evakuacije za drugi scenario (glavno i požarno stepenište) za sve četiri situacije (od najsporijeg do najbržeg kretanja)

present front side of the object and object by side with occupants inside the object.

The simulation of evacuation from the gerontology institution in this paper was realized for four different scenarios. The first evacuation scenario (Picture 3) considered that all elevators were enabled and all available stairs (main and emergency) were enabled, the second scenario (Picture 4) considered that all elevators were disabled and all available stairs were enabled, the third scenario (Picture 5) considered that all elevators were disabled and main stairs were disabled, while emergency stairs were enabled and the fourth scenario (Picture 6) considered that all elevators were disabled and emergency stairs were disabled, while main stairs were enabled.

Each scenario had four different situations. In the first situation, the speed of mobile patients is 0.5 m/s; the speed of patients in wheelchairs that needed the assistance of one medical person is from 0.5 m/s to 1.3 m/s in dependence on where they moved; the speed of patients in medical beds that needed the assistance of two medical persons is from 0.2 m/s to 0.9 m/s, in dependence on where they moved and the speed of all other medical and administrative personnel is 1 m/s.

In the second situation, the speed of mobile patients is 0.6 m/s; the speed of patients in wheelchairs that needed the assistance of one medical person is from 0.5 m/s to 1.3 m/s in dependence on where they moved; the speed of patients in medical beds that needed the assistance of two medical

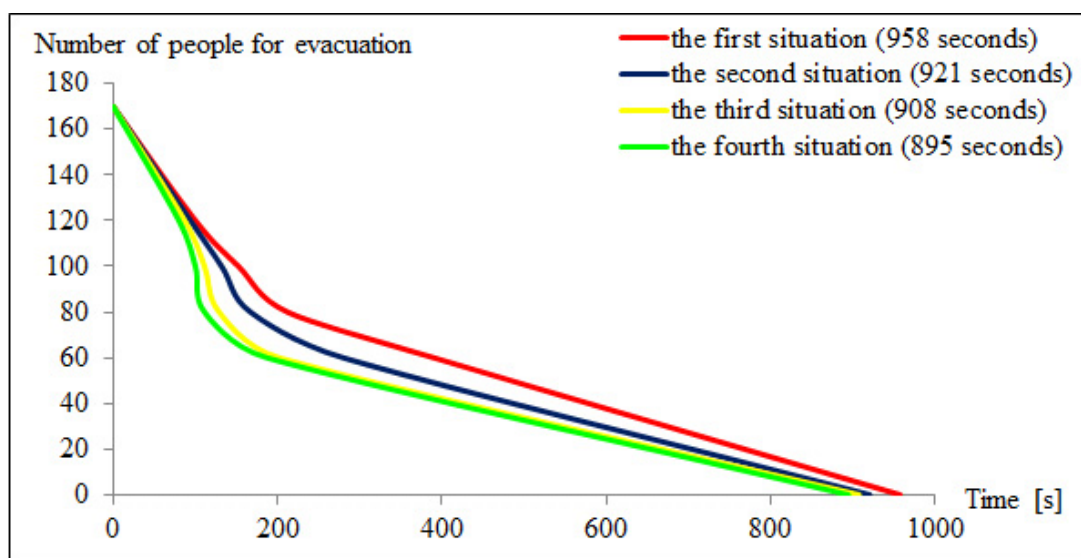


Figure 1. Speed of evacuation for the first scenario when all elevators are working and when all stairs are available for all four situations (from slowest to fastest)

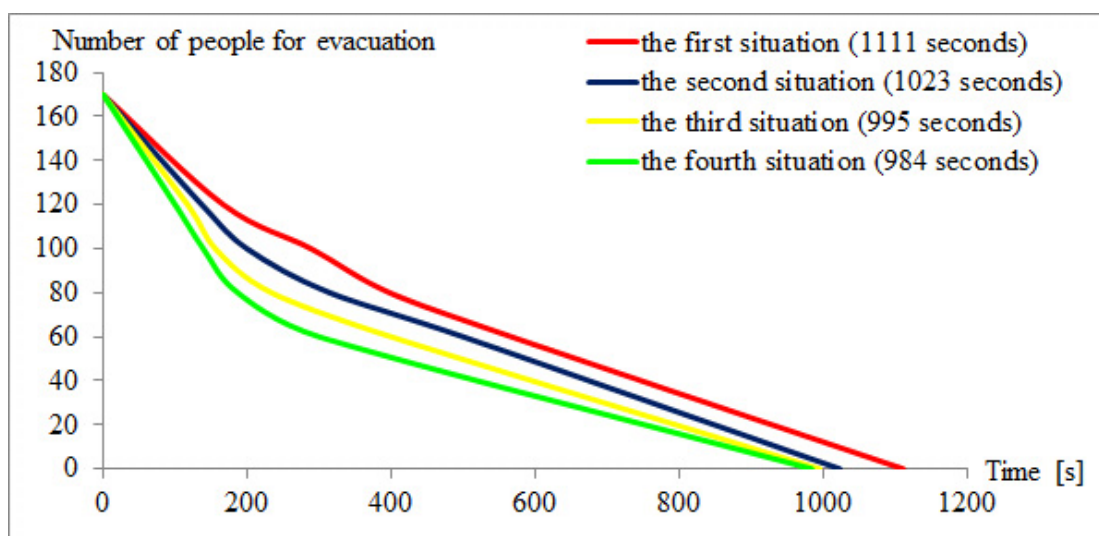
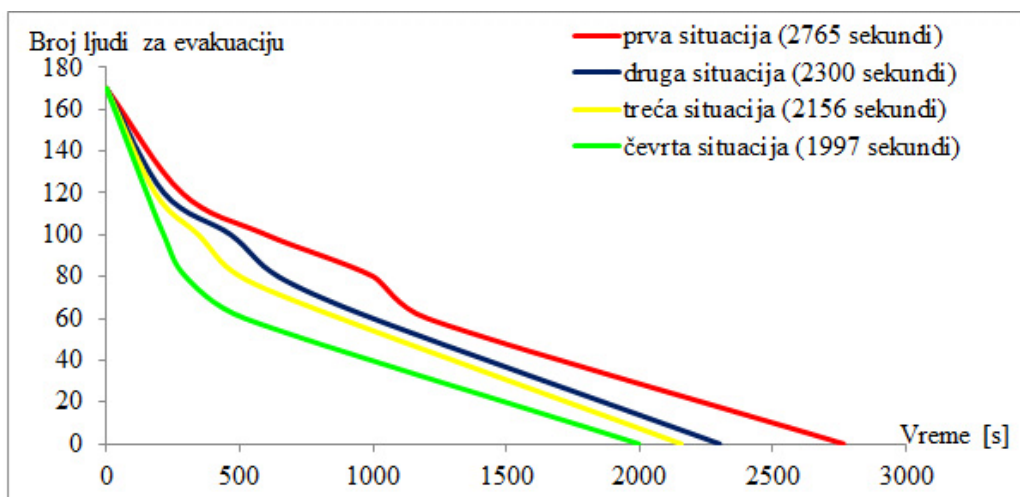
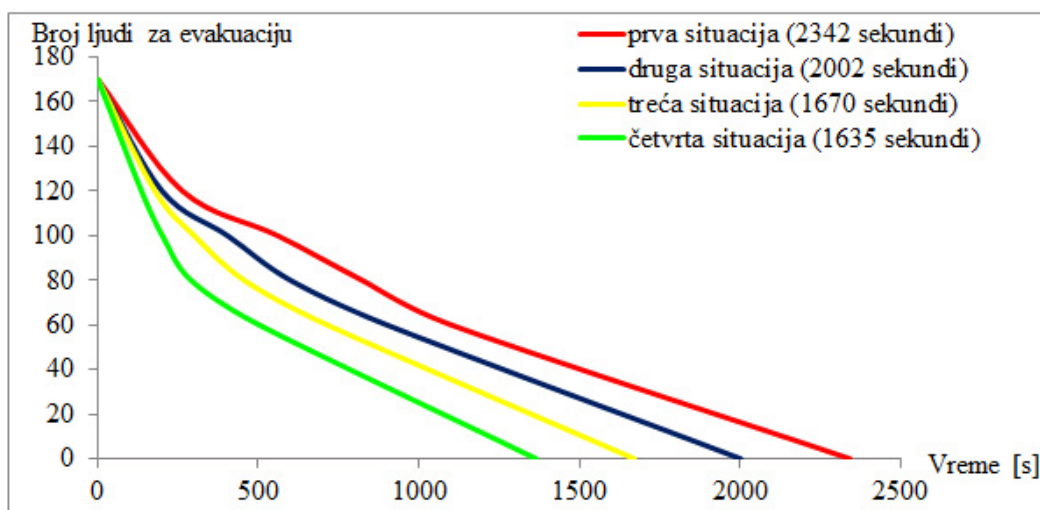


Figure 2. Speed of evacuation for the second scenario when no elevator is working and when the main and auxiliary stairs are available stairs are available for all four situations (from slowest to fastest)



Grafikon 3. Brzina evakuacije za treći scenario kada nijedan lift ne radi i kada su dostupne samo požarne stepenice za sve četiri situacije (od najsporije do najbrže)



Grafikon 4. Brzina evakuacije za četvrti scenario kada nijedan lift ne radi i kada su dostupne samo glavne stepenice za sve četiri situacije (od najsporije do najbrže)

od toga gde su se kretali, dok je brzina medicinskog i administrativnog osoblja 1 m/s.

Glavni razlog za odabir ovih brzina je činjenica da su korisnici usluga gerontološke ustanove osobe starije od 70 godina. Takođe, uzeto je u obzir da su brzine pokretnih pacijenata konstantne, da se medicinsko osoblje vraćalo po pacijente sve dok i poslednji pacijent nije evakuisan, kao i da su u sva četiri scenarija medicinsko osoblje i pacijenti znali gde treba da idu u slučaju evakuacije.

Rezultati

Rezultati simulacije za sva četiri scenarija u sve četiri situacije predstavljeni su na grafikonima 1-4.

Rezultati simulacije za prvi scenario (grafikon 1), kada su svi liftovi i kada su glavno i požarno stepenište bili u funkciji, pokazali su da se vreme evakuacije kretalo od 895 sekundi (14,9 minuta)

(prva situacija) do 958 sekundi (16 minuta) (četvrta situacija).

U drugom scenariju (grafikon 2), kada nijedan lift nije radio i kada su bile dostupne glavne i požarne stepenice, vreme evakuacije se kretalo od 984 sekunde (16,4 minuta) (prva situacija) do 1111,1 sekunde (18,5 minuta) (četvrta situacija).

U trećem scenariju (grafikon 3), kada nijedan lift nije bio u funkciji i kada su bile dostupne požarne, ali ne i glavne stepenice, vreme evakuacije se kretalo od 1997,6 sekundi (33,3 minuta) (prva situacija) do 2765,3 sekunde (46,1 minuta) (četvrta situacija).

U četvrtom scenariju (grafikon 4), kada nijedan lift nije radio i kada su dostupne glavne, ali ne i požarne, stepenice vreme evakuacije se kretalo od 1365 sekundi (22,8 minuta) (prva situacija) do 2342 sekundi (39,0 minuta) (četvrta situacija).

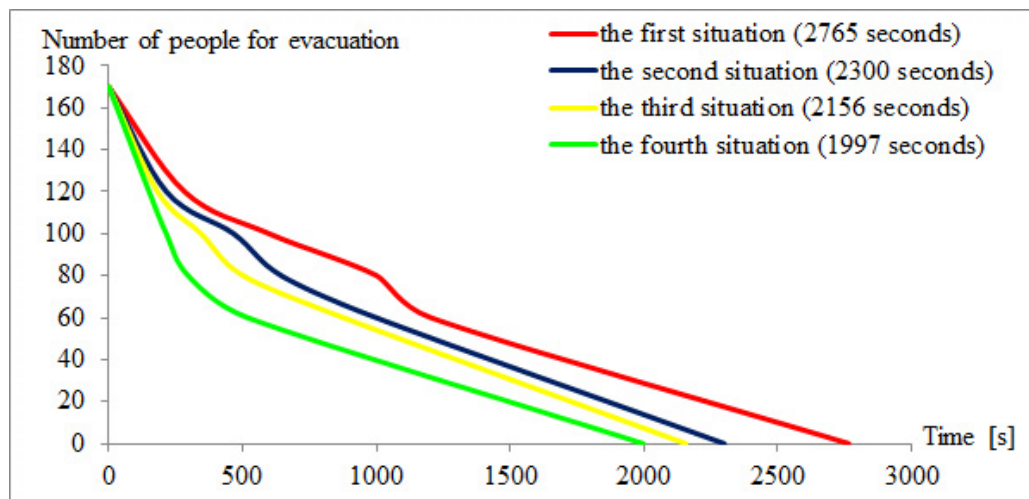


Figure 3. Speed of evacuation for the third scenario when no elevator is working and when only auxiliary stairs are accessible stairs are available for all four situations (from slowest fo fastest)

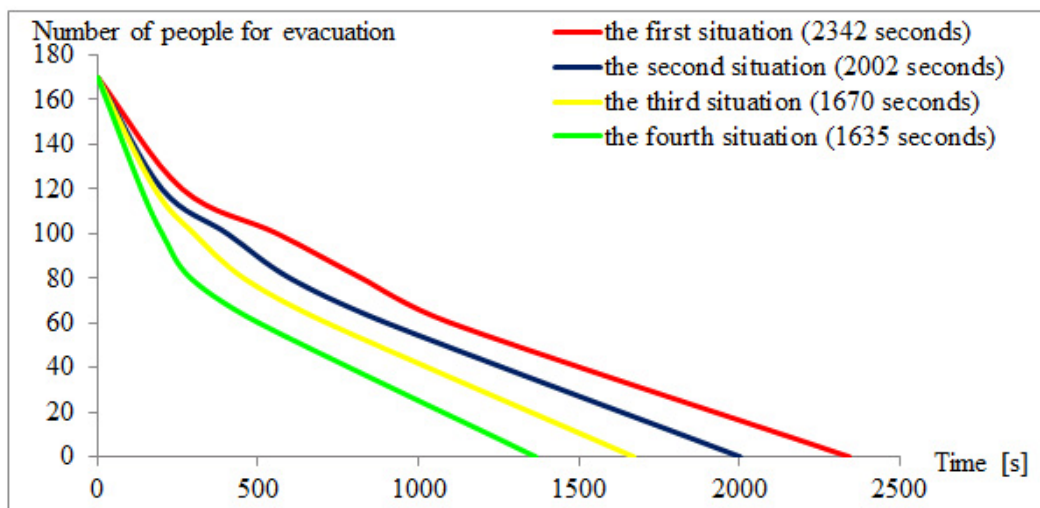


Figure 4. Speed of evacuation for the fourth scenario when no elevator is working and only the main stairs are available stairs are available for all four situations (from slowest fo fastest)

persons is from 0.2 m/s to 0.9 m/s, in dependence on where they moved and the speed of all other medical and administrative personnel is 1 m/s.

In the third situation, the speed of mobile patients is 0.7 m/s; the speed of patients in wheelchairs that needed the assistance of one medical person is from 0.5 m/s to 1.3 m/s in dependence on where they moved; the speed of patients in medical beds that needed the assistance of two medical persons is from 0.2 m/s to 0.9 m/s, in dependence on where they moved and the speed of all other medical and administrative personnel is 1 m/s.

In the fourth scenario, the speed of mobile patients is 0.8 m/s; the speed of patients in wheelchairs that needed the assistance of one medical person is from 0.5 m/s to 1.3 m/s in dependence on where they moved; the speed of patients in medical beds that needed the assistance of two

medical persons is from 0.2 m/s to 0.9 m/s, in dependence on where they moved and the speed of all other medical and administrative personnel is 1 m/s.

The main reason for those speeds selection was in the fact that the users of gerontology institutions are persons older than 70 years. It was also taken into account that speeds of mobile patients was constant, that medical staff were returning for patients until the last patient was evacuated, so as the fact that in all of four scenarios medical staff and patients knew where to go in the case of evacuation.

Results

Results of simulation for each of four scenarios in all four situations are presented in figures from 1-4.

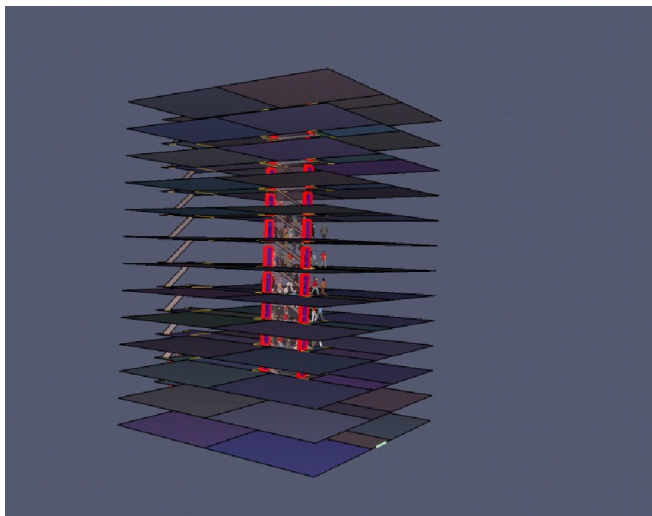
Diskusija

Rezultati našeg istraživanja ukazuju da brzina evakuacije gerontološke ustanove, gde je pretpostavljeno da su smeštene osobe starije od 70 godina, koje mogu da budu pokretne, delimično pokretne i nepokretne, mogu da doprinesu unapređenju strategije za vanredne situacije. Procenjeno je, korišćenjem softverskog programa *Pathfinder 2020*, da je vreme evakuacije iz gerontološke ustanove određenog modela kada je moguće koristiti sve liftove i glavno i požarno stepenište 895-958 sekundi (tj. 14,9-16 minuta), kada se koriste glavno i požarno stepenište 984-1111,1 sekunde (tj. 16,4 -18,5 minuta), ako se koristi požarno stepenište 1997,6 -2765,3 sekunde (tj. 33,3-46,1 minuta) i ako se koristi samo glavno stepenište 1635 -2342 sekunde (tj. 22,8 -39,0 minuta).

U okviru ove studije korišćen je *Pathfinder*, jedan od najpoznatijih softvera za izračunavanje vremena evakuacije i predviđenje potencijalnih situacija prilikom evakuacije (6). Jedna od naročito pogodnih osobina ovog softvera je mogućnost da se „uveze“ fajl iz nekog kompjuterskog programa koji je dizajniran za crtanje i računanje, kao što su Auto Cad, FDS, PyroSim, itd. Ova mogućnost štedi vreme potrebno za dizajniranje objekta. Do sada je bilo nekoliko verzija *Pathfinder* softvera za simulaciju evakuacije. Verzija *Pathfinder*-a koja je korišćena u ovom radu je *Pathfinder 2020*. Ovim programom urađena je simulacija evakuacije, ne samo iz gerontološke ustanove, nego i iz visoke stambene

ne zgrade (slika 7) (11), hotela Radon u Niškoj Banji (slika 8) (7) i Trgovinskog centra Zona I (12).

Simulacije koje su predstavljale evakuaciju stanovnika visoke stambene zgrade sa prisustvom nepokretnih osoba pokazale su koliko se može produžiti vreme potrebno za evakuaciju u zavisnosti od broja nepokretnih osoba (11). Simulacije evakuacija su realizovane tako da je prvo uzet slučaj bez prisustva nepokretnih osoba, zatim slučaj sa prisustvom 5%, a potom 10% nepokretnih osoba od ukupnog broja stanovnika. Procenja brzina evakuacije u optimalnim uslovima kada u zgradi nema nepokretnih je 150,2 sekunde, kada je 5% nepokretnih je 172 sekunde, a kada je 10% nepokretnih je 299 sekundi (11). U najnepovoljnijem slučaju, procenjena brzina evakuacije kada u zgradi nema nepokretnih je 451,6 sekundi, kada je 5% nepokretnih 599,6 sekundi, a kada je 10% nepokretnih je 754 sekunde (11). Simulacije koje su predstavljale evakuaciju osoba i osoblja iz hotela Radon u Niškoj Banji pokazale su koliko se može produžiti vreme evakuacije ukoliko su potrebne manje ili veće asistencije oko nepokretnih i delimično pokretnih osoba i kada se koriste različiti putevi za evakuaciju (7). U okviru ovog modela nepokretne i delimično pokretne osobe su se nalazile na petom i šestom spratu hotela i zahtevale su asistenciju osoblja. Procenjena brzina evakuacije svih osoba u hotelu Radon u Niškoj Banji u optimalnom slučaju je 450,4 sekunde, a u najnepovoljnijem slučaju 607,2 sekunde (7). Simulacije koje



Slika 7. Trenutak tokom simulacije evakuacije iz visoke stambene zgrade, *Pathfinder 2020*. prezentacija (11)



Slika 8. Trenutak tokom simulacije evakuacije iz Hotela Radon u Niškoj Banji, *Pathfinder 2012*. prezentacija (7)

Simulation results for the first scenario (Figure 1), when all elevators and main and emergency stairs were enabled, showed that the evacuation time ranged from 895 seconds (14.9 minutes) (first situation) to 958 seconds (16 minutes) (fourth situation).

In the second scenario (Figure 2), when all elevators were disabled while main and emergency stairs were enabled, the evacuation time ranged from 984 seconds (16.4 minutes) (first situation) to 1111.1 seconds (18.5 minutes) (fourth situation).

In the third scenario (Figure 3), when all elevators and main stairs were disabled, while emergency stairs were enabled, the evacuation time ranged from 1997.6 seconds (33.3 minutes) (first situation) to 2765.3 seconds (46.1 minutes) (fourth situation).

In the fourth scenario (Figure 4), when no elevator was working and when the main, but not emergency stairs were available, the evacuation time ranged from 1365 seconds (22.8 minutes) (first situation) to 2342 seconds (39 minutes) (fourth situation).

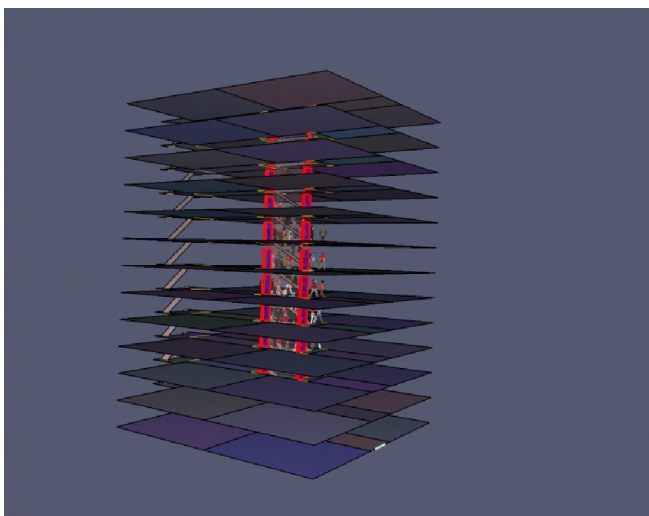
Discussion

The results of our research point to the fact that the evacuation time from the gerontology institution, where mobile, partly mobile and immobile persons older than 70 years were settled, can contribute to the improvement of emergency situations strategy.

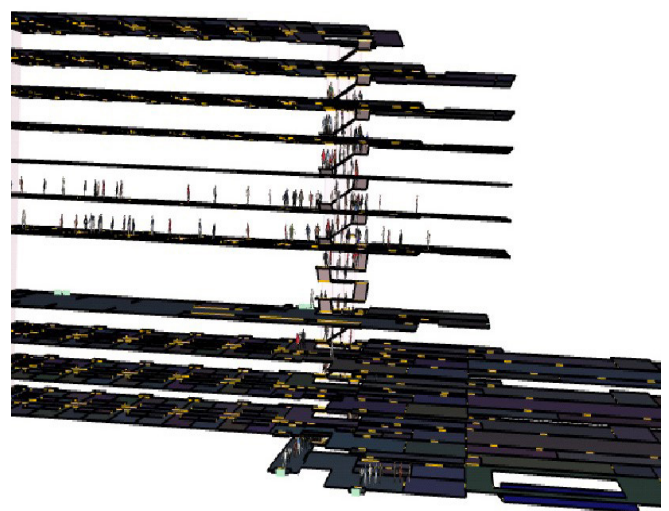
It was evaluated, by the usage of *Pathfinder 2020* software, that the evacuation time from the gerontology institution of a certain model, when all elevators and all stairs are accessible, is 895-958 seconds (14.9-16 minutes), when main and emergency stairs are used 984-1111.1 seconds (16.4-18.5 minutes), when emergency stairs are used 1997-2765 seconds (33.3-46.1 minutes) and when only main stairs are used 1635-2342 seconds (22.8-39.0 minutes).

For this research, the *Pathfinder*, one of the most famous software programs for the calculation of evacuation times and prediction of potential situations during the evacuation was used (6). One of the particularly appropriate properties of this software is a potential to "import" a file from some computer software designed for drawing and calculation, such as Auto Cad, FDS, PyroSim etc. This potential saves the time needed for the object design. So far, there have been several versions of *Pathfinder* simulation software. The version of *Pathfinder* used in this paper was *Pathfinder 2020* version. The simulation of evacuation by this program was used not only for the gerontology institution but also for the evacuation of people from the high residential building (Picture 7) (11), hotel Radon in Niška Banja (Picture 8) (7) and from market center Zona I (12).

The simulations that presented the evacuation of residents from a high residential building with the presence of immobile persons showed for how much the time needed for the evacuation can



Picture 7. A moment from the simulation of evacuation from high residential building, *Pathfinder 2020* presentation (11)



Picture 8. A moment from the simulation of evacuation from Hotel Radon in Niška Banja, *Pathfinder 2012* presentation (7)

su predstavljale evakuaciju prolaznika, posetilaca i radnika Trgovinskog centra Zona I pokazale su kako se može menjati vreme evakuacije u zavisnosti od broja i brzine kretanja prolaznika, posetilaca i radnika ovog centra (12). Pomoću ovakvog pristupa moguće je delimično predvideti gužve i zastoje koji mogu nastati i na taj način uticati na efikasnost evakuacije. Procenjeno je da se vreme evakuacije kada je 80 ljudi po spratu objekta 51-75 sekundi, za 100 ljudi po spratu 65-90 sekundi, a za 150 ljudi po spratu 1600 do 1900 sekundi (12).

Prema proceni Ujedinjenih nacija očekuje se dalji porast stanovništva starijeg od 65 godina, tako da je 2019. godine svaka jedanaesta osoba bila ovog uzrasta, a 2050. godine to će biti svaka šesta (13). Starenje populacije prisutno je u svakoj zemlji. Na globalnom nivou došlo je do porasta udela starih od 65 i više godina sa 9% u 2019. godini, na 16% u 2050. godini (13). Porast broja starih doprineće porastu opterećenja gerontoloških ustanova. Osim toga, briga o starima je još veća znajući da mogu imati fizička ili mentalna oštećenja koja im otežavaju brigu o sebi, pa samim tim i evakuaciju. Svaka evakuacija starijih lica, posebno delimično ili potpuno nepokretnih, zahteva i angažovanje medicinskih lica koja treba da im pruže pomoć u procesu evakuacije. Imajući sve ovo na umu, jako su važna istraživanja ove vrste, jer doprinose da se starija lica osećaju sigurnim i tokom vanrednih situacija. Nove mere i koncepti starenja stanovništva imaju značajne implikacije na procenu kvaliteta uslova življenja i njegovo stalno unapređivanje, pogotovo u gerontološkim ustanovama.

Zaključak

Korišćenje *Pathfinder* softvera za simulaciju evakuacije predstavlja veoma važan, bezbedan i finansijski povoljan način predviđanja evakuacije i izračunavanje vremena potrebnog za evakuaciju. Najvažnija prednost prilikom korišćenja ovog softvera za simulaciju je činjenica da se mogu testirati i porediti mnogi različiti scenariji simulacije, i na osnovu toga izabrati najbolji evakuacioni scenario. Najbolji evakuacioni scenario podrazumeva najbolji put evakuacije, najbolji model ponašanja korisnika i najbolje korišćenje stepeništa, liftova i

vrata, što je naročito važno za složene objekte, kao što su objekti sa nepokretnim licima, poput bolnica i gerontoloških ustanova, institucije za rehabilitaciju i slično. Vreme evakuacije iz gerontološke ustanove je najkraće kada rade oba lifta i kada može da se koristi glavno i požarno stepenište, a najduže kada je u funkciji samo požarno stepenište.

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be extended in dependence on immobile persons' number (11). Simulations of evacuations were realized without the presence of immobile persons, with the presence of 5% and 10% immobile persons related to the total number of residents. The evaluated speed of evacuation without the presence of immobile persons was 150.2 seconds, with the presence of 5% of immobile persons 172 seconds and with the presence of 10% of immobile persons 299 seconds, in the optimal case (11). For the worst case, the evaluated speed of evacuation without the presence of immobile persons was 451.6 seconds, with the presence of 5% of immobile persons 599.6 seconds and with the presence of 10% of immobile persons 754 seconds (11). The simulations that presented the evacuation of patients and staff from hotel Radon in Niška Banja showed for how much the time needed for the evacuation can be extended in the dependence on smaller or bigger assistances for immobile or partially mobile persons and evacuation routes (7). Immobile and partially mobile persons were located on the sixth and fifth floor and they demanded the assistance of medical staff. The evaluated speed of evacuation of all persons from hotel Radon in Niška Banja in the optimal case was 450.4 seconds, and in the worst case, 607.2 seconds (7). Simulations that presented the evacuation of passers-by, visitors and workers of market center Zona I showed how the time of evacuation can be changed in dependence on the number and speed movement of passers-by, visitors and workers of this center (12). Using this approach, it is partially possible to predict crowds and jams that can occur, and in that way, increase the efficiency of evacuation. It was evaluated that the evacuation time for the case of 80 people per floor ranged from 51 to 75 seconds, in dependence on the evacuation speed. For the case of 100 people per floor, the evacuation time ranged from 65 to 90 seconds, in dependence on the evacuation speed. For the case of 150 people per floor, there were crowds and jams and then the evacuation time ranged from 1600 to 1900 seconds (12).

According to the United Nations evaluation, a further increase in the population over the age of 65 is expected so that in 2019 every eleventh person was from this age group and in 2050, it will be every sixth person (13). The ageing of population is present in every country. At the global level, there has been an increase in the share of

people older than 65 from 9% in 2019 up to 16% in 2050 (13). The increase of older persons will contribute to increasing the workload of gerontology institutions. Besides, the care for the elderly is even bigger when they have physical or mental disorders that make self-care and evacuation more difficult. Every evacuation of older persons, particularly partially moved or immobile demands the engagement of medical staff that should take care of them in the evacuation process. With all this in mind, the researches of this kind are very important because they contribute to older persons' safety during emergencies. New measurements and concepts of population ageing have significant implications on the evaluation of quality of life and its permanent improvement, especially in gerontology institutions.

Conclusion

Using *Pathfinder* evacuation simulation software is a very important, safe and financially favorable way to predict evacuation and calculate the time required for the evacuation. The most important advantage of simulation software usage is in the fact that many different simulation scenarios can be tested, compared and, based on that, the best evacuation scenario can be chosen. The best evacuation scenario implies the best evacuation route, the best model of user behavior and the best use of stairs, elevators and doors, which is especially important for complex objects, such as objects with the presence of immobile persons: hospitals, gerontology institutions, rehabilitation institutions and similar. The evacuation time from the gerontological institution is shorter when both elevators and the main and emergency staircase are in function, and the longest when only the emergency staircase is in function.

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PRVI PRIKAZ UČINKA TERAPIJE HORMONOM RASTA KOD PACIJENTA SA SPONDILODISPLASTIČNIM TIPOM EHLERS-DANLOSOVOG SINDROMA I NORMALNOM SEKRECIJOM HORMONA RASTA

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SAŽETAK

Uvod/Cilj: Spondilodisplastični tip Ehlers-Danlosovog sindroma (sdEDS) je redak genetski poremećaj sinteze kolagena, uzrokovan mutacijama u B4GALT7, B3GALT6 ili u SLC39A13 genu. Karakteristike ovog veoma retkog poremećaja su nizak rast, hipotonija, hiperfleksibilni zglobovi, meka, tanka i preterano rastegljiva koža, retka kosa i obrve, stariji izgled lica, široko čelo i sporo zarastanje rana. Molekularna genetska analiza je neophodna za definitivnu potvrdu dijagnoze. Do sada su objavljena samo tri prikaza, koja opisuju odgovor na lečenje hormonom rasta (HR) kod pacijenata sdEDS. Svi ovi pacijenti su imali nedostatak HR. Predstavljamo prvi prikaz primene HR kod pacijenta sa sdEDS i normalnom sekrecijom HR.

Prikaz slučaja: Pacijent je bila devojčica niskog rasta sa normalnom sekrecijom HR. Kod devojčice je, imajući u vidu da je rođena mala za gestaciono doba, zbog niskog rasta započeto sa primenom HR, pre nego što je postavljena dijagnoza sdEDS. Zbog slabog terapijskog odgovora, odnosno spore brzine rasta uz primenu HR, kao i zbog fenotipa, sprovedena su genetska ispitivanja, kojima je postavljena dijagnoza sdEDS usled bialelne mutacije B4GALT gena. Po postavljanju dijagnoze sdEDS, kao i zbog neadekvatnog odgovora na terapiju, terapija HR je prekinuta u uzrastu od 11 godina.

Zaključak: Ovo je prvi prikaz primene terapije HR kod deteta sa sdEDS i normalnom sekrecijom HR, koja ukazuje na veoma ograničen terapijski efekat HR na linearni rast deteta sa sdEDS.

Cljučne reči: spondilodisplastični tip Ehlers-Danlosovog sindroma (sdEDS), beta-1,4 galaktoziltransferaza 7 (B4GALT7), terapija hormonom rasta

Uvod

Ehlers-Danlovov sindrom (engl. *Ehlers-Danlos syndrome - EDS*) predstavlja grupu retkih naslednih poremećaja vezivnog tkiva, koji za posledicu imaju poremećaj sinteze kolagena. Prema međunarodnoj klasifikaciji Ehlers-Danlosovog sindroma, postoji trinaest tipova EDS-a: klasična forma EDS-a, kardio-valvularni, vaskularni, hipermobilni, artrohalazija EDS, dermatosparaksis, kifoskolioza, sindrom krhke rožnjače, spondilodisplastični EDS, mukulokontrakturalni EDS, miopatički EDS, i periodontalni EDS (1).

Spondilodisplastični tip Ehlers-Danlosovog sindroma (sdEDS) može biti uzrokovan mutacijom u B4GALT7 genu (kodira β 1,4-galaktoziltransferazu 7), B3GALT6 (kodira β 1,3-galaktoziltransferazu 6) ili SLC39A13 genu (kodira transmembranski protein

transporter cinka). Bialelne varijante u B4GALT7 genu se dovode u vezu sa sdEDS, a do sada su registrovana trideset i tri pacijenta sa značajnom fenotipskom varijabilnošću (2).

B4GALT7 gen se nalazi na hromozomu 5 i kodira β 1,4-galaktoziltransferazu, koji vezuje glikozaminoglikane za proteoglikane u vezivnim tkivima. Proteoglikani su velika komponenta ekstracelularnog matriksa i važni su za strukturu i funkciju vezivnog tkiva (3,4).

Minimalni klinički kriterijumi koji ukazuju na dijagnozu sdEDS su sledeći: nizak rast i mišićna hipotonija (veliki kriterijumi), u kombinaciji sa barem tri mala kriterijuma i karakterističnim radiografskim abnormalnostima (Tabela 1). Konačna dijagnoza zahteva potvrdu molekularnih genetskih analiza (5).

FIRST REPORT ON GROWTH HORMONE TREATMENT RESPONSE IN A PATIENT WITH SPONDYLODYSPLASTIC TYPE OF EHLERS-DANLOS SYNDROME WITH NORMAL GROWTH HORMONE SECRETION

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SUMMARY

Introduction/Aim: Spondylodysplastic Ehlers-Danlos Syndrome (sdEDS) is a rare genetic disorder of collagen synthesis, caused by a mutation in the B4GALT7, B3GALT6, or SLC39A13 gene. Features of this very rare disorder are short stature, hypotonia, hyperflexible joints, soft, thin, and overly stretchable skin, sparse hair and eyebrows, elderly face, wide forehead and prolonged wound healing. Molecular genetic analysis is needed for definite confirmation of the diagnosis. So far, only three case reports describing growth hormone treatment response in patients with sdEDS have been published. All of these patients had growth hormone (GH) deficiency. We present the first case report regarding growth hormone treatment response in a patient with sdEDS and normal GH secretion (without GH deficiency).

Case report: Patient was a girl with short stature and normal GH secretion. Having in mind that the girl was born small for the gestational age, due to her short stature, she started using HR, before the diagnosis of sdEDS was made. Based on the lack of improvement in growth velocity as well as the girl's phenotype, genetic analyses were performed and the diagnosis of sdEDS due to biallelic mutations of the B4GALT7 gene was established. After the diagnosis of sdEDS was made and due to suboptimal response in growth velocity to the GH treatment, the GH therapy was stopped at the age of 11 years.

Conclusion: This is a first case report regarding GH treatment in a child with sdEDS and normal GH secretion, demonstrating a very limited therapeutic effect of GH on linear growth in the presented patient.

Keywords: spondylodysplastic Ehlers-Danlos Syndrome (sdEDS), beta-1,4-galactosyltransferase 7 (B4GALT7), growth hormone treatment

Introduction

Ehlers-Danlos Syndrome (EDS) represents a group of rare hereditary connective tissue disorders, resulting in a disruption of collagen synthesis. According to the International classification of Ehlers-Danlos Syndrome, there are thirteen types of EDS: Classical EDS, Classical-like EDS, cardiac-valvular, vascular, hypermobile, arthrochalasia EDS, dermatospraxis, kyphoscoliotic, brittle cornea syndrome, spondylodysplastic EDS, musculocontractural EDS, myopathic EDS, periodontal EDS (1).

Spondylodysplastic type of Ehlers-Danlos syndrome (sdEDS) can be caused by mutations in the B4GALT7 (encodes β 1,4-galactosyltransferase 7), B3GALT6 (encodes β 1,3-galactosyltransferase 6)

or SLC39A13 (encodes transmembrane zinc like protein 13) genes. Biallelic variants in B4GALT7 have been associated with sdEDS, with thirty-three patients reported to date with significant phenotypic variability (2).

B4GALT7 gene is located on chromosome 5 and it encodes beta-1,4-galactosyltransferase which links glycosaminoglycans to proteoglycans in connective tissues. Proteoglycans are a major component of the extracellular matrix and are important for the structure and function of connective tissue (3,4).

Minimal clinical criteria suggesting the diagnosis of spEDS are: short stature and muscle hypotonia (major criteria), combined with at least three minor criteria and characteristic radiographic ab-

Tabela 1. „Major” i „minor” kriterijumi za dijagnozu spondilodisplastičnog tipa Ehlers-Danlosovog sindroma (1)

„Major” kriterijumi	„Minor” kriterijumi
Nizak rast Mišićna hipotonija Angulacija ekstremiteta	Preterana rastegljivost kože, meka koža poput testa Spušteno stopalo Usporen motorni razvoj Osteopenija Usporen kognitivni razvoj Gen-specifični minorni kriterijumi za B4GALT7 mutaciju: – Radioulnarna sinostoza – Bilateralne kontrakture lakta i ograničena pokretljivost lakta – Generalizovana hiperobilnost zglobova – Simianska linija na dlanu – Karakteristične kraniofacijalne osobine (trouglasto lice, razmaknute oči, proptoza, uska usta, nisko spuštene uši, retka kosa skalpa, abnormalan raspored i broj zuba, ravno lice, široko čelo, plava sklera, i rascep nepca) – Karakteristični radiografski nalazi (uključuju radioulnarnu sinostoza, deformitete metafize, osteopeniju, subluksaciju ili dislokaciju lakta, i kratku ključnu kost sa širokim medijalnim krajevima) – Ozbiljna hipermetropija – Zamagljena rožnjača

Do sada je u medicinskoj literaturi prijavljeno jedanaest pacijenata sa sdEDS i B4GALT7 mutacijom (2,4-7).

Iako je nizak rast prisutan praktično kod svih pacijenata sa sdEDS, ishodi lečenja hormonom rasta su samo sporadično prijavljivani kod ovih pacijenata, a do sada su objavljena samo tri prikaza slučaja pacijenata sa sdEDS koji su primali hormon rasta (GH). Svi ovi pacijenti su imali nedostatak hormona rasta (5,8).

Cilj ovog prikaza slučaja je da prikaže odgovor na terapiju hormonom rasta deteta sa sdEDS i normalnim lučenjem hormona rasta (bez nedostatka ovog hormona).

Prikaz slučaja

Pacijentkinja je devojčica rođena kao drugo dete iz druge, redovno kontrolisane trudnoće. Tokom osmog meseca trudnoće, primećena je intrauterina restrikcija rasta (eng. *Intrauterine Growth Restriction* - IUGR). Rođena je carskim rezom, u 39. nedelji gestacije, i bila je mala za gestaciono doba: težina na rođenju 2400 grama (< 10-og percentila) i dužina 44 cm (< 10-og percentila), dok je Apgar skor bio 9. Hipotonija je primećena tokom neonatalnog perioda, sa usporenim motornim razvojem tokom perioda odojčeta i ranog detinjstva. Mogla je da sedi bez pomoći sa 12 meseci, dok je samostalno mogla da hoda sa 4 godine.

Od perioda odojčeta, išla je na fizikalnu terapiju i konsultacije kod ortopeda zbog usporenog motornog razvoja, luksacije kukova i deformiteta kičme (ozbiljna skolioza: leva torakalna i desna lumbalna skolioza) (Slika 1). Takođe je pratio kardiolog zbog atrijalnog septalnog defekta (ASD). Magnetna rezonanca je urađena sa 12 meseci zbog izbačenog čela i generalizovane hipotonije i pokazala je blagu redukciju bele mase supratentorijalno i ventrikulomegaliju. Takođe, *sella turcica* je opisana kao uvećana sa smanjenim parenhimom hipofize, u skladu sa dijagnozom „sindroma prazne selle“. Kada je imala 21 mesec, upućena je na konsultacije kod endokrinologa zbog niskog rasta. Devojčicin deda je imao disekciju abdominalne aorte i nije bilo drugih značajnih nalaza u porodičnoj istoriji. Tata je bio visine 192,0 cm, a mama 169,0 cm, tako da je srednja vrednost visine roditelja bila 174,0 cm, sa skorom (z-skor) standardne devijacije (SD) od otprilike +1,5 SD.

Kao što je prikazano na slici 2, u uzrastu od 21 mesec, devojčica je imala ozbiljno nizak rast sa visinom 71,0 cm (z-skor -3,94 SD), telesnom težinom 6.430 g (-4,33 SD) i BMI 12,5 kg/m² (-2,67 SD). Bila je u prepubertetskom stadijumu, nije mogla da hoda samostalno. Ostatak fizičkog pregleda nije pokazao značajnije nalaze.

Nivoi kalcijuma, fosfora, alkalne fosfataze, elektrolita, tiroidnih hormona i kortizola, kao i

Table1. Major and minor criteria for diagnosis of spondylodysplastic Ehlers–Danlos Syndrome (1)

Major criteria	Minor criteria
Short stature	Skin hyperextensibility, soft, doughy skin
Muscle hypotonia	Pes planus
Bowling of limbs	Delayed motor development
	Osteopenia
	Delayed cognitive development
	Gene-specific minor criteria for B4GALT7 mutation:
	– Radioulnar synostosis
	– Bilateral elbow contractures or limited elbow movement
	– Generalized joint hypermobility
	– Single transverse palmar crease
	– Characteristic craniofacial features (triangular face, wide-spaced eyes, proptosis, narrow mouth, low-set ears, sparse scalp hair, abnormal dentition, flat face, wide forehead, blue sclerae, and cleft palate)
	– Characteristic radiographic findings (include radioulnar synostosis, metaphyseal flaring, osteopenia, radial head subluxation or dislocation, and short clavicles with broad medial ends)
	– Severe hypermetropia
	– Clouded cornea

normalities (Table 1). A final diagnosis requires confirmation by molecular testing (5).

Eleven patients with sdEDS and B4GALT7 mutation have been reported so far in the medical literature (2,4-7).

Although short stature, usually severe, is present in virtually all patients with sdEDS, outcomes of growth hormone treatment in these patients has been only sporadically reported, with case reports on only three patients with sdEDS receiving growth hormone (GH) treatment published so far. All of these patients had partial GH deficiency (5,8).

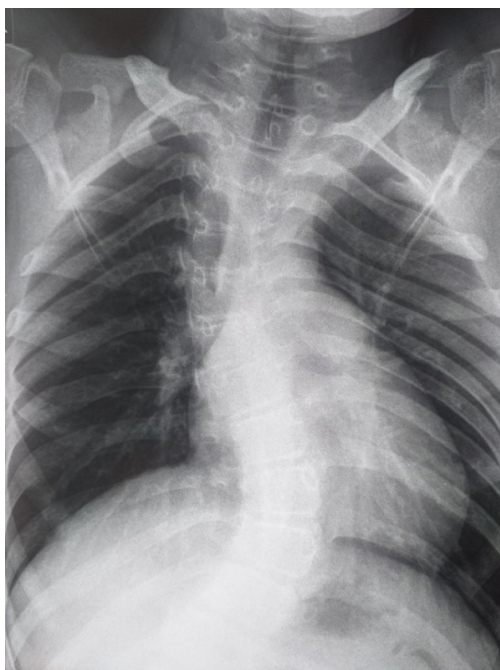
The aim of this case report was to present a response to growth hormone therapy in a child with sdEDS and normal secretion of GH (without GH deficiency).

Case report

The patient was a girl, born as a second child from second, regularly controlled pregnancy. During the eight month of pregnancy, intrauterine growth restriction (IUGR) was observed. She was delivered by caesarean section, at 39 weeks of gestation, small for gestational age (SGA): birth weight was 2400 grams (<10th percentile) and body length 44 cm (<10th percentile), Apgar score was 9. Hypotonia was noted during the neonatal period, with delayed motor development during infancy and early childhood. She was able to sit unassisted

at the age of 12 months, walked independently at the age of 4 years. Since infancy, she had physical therapy and orthopedic consults due to slow motor development, hip luxation and spinal deformity (severe scoliosis: thoracic sinistro-convex and lumbar dextro-convex scoliosis) (Figure 1). She was also followed-up by a cardiologist because of an atrial septal defect (ASD). Because of the prominent forehead and generalized hypotonia magnetic resonance imaging (MRI) was performed at the age of 12 months, showing a mild degree of supratentorial white mass reduction and ventriculomegaly. Also, *sella turcica* was described as enlarged with reduced parenchyma of the pituitary gland, consistent with the diagnosis of the Empty Sella Syndrome. At the age of 21 months, she was referred for an endocrinology consult because of her short stature. Girl's grandfather had an abdominal aortic dissection with no other notable findings in family history. Father's height is 192.0 cm, mother's height 169.0 cm, with girl's mid parental height at 174.0 cm, with standard deviation (SD) score (z-score) of approximately +1.5 SD.

As shown in Figure 2, at the age of 21 months, the girl had a severely short stature with a body height of 71.0 cm (z-score -3.94 SD), bodyweight 6430 g (-4.33 SD) and BMI 12.5 kg/m² (-2.67). She was in the prepubertal stage of development, she could not walk independently. The rest of her physical exam was unremarkable.



Slika 1. Rendgenski snimak pluća u uzrastu od 10 godina koji pokazuje ozbiljan stepen skolioze

transglutaminska antitela bili su u okviru normalnih vrednosti. Test stimulacije za hormon rasta (glukagon test) pokazao je normalnu sekreciju hormona rasta i kortizola, sa najvećom vrednošću hormona rasta u serumu od 10,0 ng/ml i najvećom vrednošću kortizola od 860 nmol/l. Insulinu sličan faktor rasta 1 (IGF-1) je bio u okviru normalnih vrednosti 53,1 ng/ml (referentne vrednosti 11-206 ng/ml). Starost kostiju je odgovarala uzrastu devojčice. Zaključeno je da je nizak rast posledica intrauterine restrikcije rasta, tako da je savetovano da se dalje prati ubrzani rast pre otpočinjanja lečenja hormonom rasta zbog niskog rasta kod ovog deteta.

Sa tri godine, devojčica je operisana zbog iščašenja levog kuka. Takođe je uvedena kineziterapija i prepisan je ortopedski korset.

Sa 4 godine i 2 meseca, primećeno je da je ubrzani rast izostao i da je njena visina bila i dalje ispod -3 SD (težina 10,2 kg, visina 86,6 cm). Zbog toga je započeto lečenje hormonom rasta, i to u dozi od 0,035 mg/kg/dan (0,24 mg/kg/nedeljno), prema protokolu za lečenje niskog rasta kod dece koja su rođena mala za gestaciono doba (MGD).

Tokom naredne dve godine lečenja hormonom rasta, devojčica je porasla 13,3 cm, sa visinom od -3 SD (99,9 cm). Psihomotorni razvoj je zaostajao za otprilike 18 meseci, uz kašnjenje motorike i govora i sa neurorazvojnim skorom (QR) 50-55.

Sa 10 godina, zbog izostanka adekvatnog odgovora na terapiju hormonom rasta, urađene su

dalje analize. Zbog činjenice da je devojčica imala splenomegaliju i leukopeniju, i nekoliko epizoda pneumonije u istoriji bolesti, konsultovan je imunolog i urađene su dodatne analize. Utvrđeno je da je devojčica imala običnu varijabilnu imunodeficijenciju (eng. *Common Variable Immunodeficiency* - CVID). Uvedena je terapija imunoglobulina intravenski (IVIg).

Na pregledima koji su usledili utvrđeno je da nije došlo do pogoršanja skolioze, a nisu primećene ni druge komplikacije zbog terapije hormonom rasta. S obzirom da je uvedena terapija IVIg za CVID, devojčica dalje nije imala infekcije. Međutim, nije bilo napredovanja u brzini rasta. Doza hormona rasta je prilagođena na osnovu devojčicine težine, nivoa IGF-1, i u uzrastu od 10 godina dostignuta je maksimalna doza hormona rasta od 0,05 mg/kg/dnevno (0,37 mg/kg/nedeljno). Zbog visoke doze hormona rasta i nivoa IGF-1 koji je bio na donjoj granici referentnog opsega, urađen je test generisanja IGF-1 kojim je dobijeno značajno povećanje nivoa IGF-1 kada je majka ponovo edukovana o pravilnom davanju terapije hormona rasta (od 78,7 do 214 ng/ml). Nakon testa proizvodnje IGF i reedukacije, nivoi IGF-1 su bili u okviru referentnih vrednosti. Međutim, brzina rasta se nije popravila u toku naredne godine (Slika 2). Stoga je, zbog nedostatka efekta terapije, u uzrastu od 11 godina prekinuto lečenje hormonom rasta.

S obzirom da se dijagnoza obične varijabilne imunodeficijencije povezuje sa niskim rastom,

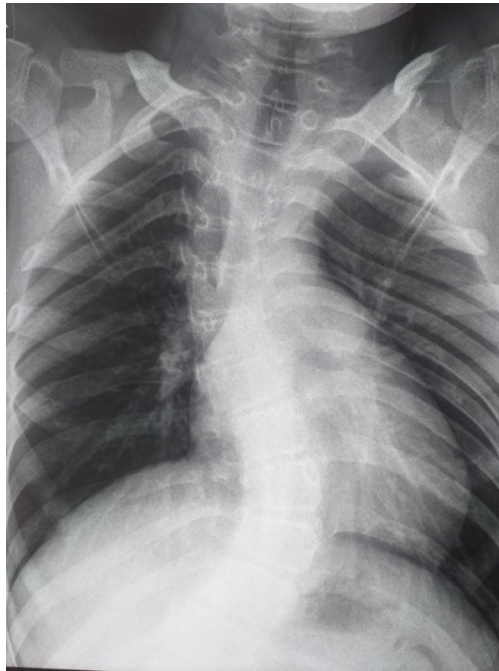


Figure 1. Chest X-ray at the age of ten years, showing the severe degree of scoliosis

Calcium, phosphorus, alkaline phosphatase, electrolytes, thyroid hormones and cortisol levels and tissue transglutaminase antibodies were within normal ranges. Growth hormone provocative testing (glucagon test) demonstrated a normal secretion of GH and cortisol, with a peak serum GH level of 10.0 ng/ml and peak cortisol level of 860 nmol/l. Her insulin-like growth factor 1 (IGF-1) level was normal 53.1 ng/ml (normal range 11-206 ng/ml). The bone age was appropriate for the girl's age. It was concluded that short stature was due to intrauterine growth restriction, so further follow-up for "catch-up" growth was advised before starting the GH treatment for short stature in SGA child.

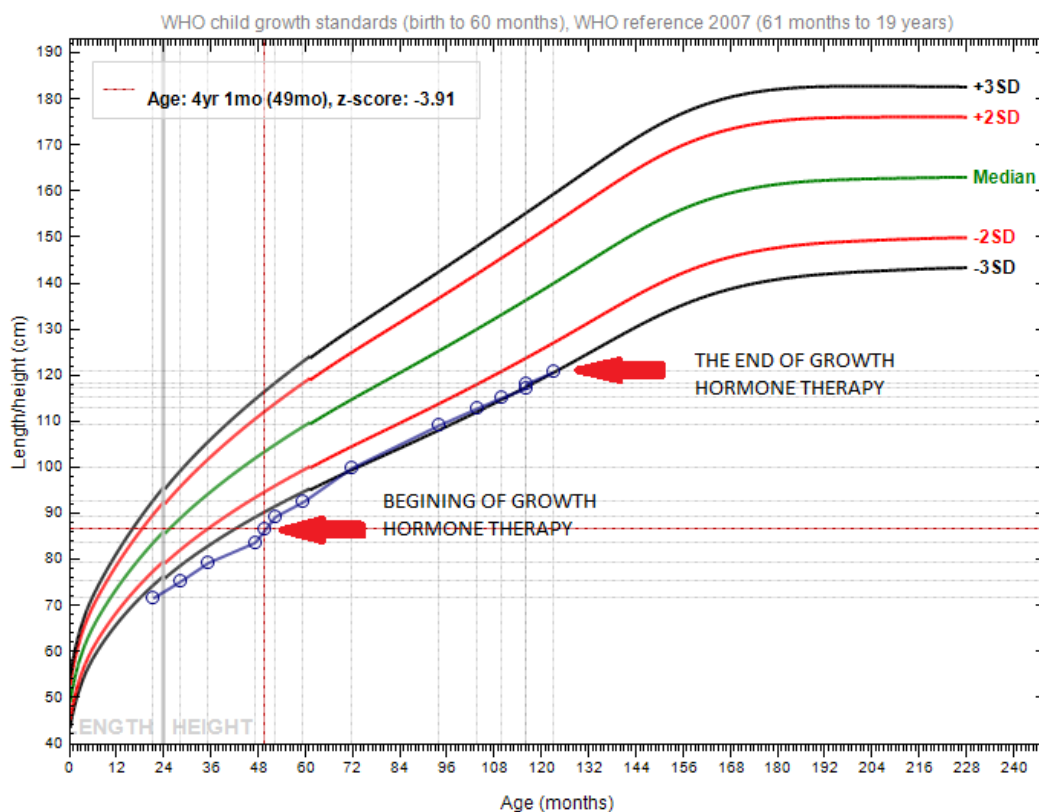
At the age of 3 years, she underwent surgery for left hip dislocation. She was also started on kinesitherapy and an orthopedic corset was prescribed.

At the age of 4 years and 2 months, it was noted that no catch-up growth occurred and her body height was still below -3 SD (BW 10,2kg, BH 86,6cm). Thus, GH treatment was started, in a dose of 0.035 mg/kg/daily (0.24 mg/kg/weekly) as per protocol for the treatment of short stature in SGA child.

During the next two years of GH treatment she grew up 13.3 cm, with body height at -3 SD (99.9 cm). Psychomotor development was lagging by approximately 18 months, with motor and speech delays with neurodevelopmental (QR) score assessed at 50-55.

At the age of 10, because of a lack of proper response to the GH treatment, further analyses were performed. Due to the fact that she had splenomegaly and leukopenia, with a history of several episodes of pneumonia immunologist was consulted and additional tests were performed. It was determined that the girl had common variable immunodeficiency (CVID). Intravenous immunoglobulin (IVIG) therapy was started.

On the follow-up examinations there was no worsening of scoliosis, and no other complications of GH treatment were observed. Since she was started on IVIG treatment for CVID, she had no further infections. However, there was no improvement in the growth velocity. The dose of growth hormone was adjusted according to the girl's weight, and IGF-1 levels, and at the age of 10, the maximum dose of growth hormone of 0.05 mg/kg/day (0.37mg/kg/week) was reached. Because of the high GH dose with IGF-1 levels at the low range, the IGF-1 generation test was performed, showing a significant increase in the level of IGF-1 once the mother was properly re-educated regarding the correct administration of GH (from 78.7 to 214 mg/ml). After the IGF generation test and re-education, IGF-1 levels were kept within reference range. However, growth velocity did not improve during the next year (Figure 2). Therefore, due to the lack of effect of therapy at the age of 11, the GH treatment was stopped.



SD – standardna devijacija

Slika 2. Grafikon rasta koji pokazuje visinu pacijenta pre lečenja hormonom rasta (kreiran uz pomoć *WHO Anthro Plus* softvera)

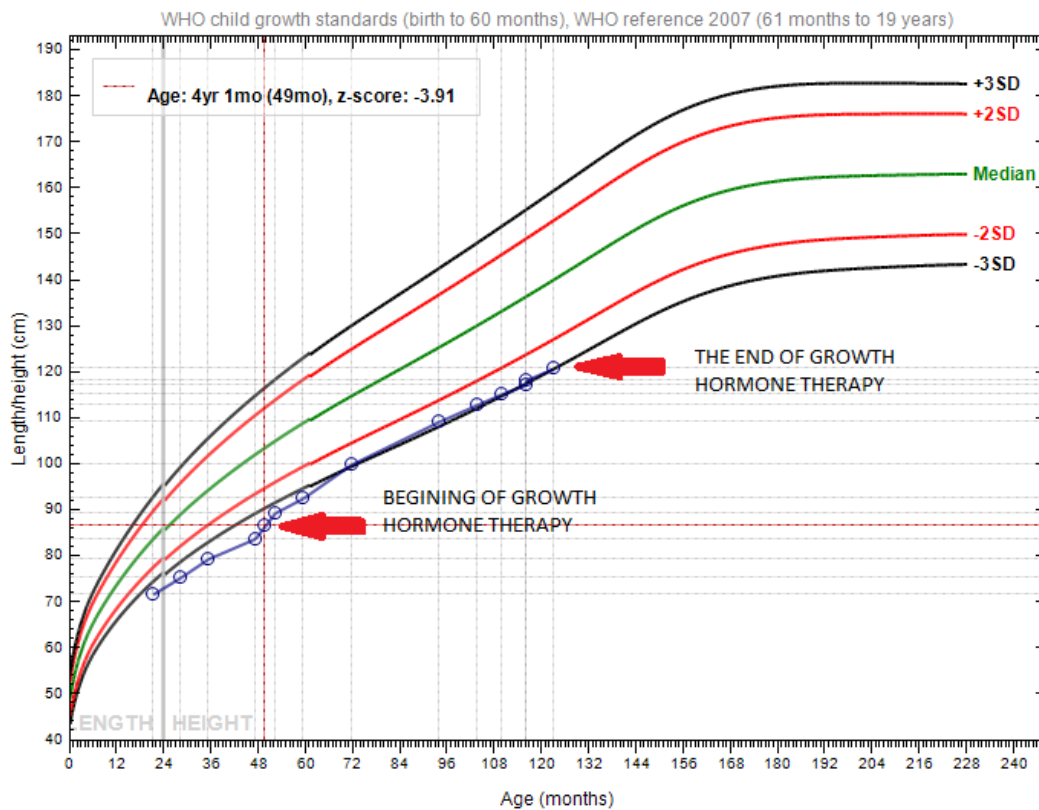
izraženom torakalnom i lumbalnom skoliozom, dodatnim fenotipskim karakteristikama, koje su postajale izraženije sa godinama (utisak malo starijeg izgleda lica, izbačeno čelo, hipoplastični tragus, tanki i suženi prsti, hiperekstenzija kolena, tanka i retka kosa, elastična i tanka koža), urađeno je sekvenciranje kliničkog egzoma (QGemonics laboratorija, Barselona, Španija). Identifikovane su dve „missense” varijante (007255:c.573C>A; c.700C>T) u B4GALT7 genu, sa bioinformatičkim sredstvima za predviđanje, koja su ukazala na štetan efekat ovih varijanti na funkciju i strukturu proteina koji gen B4GALT7 kodira. Jedna varijanta je nasleđena od oca, a druga od majke, potvrđujući bialelno nasleđivanje varijanti u B4GALT7 genu, u skladu sa dijagnozom spondilodisplastičnog Ehlers-Danlosovog sindroma tipa 1.

Diskusija

Spondilodisplastični tip Ehlers-Danlosovog sindroma karakterišu nizak rast, mišićna hipotonija, laksitet zglobova i angulacija ekstremiteta, deformiteti skeleta i hiperelastična koža. Do sada je bilo jedanaest pacijenata sa genetički potvrđenom dijagnozom sdEDS sa mutacijom u B4GALT7 genu,

a objavljeni su prikazi slučaja u vezi sa primenom terapije hormonom rasta samo za troje od ovih pacijenata (5,8).

Sandler-Wilson i saradnici (8) opisali su slučaj brata i sestre sa radioulnarnom sinostozom, niskim rastom, usporenim motornim i kognitivnim razvojem, osteopenijom, koronarnim rascepom, rascepom nepca i bialelnim patogenetskim varijantama u B4GALT7 genu i kod brata i kod sestre (c.421C>T:P.Arg141Trp; c.808C>T:p.Arg270Cys). Brat i sestra su imali parcijalnu deficijenciju hormona rasta koju je pokazalo provokativno testiranje sa klonidinom i glukagonom (sa najvećom vrednošću serumskog hormona rasta od 6,0 ng/ml). Lečenje hormonom rasta (0,3 mg/kg/nedeljno) tokom tri godine kod brata i sestre je povezivano sa porastom brzine rasta, sa napredovanjem u visini od -4,6 SD u uzrastu od 4 godine do -3,7 SD i -3,5 SD u uzrastu od 5 i 6 godina (8). *Guo* i saradnici (5) su prijavili desetogodišnjeg dečaka sa angulacijom podlaktice, fleksibilnošću zglobova, bilateralnom radioulnarnom sinostozom, mekom, baršunastom, preterano rastegljivom kožom, hipotonijom, smetnjama u učenju, niskim rastom i bialelnim B4GALT7 varijantama (c.122T>C; p.Le-



SD – standard deviation

Figure 2. Growth chart showing the patient's height before and during the treatment with growth hormone (produced using WHO Anthro Plus software)

Because the diagnosis of CVID was associated with short stature, pronounced thoracolumbar scoliosis and additional phenotypic features which were becoming more prominent with advancing age (impression of slightly older facial appearance, prominent forehead, hypoplastic tragus, slender and tapered fingers, hyperextension of knee joints, thin and sparse hair, elastic and thin skin), clinical exome sequencing was performed (QGenomics laboratory, Barcelona, Spain). Two "missense" variants (007255:c.573C>A; c.700C>T) were identified in the B4GALT7 gene, with prediction bioinformatics tools suggesting a deleterious effect of the variants over function or structure of the protein encoded by the B4GALT7 gene. One variant was inherited from the father and one from the mother, confirming the biallelic inheritance of the variants in the B4GALT7 gene, in line with the diagnosis of type 1 spondylodysplastic Ehlers-Danlos Syndrome (EDS).

Discussion

Ehlers-Danlos Syndrome spondylodysplastic type 1 is characterized by short stature, muscle hypotonia, joint laxity and bowing of the limbs, skeletal

deformities and skin hyperextensibility. Until now there have been eleven patients with genetically confirmed diagnosis of sdEDS with B4GALT7 mutation and there are case reports published regarding GH treatment for only three of these patients (5,8).

Sandler-Wilson et al. (8) described male and female siblings with radioulnar synostosis, short stature, delayed motor and cognitive development, osteopenia, coronal clefts, cleft palate and biallelic pathogenetic variants in B4GALT7 in both siblings (c.421C>T:P.Arg141Trp; c.808C>T:p.Arg270Cys). These male and female siblings had partial GH deficiency demonstrated by provocative testing with clonidine and glucagon (with peak serum GH of 6.0 ng/ml). GH treatment (0.3 mg/kg/week) during 3 years in both siblings was associated with an increase in their growth velocity, with height improvement from -4.6 SD at the age of 4 years to -3.7 SD and -3.5 SD at ages 5 and 6 years (8). Guo et al. (5) reported a 10-year-old boy with forearm bowing, joint flexibility, bilateral radioulnar synostoses, soft, velvety, hyperextensible skin, hypotonia, learning disability, short stature and biallelic B4GALT7 variants (c.122T>C; p.Leu41Pro

u41Pro i c.808C>T; p.Arg270Cys). Ovaj pacijent je takođe imao parcijalnu deficijenciju hormona rasta sa najvećom vrednošću hormona rasta od 8,96 ng/ml tokom testa stimulacije hormona rasta. Nakon 4,5 godine lečenja hormonom rasta, nije primećena značajna promena u brzini rasta ove pacijentkinje (5).

Predstavljeni slučaj je prvi prikaz slučaja pacijentkinje sa sdEDS i normalnom sekrecijom hormona rasta, koja je lečena hormonom rasta zbog niskog rasta deteta rođenog malog za gestaciono doba, pre nego što je postavljena dijagnoza sdEDS. Na osnovu izostanka napredovanja u brzini rasta i devojčicinog fenotipa, tražena je genetska analiza i postavljena je dijagnoza sdEDS zbog bialelnih mutacija u B4GALT7 genu. Nakon što je dijagnoza sdEDS postavljena i zbog ograničenog odgovora na terapiju hormonom rasta, terapija hormonom rasta je prekinuta u uzrastu od 11 godina.

Zaključak

Ovo je prvi prikaz slučaja pacijenta sa genetski potvrđenim sdEDS i normalnom sekrecijom HR tokom provokativnog testiranja HR, koji ilustruje veoma ograničen odgovor na terapiju HR kod ovog pacijenta.

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and c.808C>T; p.Arg270Cys). This patient also had partial GH deficiency, with a peak of GH level of 8.96 ng/ml during GH stimulation test. After 4.5 years of GH treatment, no significant change in the patient's growth velocity was observed (5).

The presented case is the first case report of the patient with sdEDS and normal GH secretion, who received GH treatment due to the lack of "catch-up" growth in a child born SGA, before the diagnosis of sdEDS was clear. Based on the lack of improvement in height velocity as well as the girl's phenotype, genetic analysis was sought and the diagnosis of sdEDS due to biallelic mutations of the B4GALT7 gene was established. After the diagnosis of sdEDS was made and due to limited response to the GH treatment, the GH therapy was stopped at the age of 11 years.

Conclusion

This is the first case report describing a patient with genetically confirmed spondylodysplastic type of EDS and normal secretion of growth hormone during GH provocative testing, illustrating very limited response to growth hormone treatment in this patient.

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SIFILIS U TRUDNOĆI

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SAŽETAK

U Srbiji je rani sifilis u porastu od 2010. godine i njegova zaraznost za seksualne partnere traje godinu dana od momenta inficiranja. Izuzetak čine trudnice koje infekciju mogu da prenesu na plod u toku četiri godine od inficiranja, ukoliko se ne leče. Sifilis u trudnoći može izazvati pobačaj, rađanje mrtvog deteta, deteta sa malom telesnom težinom ili nastanka kongenitalnog sifilisa. Cilj ovog rada je da prikaže kliničke manifestacije, laboratorijsku dijagnostiku i terapiju sifilisa u trudnoći, kao i da senzibilise medicinske radnike na ovo oboljenje i na uvođenje obaveznih seroloških skrining testova za sifilis kod svih trudnica.

Ključne reči: sifilis, trudnoća, skrining test

Uvod

Rani sifilis predstavlja kontagioznu formu ovog oboljenja i prema prirodnom toku bolesti čine ga primarni, sekundarni i rani latentni stadijum koji traje godinu dana od dobijanja infekcije. Osoba sa ranim sifilisom zarazna je za seksualne partnere godinu dana od momenta inficiranja, a nelečena trudnica sa ranim sifilisom infekciju može preneti na svoj plod tokom naredne četiri godine od infekcije (1). Sifilis tokom trudnoće može izazvati ozbiljne komplikacije i dovesti do spontanog pobačaja, rađanja mrtvog deteta ili deteta sa znacima kongenitalnog sifilisa. Ako se infekcija trudnice blagovremeno otkrije i leči navedene komplikacije se mogu sprečiti, dok neotkrivene infekcije dovode do ozbiljnih sekvela.

Epidemiološka situacija početkom novog milenijuma ukazuje na značajan porast obolevanja od sifilisa u Republici Srbiji (2). Iako je većina obolelih pripadala muškarcima koji imaju seks sa muškarcima (2,3), beleže se infekcije i kod žena (4), a sve inficirane trudnice bile su Romkinje, kod kojih se sifilis češće javljao u odnosu na žene neromske populacije (5). U poslednjih pet godina kod nas je registrovan jedan slučaj kongenitalnog sifilisa (6). Podaci iz Evrope ukazuju da su najviše stope sifilisa kod žena registrovane u Bugarskoj, Litvaniji, Letoniji i na Islandu, a kongenitalnog sifilisa u Bugarskoj, zatim u Portugaliji, Rumuniji i Poljskoj

(7). U toku 2017. godine u Sjedinjenim Američkim Državama zabeležen je najveći broj novorođenih sa sifilisom u poslednje dve dekade (8). Studije iz nekih Evropskih zemalja su pokazale da je preko 20% novoinficiranih žena sa sifilisom među trudnicama (9,10), a u Španiji (11) je pozitivan test kod trudnica bio dva puta i u Irskoj (12) šest puta češći u odnosu na opštu populaciju što bi se moglo objasniti povećanom primenom antenatalnog skrininga na sifilis.

Cilj ovog rada je da prikaže kliničke manifestacije, laboratorijsku dijagnostiku i terapiju sifilisa u trudnoći, kao i da senzibilise medicinske radnike na ovo oboljenje i na uvođenje obaveznih seroloških skrining testova za sifilis kod svih trudnica.

Metode

U okviru ovog preglednog rada prikazali smo kliničke, laboratorijske, dijagnostičke i terapijske specifičnosti sifilisa u trudnoći dobijene na osnovu pretraživanja literature objavljene na engleskom jeziku preko PUBMED-a korišćenjem sledećih ključnih reči: sifilis, trudnoća i skrining test.

Kliničke manifestacije sifilisa

Nakon prosečnog inkubacionog perioda od 3 nedelje na mestu ulaska treponeme palidum (lat. *Treponema pallidum*) javlja se tvrdi šankr (lat. *ulcus durum*), primarna lezija u vidu jasno

SYPHILIS IN PREGNANCY

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SUMMARY

Early syphilis has been increasing in the Republic of Serbia since 2010 and its infectivity for sexual partners lasts for a year from the moment of infection. The exception is pregnant women who, if left untreated, can transmit the infection to the fetus within four years of infection. Syphilis in pregnancy can cause miscarriage, stillbirth, low birth weight or congenital syphilis. The aim of this paper is to present the clinical manifestations, laboratory diagnostics and therapy of syphilis in pregnancy, as well as to sensitize medical workers to this disease and the introduction of mandatory serological screening tests for syphilis in all pregnant women.

Keywords: syphilis, pregnancy, screening test

Introduction

Early syphilis presents a contagious form of this disease and according to the natural course of the disease, it includes the primary, secondary and early latent stadium which lasts for one year from the moment of infection. A person with early syphilis is infectious for sexual partners one year from the moment of infection, while the untreated pregnant woman with early syphilis can transmit the infection to the fetus within four years from the moment of infection (1). Syphilis during pregnancy can cause serious complications and it can lead to miscarriage, stillbirth or childbirth with the signs of congenital syphilis. If the infection in a pregnant woman is discovered and treated timely, the above mentioned complications can be prevented, whereas the undiscovered infections lead to serious sequelae.

The epidemiological situation at the beginning of the new millennium has pointed to the significant increase of syphilis in the Republic of Serbia (2). Although the majority of people, who developed this disease, were men who had sex with men (2,3), the infection was recorded in women, as well (4), and all the infected pregnant women were Roma women, who were affected by syphilis more frequently in comparison to women who did not belong to the Roma population (5). In our country, one case of congenital syphilis has been

registered during the last five years (6). Data from Europe point to the fact that the highest rates of syphilis in women have been reported in Bulgaria, Lithuania, Latvia and Iceland, while of congenital syphilis in Bulgaria, then Portugal, Romania and Poland (7). The largest number of newborns with syphilis for the last two decades was reported in The United States of America in 2017 (8). Studies from some European countries showed that more than 20% of newly infected women with syphilis were among pregnant women (9,10), while in Spain (11), the positive test in pregnant women was two times more frequent and in Ireland (12), six times more frequent in comparison to the general population, which could be explained by the increased application of ante-natal screening for syphilis.

The aim of this work is to present the clinical manifestations, laboratory diagnostics and therapy of syphilis in pregnancy, as well as to sensitize medical workers to this disease and the introduction of mandatory serological screening tests for syphilis in all pregnant women.

Methods

In this review article, we have presented clinical, laboratory, diagnostic and therapeutic specificities of syphilis in pregnant women, based on the literature that was published in the English



Slika 1. *Ulcus durum* vulve

ograničene bezbolne uceracije tvrdih indurovanih ivica praćena bezbolnom regionalnom limfadenopatijom. *Ulcus durum* se može javiti na različitim mestima, kod vaginalnog seksa unutar vagine ili u predelu vulve (Slika 1), kod analnog seksa u analnom kanalu, završnom delu rektuma ili perianalno, a kod oralnog seksa na usnama ili u usnoj duplji (13). S obzirom na to da je šankr bezbolan i kod žena retko vidljiv, primarni stadijum infekcije se obično previdi, a bakterija se hematogenim putem širi po čitavom organizmu te nakon 2 do 10 nedelja nastaje sekundarni stadijum bolesti. On može biti praćen opštim simptomima, povišenom temperaturom, generalizovanom limfadenopatijom, kao i promenama po koži i vidljivim sluznicama (14).

Promene na koži su obično u vidu generalizovane makulozne ili papulozne ospe koja se često javlja i na dlanovima i tabanima. Ponekad nastaje alopecija u kapilicijumu koja može biti difuznog tipa ili u vidu sitnih alopecičnih polja, dok se u intertriginoznim regijama mogu javiti veoma infektivne papule – lat. *condylomata lata* (Slika 2). Promene u usnoj duplji su u vidu asimptomatskih mukoznih plakova prekrivenih beličastosivom hiperkeratotičnom membranom.

Pacijent je najinfektivniji u sekundarnom stadijumu bolesti. Ukoliko se obolela osoba ne leči oboljenje prelazi u ranu latentnu fazu koja je asimptomatska i traje do godinu dana od momenta infekcije. U ovoj fazi pacijent je i dalje in-



Slika 1. *Condylomata lata* vulve



Picture1. *Ulcus durum* on the vulva

language and searched through PUBMED, using the following key words: syphilis, pregnancy, screening test.

Clinical manifestations of syphilis

After the average incubation period of three weeks, a firm chancre (lat. *ulcus durum*) occurs at the point of entry of *Treponema pallidum*, that is, a primary lesion in the form of clearly-defined painless ulceration with the hard indurated margins, followed by the painless regional lymphadenopathy. *Ulcus durum* can occur in different places, in vaginal sex inside the vagina or in the region of vulva (Picture 1), in anal sex in the anal canal, the last part of the rectum or in the perianal

area, and in oral sex on lips or inside the mouth (13). Considering the fact that the chancre is painless and in women rarely visible, the primary stadium of infection is usually overlooked, and the bacteria spread to other parts of the body hematogenously, so the secondary stadium of disease occurs after 2 to 10 weeks. It can be followed by general symptoms, high temperature, generalized lymphadenopathy, as well as changes on the skin and visible mucosa (14).

Skin changes are usually in the form of macular and papular rash, which often appears on palms and soles. Alopecia sometimes appears in capillitium, and it can be diffuse or in the form of tiny alopecic patches, while in the intertriginous



Picture 2. *Condylomata lata* on the vulva

fektivan za svoje seksualne partnere. S obzirom na to da je sifilis „veliki imitator“, oboljenje često ostaje neprepoznato ili pogrešno lečeno. Iako se bolest seksualnim putem prenosi samo u prvoj godini od infekcije, nelečene žene su infektivne za plod naredne četiri godine. Infekcija se prenosi transplacentalno ili tokom porođaja usled kontakta ploda sa genitalnim lezijama majke. *Treponema pallidum* se može preneti putem placentе već od 14. nedelje trudnoće, a rizik prenošenja se povećava sa napredovanjem trudnoće (15). Placentarna infekcija i smanjen dotok krvi u plod su najčešći razlozi fetalne smrti. Kod trećine inficiranih trudnica fetus se rađa sa kongenitalnim sifilisom. Kod skoro dve trećine novorođenčadi infekcija je asimptomatska, a mala fetalna težina može biti jedina manifestacija infekcije (16,17).

Kongenitalni sifilis se deli na rani u kome se znaci infekcije javljaju u prve dve godine života i na kasni kongenitalni sifilis u kome se promene javljaju posle druge godine. Spektr kliničkih manifestacija kongenitalnog sifilisa je širok (18) i nije predmet ovog rada.

Dijagnostika sifilisa

Direktna detekcija bakterije iz primarnog šankra ili sa vlažnih lezija sekundarnog stadijuma obavlja se na mikroskopu u tamnom polju, ali se zbog tehničkih nemogućnosti ova metoda godinama ne sprovodi u našoj sredini. Za potvrdu dijagnoze sifilisa u trudnoći najčešće se koriste serološki testovi: nespecifični VDRL (engl. *Venereal Disease Research Laboratory*) test, koji otkriva antitela na kardiolipin i specifični TPHA (engl. *Treponema Pallidum Hemagglutination Assay*) test (19). TPHA test postaje pozitivan 4 nedelje nakon infekcije, a VDRL test nešto kasnije u periodu od 4 do 6 nedelja. Dok specifični TPHA test ostaje pozitivan do kraja života, nespecifični VDRL test se nakon terapije vremenom negativizuje i koristi se za praćenje aktivnosti bolesti nakon lečenja.

Prema preporukama Centara za kontrolu i prevenciju bolesti u Atalanti (engl. *Centers for Disease Control and Prevention - CDC*) rutinski serološki skrining test na sifilis (nespecifični i specifični) kod trudnica trebalo bi da se obavi prilikom prve prenatalne posete, a za pacijentkinje u riziku i u populacijama gde su visoke stope kongenitalnog sifilisa i oko 28 nedelje gestacije i u momentu porođaja (20). Kod žena koje su rodile mrtav plod nakon 20.

nedelje gestacije takođe se savetuje testiranje na sifilis (21). Seropozitivne trudnice bi trebalo smatrati infektivnim ako ne postoji medicinska dokumentacija o ranijem lečenju ili su pak lečene ali nije došlo do četvorostrukog smanjenja titra VDRL testa za šest meseci od terapije.

Terapija sifilisa u trudnoći

Parenteralna primena penicilina je lek izbora u lečenju svih stadijuma sifilisa. Primena penicilina je efikasna kako u prevenciji transmisije sifilisa sa majke na plod tako i u tretmanu fetalne infekcije (22). Terapija trudnica se sprovodi prema protokolu lečenja u zavisnosti od stadijuma infekcije. U ranom sifilisu ordinira se intarmuskularno 2,4 miliona IJ benzatin penicilina G, mada postoje preporuke da bi trudnice trebalo da prime još jednu dozu istog leka za 7 dana (20). Aleksander i saradnici (22) su opisali da je kod 98% trudnica sa ranim sifilisom terapija benzatin penicilinom G sprečila prenošenje infekcije na fetus. Ako se dijagnoza sifilisa postavi u toku druge polovine trudnoće savetuje se ultrazvučni pregled fetusa radi procene znakova eventualnog kongenitalnog sifilisa (hepatomegalija, ascites, hidrops ili zadebljanje placentе) koji povećava rizik za neuspešan tretman fetusa (23).

Terapija u drugoj polovini trudnoće povećava rizik prevremenog porođaja ili fetalnog distresa usled nastanka *Jarisch-Herxheimerove* reakcije pa se primena leka preporučuje u hospitalnim uslovima uz prisustvo akušera (24). Ova reakcija nastaje zbog oslobađanja endotoksina iz velikog broja raspadnutih treponema, a manifestuje se febrilnošću, glavoboljom i bolovima u mišićima u prva 24 sata od primene penicilina. Kod trudnica alergičnih na penicilin savetuje se desenzibilizacija, s obzirom na to da ne postoji alternativa ovom leku u trudnoći. Prvo serološko praćenje efikasnosti tretmana trebalo bi da se sprovede posle mesec dana, a uspeh terapije potvrđuje se četvorostrukim padom titra nespecifičnih seroloških testova 3 do 6 meseci nakon terapije ili osmostrukim padom nakon 12 meseci (20). Savetuje se testiranje svih trudnica sa sifilisom i na HIV infekciju.

Zaključak

Porast incidencije sifilisa u našoj zemlji, sekvele, koje neprepoznata infekcija ostavlja na plod, i vulnerabilnost mladih Romkinja na ovu infekciju ukazu-

regions very infectious papules can appear – lat. *condylomata lata* (Picture 2). Changes in the oral cavity appear in the form of asymptomatic mucous plaque covered with white-grey hyperkeratotic membrane.

A patient is the most infectious in the secondary stadium of disease. If the person affected by the disease is not treated, this disease develops to the early latent stage, which is asymptomatic and lasts for a year from the moment of infection. In this stage, the patient is still infectious for his sexual partners. Considering the fact that syphilis is the “great imitator”, the disease often remains unrecognized or wrongly treated. Although this disease is sexually transmitted only during the first year from the moment of infection, untreated women are contagious for the fetus during the next four years. The infection is transmitted transplacentally or during birth when a baby has contact with mother’s genital lesions. *Treponema pallidum* can be transmitted via placenta from about 14 weeks’ gestation and the risk of transmission increases with gestational age (15). The placental infection and the reduction in blood flow to the fetus are the most common causes of fetal death. In one third of infected pregnant women, fetuses are born with congenital syphilis. In almost two thirds of newborns, the infection is asymptomatic, while low birth weight can be the only manifestation of infection (16,17).

Congenital syphilis is classified into early syphilis, in which signs of infection appear in the first two years of life, and late congenital syphilis, in which changes appear after the second year of life. The spectrum of clinical manifestations of congenital syphilis is wide (18) and it is not the subject of this article.

Diagnosics of syphilis

Direct detection of bacteria from the primary chancre or from moisture lesions in the secondary stadium is performed with the help of dark field microscopy, but this method has not been conducted in our country for years due to technical incapacity. Serological tests are most commonly used to confirm the diagnosis of syphilis in pregnancy: the non-treponemal Venereal Disease Research Laboratory test (VDRL), which detects antibodies to cardiolipin, and the treponemal-specific *Treponema Pallidum* Hemagglutination Assay

test (TPHA) (19). The TPHA test becomes positive 4 weeks after infection, while the VDRL test becomes positive a little bit later, 4 to 6 weeks after infection. The specific TPHA test remains positive for life, while after therapy the non-specific VDRL test becomes negative with time and it is used to follow disease activities after treatment.

According to the recommendations of the Centers for Disease Control and Prevention (CDC) in Atlanta, routine serological screening tests for syphilis (specific and non-specific) should be conducted in pregnant women during the first prenatal visit, while in patients who are at risk or in populations, where rates of congenital syphilis are high, at 28 weeks’ gestation and at birth (20). In women, who gave birth to a stillborn child after 20 weeks’ gestation, tests for syphilis are also recommended (21). Seropositive pregnant women should be considered infectious if there are no medical records about the previous treatment or if they were treated, but it did not come to a fourfold decrease in VDRL titers six months after therapy.

Therapy of syphilis in pregnancy

Penicillin, administered parenterally, is the treatment of choice in all stages of syphilis. The administration of penicillin is efficient in the prevention of syphilis transmission from mother to child, as well as in the treatment of fetal infection (22). The therapy in pregnant women is applied according to the protocol of treatment depending on the stadium of infection. In the early stage of syphilis, 2.4 million units of benzathine penicillin G are administered intramuscularly as a single dose, although there are recommendations that pregnant women should receive one more dose of the same drug 7 days after the initial dose (20). Alexander and associates (22) described that in 98% of pregnant women with early syphilis, the therapy of benzathine penicillin G prevented the transmission of infection to the fetus. If syphilis is diagnosed during the second half of pregnancy, the ultrasonographic fetal examination is recommended for possible signs of congenital syphilis (hepatomegaly, ascites, hydrops, placental thickness), which increases the risk of unsuccessful fetal treatment (23).

The therapy in the second half of pregnancy increases the risk of premature birth or fetal distress due to Jarisch-Herxheimer reaction, and there-

ju na potrebu skrininga na sifilis u trudnoći, naročito kod osoba pod povećanim epidemiološkim rizicima.

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fore, the therapy should be administered in hospital conditions in the presence of obstetrician (24). This reaction is caused by the release of treponemal endotoxin-like compounds, and it is manifested in the form of fever, headache, myalgia during the first 24 hours after receiving penicillin. Pregnant women, who are allergic to penicillin, should be desensitized because a suitable alternative in pregnancy does not exist. The first serological testing of the treatment efficiency should be conducted after one month, while the success of therapy is confirmed by the fourfold decline in non-treponemal antibody titers 3 to 6 months after therapy, or by the eightfold decline after 12 months (20). All pregnant women with syphilis should be tested for HIV infection, as well.

Conclusion

The increase in the incidence of syphilis in our country, the unrecognized infection leading to fetal sequelae, as well as the vulnerability of young Roma women to this infection point to the need for screening for syphilis in pregnancy, especially in persons who are at increased epidemiological risks.

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UTICAJ AEROZAGAĐENJA NA EGZACERBACIJE HRONIČNE OPSTRUKTIVNE BOLESTI PLUĆA

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SAŽETAK

Hronična opstruktivna bolest pluća (HOBP) je jedan od vodećih globalnih javnozdravstvenih problema, sa procenom da će do 2030. godine biti treći po učestalosti uzrok smrti. Akutne egzacerbacije HOBP dovode do ubrzanog propadanja plućne funkcije, smanjenja kvaliteta života i povećanog broja hospitalizacija, kao i do smrtnih slučajeva. Najčešći uzrok egzacerbacija su respiratorne infekcije, ali se danas sve više ispituje uticaj faktora životne sredine na njihov nastanak. Među njima, aerozagađivači su od najvećeg značaja. Brojne studije sprovedene do sada nedvosmisleno su pokazale da povišene koncentracije suspendovanih čestica (PM), sumpor dioksida (SO₂), azot dioksida (NO₂) i ozona (O₃) u atmosferskom vazduhu imaju najizraženiji negativni efekat na bolesnike sa HOBP, povećavajući učestalost egzacerbacija HOBP kao i posledičnu smrtnost zbog njih. U ispitivanju njihovog uticaja nije dovoljno ispitivati samo efekte pojedinačnih zagađivača vazduha, već i njihove međusobne interakcije, kao i interakcije sa meteorološkim faktorima. U cilju smanjenja opterećenja zdravstvenih sistema ovom bolešću, neophodno je implementirati sve strategije koje će smanjiti učestalost HOBP. To svakako podrazumeva i globalno smanjenje aerozagađenja, što će zahtevati podršku najrazvijenijih svetskih ekonomija, značajno obnavljanje neophodnih resursa i, konačno, korenite društvene promene.

Ključne reči: aerozagađenje, egzacerbacija, hronična opstruktivna bolest pluća, suspendovane čestice, sumpor dioksid, azot dioksid, ozon

Uvod

Hronična opstruktivna bolest pluća (HOBP) je jedan od vodećih globalnih javnozdravstvenih problema, sa prevalencijom od 12% u opštoj populaciji, oko tri miliona smrtnih ishoda godišnje na globalnom nivou (1), i najvišom incidencijom u ekonomski nerazvijenim i zemljama u razvoju (preko 85% svih registrovanih novoobolelih slučajeva) (2). Svetska zdravstvena organizacija (SZO) procenjuje da će 2030. godine HOBP biti treći vodeći uzrok smrti u svetu (3). Hroničan i progresivan tok ovog oboljenja karakterišu periodi remisije sa povremenim pogoršanjima (egzacerbacije) u formi izraženih dispnoičnih tegoba, a koja značajno doprinose bržem propradanju plućne funkcije, smanjenju kvaliteta života, češćoj potrebi za pregledom lekara, češćim hospitalizacijama i, konačno, povećanom umiranju ovih bolesnika (4).

Egzacerbacije bolesti su u najvećem broju slučajeva prouzrokovane respiratornim infekcijama virusne ili bakterijske etiologije (50-70% slučajeva), ali se poslednjih godina sve više pažnje posvećuje proučavanju uticaja izloženosti faktorima životne sredine na nastanak akutnih pogoršanja HOBP: zagađivačima vazduha, meteorološkim uslovima, kao i aerogenim štetnostima na radnom mestu.

Prema izveštaju SZO o globalnom opterećenju bolestima iz 2013. godine, zagađenje vazduha je bilo peti po redu značajnosti faktor rizika za nastanak oboljenja, učestvujući sa 6% u izgubljenim godinama zdravog života stanovništva (odnosno DALY-jima, engl. *Disability-Adjusted Life Year*) (5), kao i uzrok oko 4,2 miliona smrtnih ishoda širom sveta (6). HOBP se nalazi na trećem mestu svih uzroka smrti usled zagađenja vazduha (7). Utvrđeno je da porast koncentracija suspendovanih česti-

THE EFFECT OF AIR POLLUTION ON CHRONIC OBSTRUCTIVE PULMONARY DISEASE EXACERBATIONS

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SUMMARY

Chronic obstructive pulmonary disease (COPD) is one of the greatest global public health challenges, emerging as the third leading cause of death by 2030. Acute exacerbations of COPD (AECOPD) contribute to the accelerated deterioration of lung function, reduced quality of life and higher hospitalizations and mortality rates. The cause of exacerbation is usually an infectious agent, but the impact of exposure to environmental factors is being studied more thoroughly. Among them, atmospheric pollutants emerged as the most important ones. Multiple studies showed that elevated concentrations of particulate matter (PM), sulphur dioxide (SO₂), nitric dioxide (NO₂) and ozone (O₃) in the atmosphere, have the most significant negative effect on patients with COPD, increasing hospitalisations and mortality rates due to COPD. While examining their effect on AECOPD, it is important to consider the mutual interactions of different air pollutants, as well as interactions with meteorological factors. In order to decrease the burden of COPD, it is necessary to implement all strategies that will reduce the incidence of COPD, including global reduction of air pollution. That will require the support of the world's most developed economies, a significant renewal of the necessary resources and, finally, radical social change.

Key words: air pollution, chronic obstructive pulmonary disease, exacerbation, particulate matter, sulphur dioxide, nitric dioxide, ozone

Introduction

Chronic obstructive pulmonary disease (COPD) is one of the greatest global public health problems, with the prevalence of 12% in the general population, about three million deathly outcomes per year globally (1), and the highest incidence in economically underdeveloped and developing countries (more than 85% of all registered new cases) (2). The World Health Organization (WHO) estimates that COPD will be the third leading cause of death in the world by 2030 (3). The chronic and progressive course of this disease is characterized by periods of remission with periodical exacerbations in the form of severe dyspnea, which significantly contribute to the accelerated deterioration of lung function, reduced quality of life, need for more frequent medical examinations, more frequent hospitalizations and eventually to higher mortality of these patients (4). Disease exacerbations

are in most cases caused by respiratory infections of viral and bacterial etiology (50-70% of cases), but in recent years the impact of exposure to environmental factors on acute COPD exacerbations has been studied more thoroughly: air pollutants, meteorological factors and occupational air pollutants.

According to the World Health Organization's report on the burden of disease from 2013, air pollution was the fifth leading risk factor, with 6% of years of healthy life lost, that is DALYs (Disability-Adjusted Life Years) (5), as well as a cause of about 4.2 million deaths worldwide (6). COPD is the third leading cause of death due to air pollution (7). It was found out that elevated concentrations of particulate matter (PM), sulfur dioxide (SO₂), ground-level ozone (O₃), and nitrogen dioxide (NO₂) in the atmosphere influenced exacerbations of dyspnea and other respiratory symptoms

ca (PM), sumpor dioksida (SO₂), prizemnog ozona (O₃) i azot dioksida (NO₂) u spoljašnjem vazduhu utiče na pogoršanje dispeničnih tegoba i ostalih respiratornih simptoma kod bolesnika sa HOBP, sa posledično većim brojem intervencija službi hitne medicinke pomoći, ambulantnih poseta lekaru i broja hospitalizacija, kao i porastom mortaliteta od HOBP (8,9). Ovi problemi mogu da se jave čak i kada su koncentracije aeropolutanata u normativno dozvoljenim vrednostima (10); tj. čak i kada su dostignute preporuke Svetske zdravstvene organizacije (SZO) za održavanje kvaliteta vazduha životne sredine, i dalje postoji povećan zdravstveni rizik od obolevanja, a to se odnosi ne samo na bolesnike koji boluju od HOBP, već i na druge hronične bolesti na koje aeropolutanti mogu imati uticaja. Takođe, postoji mogućnost sinergističkog delovanja među različitim čvrstim i gasovitim zagađivačima vazduha, ali i sa drugim faktorima životne sredine (poput klimatskih faktora), što se mora uzeti obzir u istraživanjima prilikom procene efekta pojedinačnih faktora na akutne egzacerbacije hronične opstruktivne bolesti pluća (AEHOBP) (11).

Cilj ovog preglednog rada je da se analizira značaj aerozagađenja, i to suspendovanih čestica, sumpor dioksida, azot dioksida i ozona, na egzacerbaciju HOBP.

Metode

U cilju analize značaja aerozagađenja, i to suspendovanih čestica, sumpor dioksida, azot dioksida i ozona na egzacerbaciju HOBP, korišćena je literatura objavljenja na engleskom jeziku tokom poslednjih 25 godina, a koja je dobijena pretraživanjem PUBMED-a korišćenjem sledećih ključnih reči: aerozagađenje, egzacerbacija, hronična opstruktivna bolest pluća, suspendovane čestice, sumpor dioksid, azot dioksid i ozon.

Uticaj suspendovanih čestica na egzacerbaciju HOBP

Suspendovane čestice (PM, engl. *particulate matter*) predstavljaju jedan od najznačajnijih faktora aerozagađenja koji se dovodi u vezu sa egzacerbacijom HOBP. Utvrđeno je da PM, zbog svojih karakterističnih osobina (porekla, veličine, hemijskog sastava), tj. mogućnosti dopiranja do različitih dubina respiratornog sistema, dovode do nadržajnih ili opstruktivnih efekata na nivou bronhija. Na osnovu aerodinamskog dijametra, suspendo-

vane čestice se mogu podeliti na PM₁₀ (čestice čiji je dijametar ispod ili jednak 10 μm), grubu frakciju (od 2,5 μm do 9 μm), kao i finu frakciju u koju se ubrajaju PM_{2,5} (veličine od 0,1 μm do 2,5 μm) i ultrafine čestice (ispod 0,1 μm). Najčešće se sistemski prate koncentracije PM₁₀ i PM_{2,5} u vazduhu, dok se ultrafine čestice retko rutinski prate. Čestice koje su iznad 2,5 μm u prečniku obično sadrže resuspendovanu prašinu sa puteva, kao i onu nastalu industrijskom aktivnošću, biološke materije kao što su granule polena i fragmenti bakterija, mineralne materije koje se donose vetrom sa poljoprivrednih zemljišta, mineralnih polja, evaporacijom sa površine mora, pepeo i dr. Čestice fine frakcije obično nastaju procesom evaporacije ili kao sekundarni polutanti u atmosferi, nakon čega se dalje procesima kondenzacije i koagulacije uvećavaju u prečniku (6). Oko dve trećine PM su antropogenog porekla, nastale sagorevanjem fosilnih goriva, biomase ili emitovanjem amonijaka.

Mehanizmi delovanja PM na ljudski organizam podrazumevaju više različitih efekata: izazivanje inflamacije i oksidativnog stresa u disajnim putevima, hiperreaktibilnost disajnih puteva, smanjenje efekta zaštitnih mehanizama, genotoksičnost i trombogeno delovanje na nivou krvnih sudova. Zdravstvene posledice takvog efekta uključuju: povećan broj hospitalizacija i povećanje stope smrtnosti zbog pogoršanja opstruktivnih oboljenja pluća (HOBP i astma), kao i kardiovaskularnih bolesti (promene arterijskog pritiska, srčane frekvencije, poremećaji ritma, ishemijska bolest srca), šećerne bolesti, ubrzanje procesa ateroskleroze, iniciranje karcinogeze i sl. (6). Eksperimentalne studije su pokazale da PM podstiču nastanak snažnog inflamatornog procesa u disajnim putevima, sa posledičnim pojačanim lučenjem brojnih citokina i slobodnih radikala koji mogu da oštete tkivo (12). Pacijenti sa HOBP imaju deficitarne antioksidativne mehanizme, tako da su veoma prijemčiva kategorija za pogoršanje inflamatornog procesa u zidovima disajnih puteva i akutnu egzacerbaciju HOBP. Epidemiološka istraživanja ukazuju na snažnu korelacionu povezanost čestica PM₁₀ i PM_{2,5} sa respiratornim morbiditetom i mortalitetom (13). U studiji *Schikowskog* i saradnika (14), porast koncentracije PM₁₀ na 7 μg/m³ je bio povezan sa smanjenjem vrednosti forsiranog ekspirijumskog volumena u prvoj sekundi (FEV1) za 5,1% tokom petogodišnjeg praćenja, a stanovanje

in patients with COPD, resulting in the increased number of interventions in emergency departments, physician office visits and hospitalizations, as well as in the increase of mortality rates caused by COPD (8,9). These problems may appear even when concentrations of air pollutants are within the limit values (10); that is, even when the WHO air quality guidelines levels are met, the increased health risk for the occurrence of disease still exists, and this does not only relate to COPD patients, but also to other chronic diseases, which could be influenced by air pollutants. Also, synergistic effects of different solid and gas air pollutants are possible, together with other environmental factors (such as factors affecting climate), which has to be taken into consideration in researches during the assessment of effects of individual factors on acute exacerbations of chronic obstructive pulmonary disease (AEHOPD) (11).

The aim of this review article is to analyze the significance of air pollution, that is, the influence of particulate matter, sulfur dioxide, nitrogen dioxide and ozone on COPD exacerbations.

Methods

In order to analyze the significance of air pollution, and the influence of particulate matter, sulfur dioxide, nitrogen dioxide and ozone on COPD exacerbations, we used literature that has been published in the English language during the last 25 years, which we searched with the help of PUBMED using the following words: air pollution, exacerbations, chronic obstructive pulmonary disease, particulate matter, sulfur dioxide, nitrogen dioxide and ozone.

The influence of particulate matter on COPD exacerbations

Particulate matter presents one of the most significant factors of air pollution, which is connected with COPD exacerbations. It was found out that PM, due to its characteristic traits (origin, size, chemical structure), that is, due to their ability to penetrate deep into the respiratory system, leads to irritation or obstructive effects at the level of bronchi. According to the aerodynamic diameter, suspended particles can be divided into PM₁₀ (particles with a diameter of 10 µm or less), coarse particles (from 2.5 µm to 9 µm), as well as fine particles which include PM_{2.5} (from 0.1 µm to

2.5 µm) and ultrafine particles (less than 0.1 µm). Most frequently concentrations of PM₁₀ and PM_{2.5} in the air are systematically observed, while ultrafine particles are rarely observed. Particles with a diameter more than 2.5 µm usually contain re-suspended particles of road dust, as well as dust which was created due to industrial activities, biological matter such as pollen grains and fragments of bacteria, mineral matter brought by wind from agricultural soils, mineral fields, evaporation from sea surface etc. Particles of fine fraction usually appear in the evaporation process or as secondary pollutants in the atmosphere, and afterwards their diameter increases in the process of condensation and coagulation (6). About two thirds of particles have an anthropogenic origin, and they appear due to combustion of fossil fuels, biomass or ammonia emissions.

The mechanisms of impact of PM on human body include various effects: airway inflammation and oxidative stress, airway hyperresponsiveness, reduced effects of defense mechanisms, genotoxicity and thrombogenic activity in blood vessels. Health consequences of such effects include: increased number of hospitalizations and increase in mortality rates due to exacerbations of obstructive pulmonary diseases (COPD and asthma), as well as cardiovascular diseases (changes in arterial blood pressure, heart frequency, heart arrhythmias, ischemic heart disease), diabetes, accelerated atherosclerosis, initiation of carcinogenesis etc. (6). Experimental studies showed that PM induced the occurrence of strong airway inflammation, resulting in the increased secretion of numerous cytokines and free radicals that can cause tissue damage (12). Patients with COPD have deficient antioxidative mechanisms, and therefore, they are susceptible to the exacerbation of inflammatory process in airway walls and acute exacerbations of COPD. Epidemiological studies point to the strong correlation between PM₁₀ and PM_{2.5} and respiratory morbidity and mortality (13). In the study of Schikowski and associates (14), the increase in concentrations of PM₁₀ to 7 µg/m³ was connected with the value of forced expiratory volume which decreased for 5.1% in one second (FEV1) during the five-year follow-up, while living within 100 meters of the highway was connected with harmful effects on lung function and it presented a risk factor for the occurrence of COPD in previously healthy persons. Dominici and associates in their study (15)

u dijametru od 100 metara u odnosu na velike saobraćajnice je bilo povezano sa štetnim efektima na plućnu funkciju i predstavljalo faktor rizika za nastanak HOBP kod prethodno zdravih osoba. *Dominici* i saradnici u svojoj studiji (15) ukazuju na skoro udvostručen broj hospitalizacija zbog pogoršanja HOBP za svako povećanje koncentracije $PM_{2,5}$ od $10 \mu\text{g}/\text{m}^3$. Nije samo izloženost PM u spoljašnjem vazduhu faktor rizika za pogoršanje plućne funkcije, već je dokazana i značajna povezanost između prevalencije HOBP i korišćenja biomase u domaćinstvima kao goriva za kuvanje i grejanje u ruralnim predelima Kine, a ovaj efekat je bio najizraženiji kod osoba ženskog pola (16). Pored povećanja morbiditeta, rezultati pojedinih studija govore i u prilog povećanog umiranja pacijenata sa HOBP odmah nakon izlaganja većim koncentracijama PM, a ovaj efekat je uočen i za druge aeropolutante, poput SO_2 i NO_2 (17). U meta-analizi iz 2017. godine, povećanje koncentracije $PM_{2,5}$ od $10 \mu\text{g}/\text{m}^3$ je bilo u vezi sa povećanjem učestalosti ambulantnih pregleda i hospitalizacija zbog HOBP za 2,5% (95% CI: 1,6–3,4%) (18).

Uticaj sumpor dioksida na pogoršanje HOBP

SO_2 može da se nađe u vazduhu emisijom iz prirodnih (npr. vulkanske erupcije, itd.) i antropogenih izvora (npr. izduvni gasovi motornih vozila, korišćenje sulfidnih ruda u termoelektrana, industriji, za grejanje itd.). Neželjena dejstva ostvaruje preko bisulfata koji kao redukciono sredstvo može da smanji količinu glutaciona kao oksidacionog sredstva u tkivima. Pored toga, u bronhijalnoj sluznici može dovesti i do nastanka strukturalnih promena u smislu povećanja broja mukoznih ćelija i žlezda, smanjenja mukocilijarnog klirensa i bronhospazma (6). Kao posledica kratkotrajne ekspozicije (kraće od 24 h) povećanim koncentracijama SO_2 u vazduhu, može doći do naglog nastanka bronhospazma i posledičnog smanjenja FEV1, te povećanja endobronhijalnog otpora, rezultirajući konačno pojavom dispnoičnih simptoma (otežano disanje, zviždanje u grudima); ovaj efekat je izraženiji kod astmatičara (19) i bolesnika sa HOBP (20) u odnosu na zdrave pojedince. Dugotrajne ekspozicije (duže od 24h) potencijalno bi mogle da povećavaju učestalost oboljevanja i umiranja od respiratornih i kardiovaskularnih bolesti, ali se ne može sa sigurnošću tvrditi da li je

to posledica potenciranja efekta PM ili indirektnog uticaja preko sulfatne kiseline i bisulfata.

Projekat APHEA (engl. *The Air Pollution and Health, a European Approach*) bio je jedan od najvažnijih istraživačkih poduhvata koji se bavio uticajem kratkoročnog izlaganja aerozagađenju na morbiditet i mortalitet u nekoliko evropskih gradova. U jednom delu istraživanja utvrđeno je da je porast koncentracije SO_2 na $50 \mu\text{g}/\text{m}^3$ doveo do porasta dnevne smrtnosti od svih uzroka za 3%, dok su PM_{10} čestice kao uzrok smrti učestvovala sa 2% na dnevnom nivou u isto vreme. Kumulativni efekti produženog izlaganja (dva ili četiri dana) zagađivačima vazduha imalo je slične efekte kao nakon jednodnevnog izlaganja (21). Relativni rizik za hospitalizaciju zbog AEHOBP nakon povećanja koncentracije SO_2 na $50 \mu\text{g}/\text{m}^3$ bio je 1,02 (20). U APHEA 2 projektu, utvrđeno je da porast koncentracije SO_2 za $10 \mu\text{g}/\text{m}^3$ dovodi do porasta učestalosti javljanja službi hitne medicinske pomoći zbog pogoršanja HOBP i astme za 0,6% (22), što sve govori u prilog štetnog delovanja SO_2 na bolesnike sa HOBP.

Uticaj azot dioksida na pogoršanje HOBP

Azot dioksid može nastati nakon što se drugi azotni oksidi iz stratosfere spuste u niže atmosferske slojeve i potom se putem odgovarajućih hemijskih reakcija pretvore u NO_2 , zatim kao posledica metaboličkih procesa bakterija, vulkanske aktivnosti, dok su antropogeni izvori češće zastupljeni, i u tom kontekstu NO_2 nastaje kao posledica sagorevanja goriva iz stacionarnih ili mobilnih izvora aerozagađenja (obično se emituje azot monoksid koji u reakciji sa ozonom daje azot dioksid), sagorevanjem duvana, zavarivanjem ili tokom proizvodnje amonijaka (6). U kliničkim studijama, utvrđeno je da izlaganje visokim koncentracijama NO_2 kod ljudi koji imaju HOBP može dovesti do dodatnog smanjenja FVC (forsiranog vitalnog kapaciteta), FEV1 i povećanja endobronhijalnog otpora, sa posledičnim pogoršanjem osnovne bolesti (23).

U više studija dokazano je da kratkotrajno izlaganje O_3 , NO_2 i SO_2 povećava broj hospitalizacija zbog HOBP, a među ovim gasovitim aeropolutantima, NO_2 je bio najjači prediktor hospitalizacija (24). Razlog za to je možda u činjenici da ovaj gas nije preterano rastvorljiv, pa dospeva do najsitnijih bronhijalnih puteva gde izaziva štetne efekte. U prethodnoj pomenutoj meta-analizi iz 2017.

pointed to the fact that the number of hospitalizations due to COPD exacerbations doubled for each increase of $10 \mu\text{g}/\text{m}^3$ in the concentrations $\text{PM}_{2.5}$. The exposure to PM in the atmosphere is not the only risk factor for the exacerbation of pulmonary function. However, the significant correlation between the prevalence of COPD and the use of biomass for cooking and heating in households in the rural regions of China was proved, and this effect was more pronounced in women (16). In addition to the increase in morbidity, results of several studies point to the increased mortality among patients with COPD immediately after the exposure to increased concentrations of PM, and this effect was noticed in other air pollutants, such as SO_2 and NO_2 (17). In the meta-analysis form 2017, the increase of $10 \mu\text{g}/\text{m}^3$ in the concentrations of $\text{PM}_{2.5}$ was connected with the increase in the number of infirmity examinations and hospitalizations due to COPB for 2.5% (95% CI: 1.6-3.4%) (18).

The impact of sulfur dioxide on the COPD exacerbation

SO_2 can be found in the air due to emissions from natural sources (for example, volcanic eruptions) and anthropogenic sources (vehicle exhaust gases, use of sulfide ores in thermal power stations, industry, heating etc.). Side effects are caused by bisulfates, which as reducing agents can reduce the amount of glutathione as an oxidizing agent in tissues. In addition to this, structural changes can appear in bronchial mucosa, such as the increase in the number of mucous cells and glands, a decrease in mucociliary clearance and bronchospasm (6). Short exposure (less than 24 h) to the elevated concentrations of SO_2 in the air can cause sudden bronchospasm and consequential FEV1, as well as the increased endobronchial resistance, resulting in dyspnoeic symptoms (heavy breathing, wheezing); this effect is more pronounced in patients with asthma (19) and patients with COPD (20) in comparison to healthy individuals. Long-term exposure (longer than 24 h) could possibly increase the frequency of disease occurrence and mortality caused by respiratory and cardiovascular diseases, but it cannot be stated with certainty whether this is the consequence of stressing the effects of PM or indirect impact through the sulfuric acid or bisulfates.

The Air Pollution and Health, a European Approach (APHEA) project was one of the most important research undertakings, which dealt with the influence of short-term exposure to air pollution on morbidity and mortality in several European cities. In one part of the research it was found out that the increase of $50 \mu\text{g}/\text{m}^3$ in the concentrations of SO_2 led to the increase in daily mortality due to all causes for 3%, while at the same time PM_{10} particles as a cause of death participated with 2% on a daily basis. Cumulative effects of prolonged exposure (two or four days) to air pollutants had similar effects as after exposure that lasted one day (21). A relative risk for the hospitalization due to AECOPD after the increase of $50 \mu\text{g}/\text{m}^3$ in the concentrations of SO_2 was 1.02 (20). In the APHEA project, it was found out that the increase of SO_2 concentrations for $10 \mu\text{g}/\text{m}^3$ led to the increase in the number of visits to emergency departments due to the exacerbations of COPD and asthma for 6% (22), which confirms the harmful effects of SO_2 on patients with COPD.

The impact of nitrogen dioxide on COPD exacerbation

Nitrogen dioxide can appear after other nitrogen oxides descend from the stratosphere to lower layers of atmosphere and then turn to NO_2 by means of certain chemical reactions, then as a consequence of metabolic processes of bacteria, volcanic activity, whereas anthropogenic sources are more common, and in that context NO_2 appears as a consequence of fossil fuels combustion from the stationary or mobile sources of air pollution (usually emissions of nitrogen monoxide, which in reaction with ozone gives nitrogen dioxide), tobacco smoke, welding or ammonium production (6). In clinical studies, it was found out that exposure to high concentrations of NO_2 in people who have COPD can lead to additional FVC (forced vital capacity), FEV1 and increase of endobronchial resistance, with the consequential exacerbation of main disease (23).

It was proved in several studies that short-term exposure to O_3 , NO_2 and SO_2 increases the number of hospitalizations due to COPD, and among these gaseous air pollutants, NO_2 was the strongest predictor of hospitalizations (24). A reason for that may be in the fact that this gas is not very soluble, and therefore, it reaches the tiniest bronchi-

godine (18), povećanje koncentracije NO₂ za 10 µg/m³ bilo je povezano sa povećanjem ambulantnih poseta lekaru i hospitalizacija zbog HOBP za 4,2% (95%CI: 2,5–6,0%). Relativni rizik za hospitalizaciju zbog AEHOBP nakon povećanja koncentracije NO₂ za 50 µg/m³ u APHEA projektu bio je 1,02 (20).

Uticaj ozona na pogoršanje HOBP

Ozon je sekundarni zagađivač vazduha, što znači da se ne emituje direktno iz izvora aerozagađenja. Umesto toga, proizvodi se kada se ugljen monoksid (CO), metan ili druga isparljiva organska jedinjenja (VOCs) oksidišu u prisustvu azotnih oksida (NO_x) i sunčeve svetlosti. Osnovni mehanizam negativnog delovanja na respiratorni sistem je oksidacija odgovarajućih komponenti sekreta nad respiratornim epitelom, pri čemu nastaju slobodni radikali koji doprinose pojačanju inflamatornog procesa i oštećenju epitelnih ćelija. Pored toga, ozon utiče na smanjenje mukocilijarnog klirensa, povećava reaktivnost bronha, a dugotrajnom ekspozicijom nastaju strukturalne promene u smislu hiperplazije mukoznih ćelija i žlezda, zadebljanja zida bronha i alveolarne fibroze (6). Ovakvi efekti mogu da ugroze respiratornu funkciju, izazivajući opstruktivne promene u respiratornom traktu, naročito kod osoba koje već boluju od astme i/ili alergijskog rinitisa (25), ali je ovakav efekat uočen i kod bolesnika sa HOBP.

U studiji *Stieba* i saradnika utvrđeno je da porast koncentracije O₃ za 18,4 µg/m³ dovodi do povećanja ukupnog broja pregleda pacijenata usled pogoršanja astme (3,2%) i HOBP (3,7%) (26). U studiji koju je sproveo *Schwartz* (27) otkriveno je da je O₃ povezan sa povećanim rizikom od hospitalizacije zbog AEHOBP. Takođe, studija koja je sprovedena u iranskoj prestonici Teheranu (28), pokazala je da povećanje koncentracije O₃ u vazduhu za 10 µg/m³ istovremeno povećava i rizik od AEHOBP za 0,86% (95% CI: 0,44–1,3%), a 93% od ukupnog broja hospitalizacija je moglo biti pripisano danima u kojima koncentracija O₃ nije prešla 110 µg/m³.

Zaključak

Dosadašnja istaživanja nedvosmisleno su dokazala da povećane koncentracije PM, SO₂, NO₂ i O₃ dovode do pogoršanja simptoma kod bolesnika sa HOBP. Iako neke studije pokazuju da se u poslednje vreme beleži smanjenje koncentracija O₃ i NO₂ na globalnom nivou kao posledica primene efikas-

nih strategija za smanjenje zagađenja vazduha, PM, O₃, NO₂ i SO₂ još uvek imaju izražen uticaj na pojavu AEHOBP. Budući da je korelacija pomenuatih aeropolutanata sa geografskim, demografskim i klimatskim karakteristikama različitih regiona u svetu još uvek nedovoljno proučena, jasno je da postoji objektivna potreba za daljim istraživanjima u ovoj oblasti.

Svaka procena kvaliteta vazduha životne sredine i utvrđivanje povezanosti sa obolevanjem stanovništva, odnosno procena uticaja faktora životne sredine na zdravlje stanovništva, od neprocenjive je važnosti za unapređenje politike unapređenja zdravlja stanovništva i upravljanja kvalitetom vazduha životne sredine. Globalna eliminacija zagađenja vazduha će zahtevati podršku najrazvijenijih svetskih ekonomija, značajno obnavljanje neophodnih resursa međunarodne zajednice i, konačno, korenite društvene promene. Da bi se ovi ciljevi ostvarili, neophodno je da sve države u svetu postepeno pređu na korišćenje obnovljivih izvora energije koji ne zagađuju životnu sredinu, smanje emisiju štetnih gasova u saobraćaju i redizajniraju industrijske procese, kako bi se smanjilo stvaranje otpadnih materija i pomerilo sa ekonomskih modela razvoja zasnovanih na masovnom utrošku prirodnih resursa ka održivom ekonomskom modelu razvoja.

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al ways, where it causes harmful effects. In the previously mentioned meta-analysis from 2017 (18), the increase in NO₂ concentrations for 10 µg/m³ was connected with the increase in physician office visits and hospitalizations due to COPD for 4.2% (95% CI: 2.5-6.0%). A relative risk for the hospitalization due to AECOPD after the increase in NO₂ concentrations for 50 µg/m³ was 1.02 in the APHEA project (20).

The impact of ozone on COPD exacerbation

Ozone is the secondary air pollutant, which means that it is not emitted directly from the source of air pollution. Instead of that, it is produced when carbon monoxide (CO), methane or other volatile organic compound (VOCs) react in the presence of nitrogen oxides and sunlight. The basic mechanism of negative influence on the respiratory system is the oxidation of certain components of secretion of the respiratory epithelium, when free radicals appear and contribute to the intensification of inflammatory process and epithelial cells damage. In addition to this, ozone influences the decrease of mucociliary clearance, the increase in bronchial reactivity, while long-term exposure causes structural changes, such as the hyperplasia of mucous cells and glands, bronchial wall thickening and pulmonary alveolar fibrosis (6). Such effects can endanger the respiratory function, thus causing obstructive changes in the respiratory tract, especially in persons already affected by asthma and/or allergic rhinitis (25). However, this effect was noticed in patients with COPD as well.

In the study of Stieb and associates, it was found out that the increase in O₃ concentrations for 18.4 µg/m³ led to the increase in the total number of examinations due to exacerbations of asthma (3.2%) and COPD (3.7%) (26). In the study conducted by Schwartz (27), it was found out that O₃ was connected with the increased risk of hospitalization due to AECOPD. Also, the study, which was conducted in the Iranian capital city, Teheran (28), showed that the increase in O₃ concentrations in the air for 10 µg/m³ simultaneously increased the risk of AECOPD for 0.86% (95% CI: 0.44-1.3%), while 93% of the total number of hospitalizations could be attributed to days when O₃ concentration did not exceed 110 µg/m³.

Conclusion

Previous research results have unambiguously proved that increased concentrations of PM, SO₂, NO₂ and O₃ lead to the exacerbations of symptoms in patients with COPD. Although some studies show that in recent years, the decrease in O₃ and NO₂ concentrations has been registered globally as a consequence of efficient strategies applied in order to reduce air pollution, PM, O₃, NO₂, and SO₂ still have a pronounced impact on the AECOPD occurrence. Having in mind the fact that the correlation between the above mentioned air pollutants and geographical, demographic and climate characteristics of different world regions has not been studied enough, it is clear that there is the objective need for further research in this field.

Each estimate of ambient air quality and determination of connectedness with disease occurrence, that is, the assessment of influence of environmental factors on population health is of utmost importance for the promotion of health policy and management of ambient air quality. Global elimination of air pollution will demand the support of the most developed world economies, significant recovery of necessary resources of the international community and finally, radical social changes. To achieve these goals, it is necessary that all countries in the world gradually switch to renewable energy sources, which do not pollute the environment, decrease the emission of traffic-related harmful gases and redesign industrial processes, in order to decrease the production of waste and shift from economic models of development based on mass consumption of natural resources to sustainable economic model of development.

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KVALITET ŽIVOTA STARIH OSOBA SMEŠTENIH U STARAČKOM DOMU

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SAŽETAK

Moderno društvo poslednjih decenija suočava se sa velikim porastom udela osoba starijih od 65 godina u ukupnoj populaciji. Istraživanja pokazuju da je trend porasta broja starih takav da je procena da će udeo osoba starosti 65 i više godina u svetskoj populaciji znatno porasti (za 56%), sa 901 milion (12,3%) u 2015. godini na 1,4 milijarde (16,5%) u 2030. godini. Domovi za smeštaj i negu starih lica predstavljaju sigurna mesta koja starim osobama sa smanjenim fizičkim aktivnostima i ostalim mogućnostima osiguravaju život dostojan čoveka. Široko polje interesovanja za istraživanje jesu percepcija i iskustvo korisnika domova za stara lica o tome šta bi moglo predstavljati dobar kvalitet života u ovom okruženju. U sklopu procene kvaliteta života procenjuju se različiti domeni, a u izbor domena kvaliteta života uključen je i određen stepen subjektivne procene. S obzirom na demografske promene koje su dovele do starenja stanovništva, kao i na sve duži životni vek, nove mere socijalne i zdravstvene politike prema starima se sve više usmeravaju na podizanje kvaliteta života starih, dok se naučna istraživanja sve više usmeravaju na otkrivanje faktora koji utiču na kvalitet života starih.

Ključne reči: stare osobe, domovi za stare, kvalitet života, procena

Uvod

Produženje očekivanog trajanja života i porast populacije starih širom sveta uticali su na promenu morbiditeta i mortaliteta u 21. veku. Moderno društvo poslednjih decenija suočava se sa velikim porastom udela osoba starijih od 65 godina u ukupnoj populaciji, što je rezultat produžavanja životnog veka, napretka u medicini i nauci uopšte, kao i poboljšanja kvaliteta života. Istraživanja pokazuju da je trend porasta broja starih takav da je procena da će udeo osoba starosti 65 i više godina u svetskoj populaciji znatno porasti (za 56%), sa 901 milion (12,3%) u 2015. godini na 1,4 milijarde (16,5%) u 2030. godini (1). Stari predstavljaju vulnerabilnu populacionu grupu čije su potrebe brojne, raznovrsne i visoko specifične (2). Mnogobrojne potrebe (zdravstvene, ekonomske i socijalne) prisutne su u velikoj meri u gerijatrijskoj populaciji, što zahteva posebne načine rada na svim nivoima zdravstvene zaštite (3).

Kvalitet života starih osoba

Razlozi za procenu kvaliteta života su različiti, kako na polju društvenih nauka tako i na polju prirodnih nauka. Autori iz različitih oblasti pristupaju konceptu kvaliteta života na različite načine, te danas postoji i veliki broj definicija kvaliteta života (4). Prema definiciji kvaliteta života koju su dali *Felce* i *Perry* (5) kvalitet života predstavlja sveukupno opšte blagostanje, koje obuhvata objektivne faktore i subjektivno vrednovanje fizičkog, materijalnog, socijalnog i emocionalnog blagostanja. Svetska zdravstvena organizacija kvalitet života definiše kao percepciju pojedinca o sopstvenom položaju u životu u kontekstu kulture i sistema vrednosti u kojem živi, a takođe i u odnosu na sopstvene ciljeve, očekivanja, standarde i interesovanja (6). Evidentno je da je, prema definiciji Svetske zdravstvene organizacije kvalitet života na prvom mestu psihološka kategorija, koja ne proizilazi automatski iz zadovoljavanja nekih osnovnih potreba, već iz celokupne psihološke strukture pojedinca u inter-

QUALITY OF LIFE OF ELDERLY PERSONS PLACED IN A NURSING HOME

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SUMMARY

Modern society in recent decades is facing a large increase in the share of people over 65 in the total population. The research shows that the trend of increasing the number of the elderly is such that it is estimated that the share of people aged 65 and over in the world population will increase significantly (by 56%), from 901 million (12.3%) in 2015 to 1.4 billion (16.5%) in 2030. Nursing homes for the accommodation and care of the elderly are safe places that provide the elderly with reduced physical and other abilities and a life worthy of a human being. A wide field of interest for the research is the perception and experience of home care users about what a quality life in this environment could represent. As part of the quality of life assessment, different domains are assessed, and a certain degree of subjective assessment is included in the choice of quality of life domains. Given the demographic changes that have led to an aging population, as well as longer life expectancy, new measures of social and health policy towards the elderly are increasingly aimed at raising the quality of life of the elderly, while scientific research is increasingly focused on identifying factors that affect the quality of life of the elderly.

Key words: elderly people, old people's homes, quality of life, assessment

Introduction

The prolongation of life expectancy and the increase in the number of elderly people all over the world have influenced the change in morbidity and mortality in the 21st century. In recent decades, modern society has faced a large increase in the share of people older than 65 in the total population, which is the result of longer life expectancy, progress in the field of medicine and science in general, as well as the improvement of life quality. Studies have shown that the trend of increase in the number of elderly people is such that it is estimated that the share of people aged 65 and older in the world population will increase significantly (by 56%), from 901 million (12.3%) in 2015 to 1.4 billion (16.5%) in 2030. The elderly represent a vulnerable population group, whose needs are numerous, different and highly-specific (2). A lot of needs (health, economic, social) are present to a great extent in the geriatric population, which demands specific ways of work at all levels of health care (3).

The quality of life of elderly people

Reasons for the assessment of quality of life are different in the field of social sciences, as well as in the field of natural sciences. Authors from different fields have approached the concept of quality of life in different ways, and therefore there are numerous definitions of quality of life today (4). According to the definition of quality of life given by Felce and Perry (5), quality of life presents an overall general well-being, which integrates objective indicators and subjective evaluation of physical, material, social and emotional well-being. The World Health Organization defines quality of life as an individual's perception of their own position in life in the context of the culture and value systems in which they live in relation to their goals, expectations, standards and concerns (6). It is evident that, according to the definition of the World Health Organization, quality of life is, first of all, a psychological category, which does not come automatically from the satisfaction of some basic needs, but from the overall psychological struc-

akciji sa fizičkom i socijalnom okolinom u kojoj živi (6). Nema sumnje da će u budućnosti stare osobe patiti od raznih bolesti koje dovode do invaliditeta i smanjenog kvaliteta života. Interesi starijih i poboljšanje kvaliteta života u ovom dobu, uključujući i njihove zdravstvene probleme, moraju biti prioritet u narednim godinama (7).

Domovi za stara lica

Domovi za smeštaj i negu starih lica su ustanove za zbrinjavanje starih osoba koje više nisu u mogućnosti da brinu o najosnovnijim svakodnevnim životnim potrebama, a nemaju nikakvu pomoć porodice i svojih bližnjih. Predstavljaju sigurna mesta koja starim osobama sa smanjenim fizičkim i ostalim mogućnostima osiguravaju život dostojan čoveka. Potražnja za domovima je uvek aktuelna, iako postoje brojne pritužbe na domski smeštaj i brigu o starim osobama ovakvog tipa (8). U današnje vreme mnoga istraživanja su usmerena ka proceni kvaliteta života starih osoba koje su smeštene u domovima. Korisnici doma uglavnom govore o umerenom nivou kvaliteta života. Široko polje interesovanja za istraživanje jesu percepcija i iskustvo korisnika o tome šta bi moglo predstavljati dobar kvalitet života u ovom okruženju. Ne ograničavajući se na zdravstvene probleme, na kvalitet života u domovima za stare utiče mnoštvo aspekata i dimenzija. Međutim, zbog učestalih fizičkih ili kognitivnih ograničenja u ovoj životnoj fazi i kontekstu, istraživanje kvaliteta života često se svodi na kvalitet života vezan za zdravlje i/ili kvalitet nege. Ovi koncepti su nesumnjivo važni, ali ne mogu zameniti višedimenzionalnu konceptualizaciju kvaliteta života, jer zanemaruju druge dimenzije osim zdravlja i nege (9). Utvrđeno je da je kvalitet života značajan prediktor smrtnosti, fizičke zavisnosti i korišćenja usluga kod starijih osoba. Starije osobe imaju veću verovatnoću da doživljavaju smanjen kvalitet života zbog pogoršanja zdravstvenog stanja, promena u životnom okruženju, krute svakodnevne rutine i izmenjenog obrasca društvene interakcije (10).

Studija koja je sprovedena u Zagrebu kod 2531 ispitanika smeštenih u 19 domova za starije i nemoćne osobe pokazuje da je 60% starih osoba koje žive u domovima zadovoljno ili jako zadovoljno svojim životom (jedan od indikatora kvaliteta života), dok je 12,8% jako nezadovoljno i nezadovoljno svojim životom. Autori navode da su rezultati puno bolji nego u drugim istraživanjima sprovedenim među starim osobama izvan domova

za stare. Najveći broj osoba je zadovoljan ili potpuno zadovoljan životom u domu, njih 70,4%, dok je 4,8% potpuno nezadovoljno i nezadovoljno. Gotovo jedna petina ispitanika (24,8%) svoje zadovoljstvo domom procenjuje osrednje. Rezultati studije sprovedene u Zagrebu, takođe, ukazuju da je zadovoljstvo druženjem i aktivnostima u domu, prema zbirnoj varijabli, najslabije ocenjen aspekt zadovoljstva domskim uslugama. Skoro trećina učesnika u istraživanju (31,2%) ocenila je svoje zadovoljstvo druženjem u domu kao osrednje, 8,4% je izjavilo da su veoma nezadovoljni i nezadovoljni, a 57,2% ispitanika je reklo da su zadovoljni i veoma zadovoljni druženjem u domu, dok je 3,2% ispitanika uskratilo svoj odgovor na ovo pitanje. Zadovoljstvo druženjem u domu ispitano je kroz nekoliko varijabli, u smislu zadovoljstva raznolikošću sadržaja, učestalosti društvenih događanja i uključenosti u događanja. Od svih navedenih varijabli, varijabla koja se odnosila na zadovoljstvo njihovim učešćem u aktivnostima u domu imala je najnižu vrednost. Raznolikost sadržaja i učestalost društvenih događanja su varijable koje su procenjene lošijima od svih drugih varijabli u bilo kom drugom aspektu domskog života (11).

Rezultati istraživanja Klarina i Telebara (12), koje je sprovedeno na uzorku od 260 osoba starije životne dobi smeštenih u domu za starije i nemoćne, pokazuju da je zadovoljstvo životom blago pomerenom prema višim vrednostima. Može se pretpostaviti da su osobe koje žive u institucijama kao što su domovi za starije svesne toga da se mogu osloniti na celokupni tim stručnjaka koji brine o njima, da imaju više prilika da se druže sa svojim vršnjacima, te da su manje usamljeni i ne razmišljaju negativno o svom životu. Osobama starije životne dobi koje žive u domu za starije i nemoćne, savremenim pristupom omogućeno je dostojanstveno i ugodno starenje (12). U istraživanju, sprovedenom kod 55% ispitanika smeštenih u domovima za stare u Belgiji, *Van Malderen* i saradnici (9) su ispitali u kojoj meri domovi za stare primenjuju pristup usmeren aktivnom starenju, te navode da, što više korisnici doživljavaju pristup koji je usmeren prema aktivnom starenju u domu, to je veći i njihov kvalitet života. Ustanovljeno je da su korisnici prilično pozitivni u pogledu aktivnog starenja u svojim domovima i da imaju umereno pozitivnu ocenu kvaliteta svog života. Autori ističu da navedeni rezultati odgovaraju rezultatima drugih studija i suprotstavljaju se široko rasprostranjenim

ture of an individual in interaction with physical and social environment (6). Undoubtedly, in the future the elderly will suffer from various diseases, which lead to disability and lower quality of life. Interests of elderly people and improving quality of life in this life stage, including their health problems, must be the priority in the years to come (7).

Nursing homes for the elderly

Nursing homes for the residential care of elderly people are institutions for elderly people who are not able to take care of basic daily routines, and who are not assisted by their family and close people. They represent safe places which provide a life worthy of a man to elderly people with diminished physical and other abilities. Demand for nursing homes is always present, although there have been numerous complaints about accommodation and care in nursing homes for the elderly (8). Nowadays, a lot of research studies are focused on assessing the quality of life of elderly people who are accommodated in nursing homes. Residents of nursing homes mainly speak about the moderate level of quality of life. Residents' experience and perception about what would be good quality of life in this environment present a wide field of interest for the research. A lot of aspects and dimensions influence quality of life in nursing homes, not only health problems. However, due to frequent physical or cognitive limitations in this life stage and context, the research of quality of life is often limited to quality of life in relation to health and/or quality of care. These concepts are undoubtedly important, but they cannot replace the multidimensional conceptualization of quality of life because they disregard other dimensions except health and care (9). It has been found out that quality of life is a significant predictor of mortality, physical dependence and use of services in elderly people. There is a great possibility that elderly people will experience lower quality of life due to the worsening of health condition, changes in the surroundings, rigid daily routine and changed pattern of social interaction (10).

A study, which was conducted in Zagreb and which included 2351 examinees placed in 19 nursing homes for elderly and helpless people, showed that 60% of elderly people living in nursing homes were satisfied or very satisfied with their lives (one of the indicators of quality of life), while 12.8% were very dissatisfied or dissatisfied

with their lives. The authors stated that the results were a lot better in comparison to other research studies that included elderly people not living in nursing homes. The largest number of people was satisfied or completely satisfied with the life in the nursing home, that is, 70.4% of them, while 4.8% were completely dissatisfied or dissatisfied. Almost one fifth of examinees (24.8%) estimated their satisfaction with the nursing home as moderate. The results of the study conducted in Zagreb also pointed to the fact that satisfaction with social activities in the nursing home, according to the collective variable, was the most weakly assessed aspect of satisfaction with nursing home services. Almost one third of participants of this research (31.2%) evaluated their satisfaction with socializing in the nursing home as moderate, 8.4% stated that they were very dissatisfied and dissatisfied, while 57.2% of examinees said that they were satisfied and very satisfied with socializing in the nursing home, while 3.2% of examinees did not respond to this question. Satisfaction with socializing in the nursing home was assessed with the help of several variables in terms of satisfaction with the variety of contents, frequency of social events and participation in those events. Of all the mentioned variables, the variable relating to their satisfaction with the participation in activities in the nursing home had the lowest value. The variety of contents and frequency of social events were variables that were assessed as worse than all the other variables regarding any other aspect of life in the nursing home (11).

The results of the research of Klarin and Tešbar (12), which was conducted on the sample of 260 elderly people placed in the nursing home for the elderly and helpless, showed that satisfaction with life slightly improved to higher values. It could be assumed that people, who lived in institutions such as nursing homes for the elderly, were aware of the fact that they could rely on the whole team of professionals who took care of them, that they had more opportunities to socialize with their peers, and therefore they were less lonely and did not think of their lives in a negative way. The modern approach enabled dignified and comfortable ageing for elderly people living in a nursing home. In the research, which included 55% of examinees placed in nursing homes in Belgium, Van Malderen and associates (9) examined to which extent nursing homes applied the

društvenim predrasudama da korisnici doma za stare imaju loš kvalitet života (9).

Pavlović (13), u istraživanju sprovedenom u Republici Srpskoj među osobama starijim od 65 godina života, navodi da na kvalitet života starih osoba utiče i nedostatak gerijatarata i osoblja specijalizovanog za oblast gerontologije u Bosni i Hercegovini, što doprinosi veličini problema među korisnicima staračkih domova za negu i zanemarivanju procene kvaliteta života, jer su korisnici staračkih domova uglavnom stariji i slabiji. Ispitanici u staračkim domovima imaju lošiji i funkcionalni status u odnosu na ispitanike koji žive u zajednici, što zahteva obavezan stalan nadzor u obavljanju osnovnih i instrumentalnih aktivnosti svakodnevnog života (13). Slične nalaze opisuju i drugi autori koji su istraživali vezu između mesta boravka starih osoba i njihovog fizičkog funkcionisanja (14).

Merenje kvaliteta života

Postoje brojni instrumenti koji služe za merenje kvaliteta života kod starih osoba. U praksi se koriste i višedimenzionalna merenja koja koriste skalu pomoću koje se kvalitet života definiše preko različitih dimenzija za koje se smatra da su bitne za evaluaciju. U sklopu procene kvaliteta života procenjuju se različiti domen, a u izbor domena kvaliteta života je uključen i određen stepen subjektivne procene (15,16).

Danas postoji veoma veliki broj instrumenata pomoću kojih se meri konstrukt kvaliteta života povezan sa domenom zdravlja, a mogu se podeliti u tri grupe. Prva grupa instrumenata je višedimenzionalna (obuhvata veći broj područja kvaliteta života) i ima najširu upotrebu te se koristi kod različitih oboljenja, ali i kod zdrave populacije, gde se ispituju demografske i kulturološke razlike kada je u pitanju procena kvaliteta života. Od instrumenata ove vrste često se koriste SF-36 (engl. *Short Form Survey-36*) i Upitnik kvaliteta života Svetske zdravstvene organizacije (engl. *The World Health Organization Quality of Life Assessment*) (6,17). Drugu grupu čine instrumenti vezani za određene bolesti, razvijeni za specifičnu upotrebu kod pacijenata koji imaju slične tegobe. Neki od njih konstruisani su za tegobe kod osoba obolelih od raka, artritisa, dijabetesa i slično, a upitnicima su obuhvaćeni domen kvaliteta života koji su značajni za pojedino oboljenje. Kod starih pacijenata obolelih od artritisa kvalitet života često se ispituje Skalom za merenje uticaja artritisa (engl. *Arthritis Impact Measurement Scale*) (18).

Kod pacijenata obolelih od raka upotrebljava se Skala Evropske organizacije za istraživanje i lečenje raka (engl. *European Organization for Research on Treatment of Cancer*). Treću grupu čine instrumenti koji se koriste za procenu domena kvaliteta života, poput telesnog funkcionisanja ili psihičkog zdravlja. Primer ove vrste upitnika je Bekov upitnik depresije (engl. *Beck Depression Inventory*) (19,20). Rezultati istraživanja pokazuju da postoje značajne razlike u uticaju pola na četiri različite skale kvaliteta života (fizičko zdravlje, psihološko zdravlje, socijalne veze i okruženje), pri čemu žene imaju znatno niže vrednosti na ovim skalama, što ukazuje na niži kvalitet života žena u odnosu na kvalitet života muškaraca (7).

Po Meknultiju (21), pozitivna psihologija se bazira na subjektivnim pozitivnim iskustvima. Ova unutrašnja iskustva su određena opštim blagostanjem čoveka, duhovnim i materijalnim; zadovoljstvom i optimizmom, što se i nalazi u korenu koncepta kvaliteta života. Proučavanje kvaliteta života od izuzetnog je značaja za staru populaciju (21). S obzirom na demografske promene koje su dovele do starenja stanovništva, kao i na sve duži životni vek, nove mere socijalne i zdravstvene politike prema starima se sve više usmeravaju na podizanje kvaliteta života starih, dok se naučna istraživanja sve više usmeravaju na otkrivanje faktora koji utiču na kvalitet života starih. Istraživači su u poslednje vreme počeli da razlikuju dva aspekta blagostanja: emocionalno blagostanje, gde ispitanici daju odgovore o kvalitetu svakodnevnih emocionalnih iskustava; i evaluaciju svog života, gde ispitanici treba da izaberu vrednost na skali, i ocene svoj život u potpunosti (22,23). Najčešće korišćene mere kvaliteta života su Indeks subjektivno procenjenog blagostanja (engl. *Subjective Well Being, Happy Planet Index*), kao i Indeks zadovoljstva životom (engl. *Life Satisfaction Index*). Većina mera se bazira na skali Likertovog tipa, gde se kvalitet života računa kao skor vrednosti (24,25).

Rezultati mnogih istraživanja upućuju na postojanje dobnih razlika u proceni kvaliteta života u celini, ali i u pojedinim domenima kvaliteta života. Subjektivna procena kvaliteta života se smanjuje kako organizam stari, ali ostaje u okviru očekivane vrednosti kod svih starosnih grupa osim kod osoba starih 70 i više godina. Proučavanje različitih društvenih aspekata starosti i njihovog istorijskog toka sa sigurnošću doprinosi boljem razumevanju ovog fenomena. Multimorbiditet, učestale hospitalizaci-

approach oriented to active ageing. They stated that the more residents experienced the approach oriented to active ageing, the better quality of life they had. It was found out that the residents were quite positive about active ageing in their nursing homes and they had a moderately positive estimate of their lives. The authors emphasized that the above mentioned results corresponded with the results of other studies and they confronted the widespread prejudice that nursing homes residents had poor quality of life (9).

Pavlovic (13) in the research conducted in The Republic of Srpska among people aged 65 and older stated that the quality of life of the elderly was influenced by the lack of geriatric doctors and staff specialized in gerontology in Bosnia and Herzegovina, which contributed to the size of the problem among residents of nursing homes and neglecting the evaluation of life quality because residents are usually elderly and weak people. Examinees in nursing homes had a weaker functional status than examinees who lived in the community, which demanded compulsory and constant supervision regarding basic and instrumental daily activities (13). Similar findings were described by other authors, who examined the relationship between the place of residence of elderly people and their physical functioning (14).

Measuring quality of life

There are numerous instruments that are used for measuring quality of life in elderly people. In practice, multidimensional measurements are used as well, and they use the scale with the help of which quality of life is defined through different dimensions, which are deemed to be important for the evaluation. Within the assessment of quality of life, different domains are assessed, and a level of subjective assessment is included in the choice of quality of life domains (15,16).

Nowadays, there are numerous instruments with the help of which the construct of quality of life is assessed in relation to health domain, and they can be divided into three groups. The first group of instruments is multidimensional (it integrates a greater number of quality of life domains) and it is most widely used. Therefore, it is used in different diseases, as well as in a healthy population, when demographic and cultural differences are examined in relation to quality of life assessment. As far as this group of instruments is

concerned, SF-36 (Short Form Survey-36) and The World Health Organization Quality of Life Assessment are often used (6,17). The second group includes instruments connected with specific diseases that were developed for the specific use in patients with similar problems. Some of them were designed for troubles in patients affected by cancer, arthritis, diabetes, while some questionnaires incorporated only domains of quality of life that were significant for a specific disease. In elderly patients with arthritis, quality of life is often assessed with the help of Arthritis Impact Measurement Scale (18). In patients with cancer, scale of the European Organization for Research on the Treatment of Cancer is used. The third group is instruments, which are used for the assessment of quality of life domains such as physical functioning or mental health. An example of this kind of questionnaire is Beck Depression Inventory (19,20). The results of the research showed that there was a significant difference in gender-related influence on four different scales of quality of life (physical health, mental health, social relations and environment), while women had lower values on these scales, which pointed to lower quality of life of women in comparison to men (7).

According to McNulty (21), positive psychology is based on subjective positive experience. This inner experience is determined by the general well-being of a man, spiritual and material well-being; satisfaction and optimism, which are rooted in the concept of quality of life. Analyzing quality of life is of great importance for the population of elderly people (21). Having in mind demographic changes that have led to population ageing, as well as longer life expectancy, new measures of social and health politics are becoming more and more oriented towards the increase of quality of life of elderly people, whereas scientific research is oriented towards discovering factors that influence quality of life of elderly people. Researchers recently started to make difference between two aspects of well-being: emotional well-being, where examinees give answers about the quality of everyday emotional experience; and the evaluation of their lives, where examinees have to choose a value on the scale and evaluate their lives completely (22,23). The most frequently used measures of quality of life are the Index of subjectively assessed well-being (Subjective Well Being, Happy Planet Index), as well as the Life Satisfac-

je, polifarmacija, gubitak zuba, mišićna slabost, otežana pokretljivost i kognitivna oštećenja negativno utiču na kvalitet života starih osoba posebno onih koji borave u staračkim domovima. Prospektivne studije su neophodne kako bi se analizirali faktori onesposobljavanja starih i potencijalni modeli nege koji mogu doprineti očuvanju funkcionalne sposobnosti gerontoloških pacijenata (13).

Na osnovu svega navedenog, može se reći da je kvalitet života starih osoba koncept koji se sve više istražuje u relevantnoj svetskoj literaturi i predmet je interesa mnogih naučnika, ali procena kvaliteta života starih osoba ima i svoje praktične doprinose. Stare osobe imaju mnogobrojne probleme, a samim tim i mnogobrojne potrebe, koje su najčešće u trećem životnom dobu narušene. Zahtevi za zadovoljavanjem zdravstvenih i socijalnih potreba starijih osoba gotovo su uvek veći od ekonomskih mogućnosti društva, koliko god ono bilo bogato. Trajan nedostatak sredstava je bazična konstanta svake socijalne politike koja je usmerena ka zadovoljavanju potreba starijih osoba (13).

Zaključak

Starenje populacije jedan je od najvećih izazova sa kojima se suočava savremeni svet. Život u domovima za stare nudi pogodnosti korisnicima, ali istovremeno ima mnogo i izazova sa kojima se oni susreću. S obzirom na to da se starija populacija povećava u najrazvijenijim zemljama, deo ove populacije će živeti u domovima za stare. Zbog toga je važno razmotriti načine i sredstva za poboljšanje uslova smeštaja u domovima za stara lica i naći sredstva za poboljšanje života starijih koji žive u ovim institucijama.

Kvalitet života nalazi se u fokusu javnozdravstvenih politika usmerenih na stare, tako da istraživači u oblasti javnog zdravlja i drugih srodnih disciplina pažnju usmeravaju na identifikaciju faktora od značaja za podizanje blagostanja i životnog standarda kod starih osoba. Od velike važnosti je i implementacija naučnih saznanja u nacionalnim i globalnim strategijama, u cilju promovisanja zdravog i aktivnog starenja, međugeneracijske solidarnosti, kao i stvaranja društvene sredine koja može adekvatno da odgovori na mnoge potrebe starije populacije.

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tion Index. The majority of measures are based on Likert scale, where quality of life is measured as a score of values (24,25).

The results of many studies have pointed to the existence of age-related difference in the evaluation of the overall quality of life, as well as specific domains of quality of life. The subjective assessment of quality of life decreases as an organism gets older, but it remains in the scope of expected values in all age groups, except in people older than 70 years. The analysis of different social aspects of old age and their historical course certainly contributes to better understanding of this phenomenon. Multimorbidity, frequent hospitalizations, polypharmacy, loss of teeth, muscular weakness, impeded mobility and cognitive damage influence negatively the quality of life of elderly people, especially those in the nursing homes. Prospective studies are necessary in order to analyze trigger factors that disable the elderly, as well as potential models of care, which could contribute to preserving functional ability of gerontology patients (13).

According to the above mentioned, it could be said that the quality of life of elderly people is the concept that is more and more researched in the relevant world literature and it is the field of interest for many scientists, but the assessment of quality of life of elderly people has its practical contribution. Elderly people have numerous problems, and therefore, numerous needs that are impaired in this life stage. Demands for satisfying health and social needs of elderly people are almost always greater than the economic possibilities of one society, no matter how prosperous it is. Permanent lack of resources is the basic constant of each social policy, which is focused on satisfying old people's needs (13).

Conclusion

Population ageing is one of the greatest challenges, which the contemporary world faces. Life in nursing homes offers comforts to the users, but they are faced with a lot of challenges. Considering the fact that the population of elderly people increases in the most developed countries, it is certain that one part of them will live in nursing homes. Therefore, it is important to examine the means and resources for the improvement of conditions of accommodation in nursing homes for the elderly and to find means for improving the lives of elderly people who live in these institu-

tions.

Quality of life is in focus of public health policies oriented towards the elderly, and therefore, researchers from the field of public health and other related disciplines focus on identifying factors that are important for improving the welfare and life standard of elderly people. The implementation of scientific knowledge is of great importance in national and global strategies, aimed at promoting healthy and active ageing, inter-generational solidarity, as well as creating social environment which can respond adequately to numerous needs of elderly population.

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Acknowledgment

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