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## Prikaz kretanja KEP indeksa u Hrvatskoj i Europi

### Presentation of DMF Index in Croatia and Europe

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#### Sažetak

Karijes je najčešća oralna bolest svih dobnih skupina i glavni je uzročnik gubitka zuba. Iako je u svijetu zabilježen pad u njegovoj prevalenciji, u mnogim zemljama i dalje je glavni oralnozdravstveni problem. **Svrha:** Ovim se radom željelo prikazati kretanje vrijednosti KEP/kep indeksa u Hrvatskoj i usporediti ga s europskim zemljama te predstaviti planove usmjerene prema promicanju oralnoga zdravlja i smanjenju prevalencije karijesa. **Materijal i metode:** Podatci o KEP indeksu prikupljeni su pretraživanjem internetskih baza podataka od 1985. do 2015. godine. **Rezultati:** Hrvatska se ubraja u europske zemlje s visokim KEP indeksom među dvanaestogodišnjacima (4, 18). Iskustva zemalja s malim KEP-om pokazala su da je karijes moguće kontrolirati edukacijom i preventivnim aktivnostima, što u konačnici rezultira smanjenjem sveukupnih financijskih troškova na individualnoj i nacionalnoj razini te poboljšanjem općega zdravlja i kvalitete života. **Zaključak:** Praćenje i nadzor oralnoga zdravlja, odnosno dentalnog karijesa, zahtijeva u sustavu bolje prikupljanje podataka o njegovoj prevalenciji, utvrđivanje multifaktorijskih uzroka u njegovu nastanku te provedbu nacionalnih preventivnih programa.

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#### Ključne riječi

zubni karijes, KEP indeks, Hrvatska, Europa

#### Uvod

Prema definiciji Svjetske zdravstvene organizacije (SZO) dentalni karijes je lokalni post-eruptivni patološki proces egzogenog podrijetla, progredijentnog toka, ireverzibilne prirode i nedovoljno razjašnjene etiologije (1). Zahvaća tvrda zubna tkiva i uzrokuje njihovu demineralizaciju zbog djelovanja mikroorganizama, što posljedično rezultira stvaranjem šupljine u zubu te uzrokuje bol, a ako se ne liječi, prijeti i gubitak zuba. Dosadašnja istraživanja pokazala su da je karijes moguće prevenirati i kontrolirati, a da bi se primijenile mjere za prevenciju, potrebni su pouzdani epidemiološki podaci o njegovoj distribuciji (2). Od 1938. godine KEP indeks postaje relevantan u praćenju distribucijskih trendova karijesa kojima se SZO koristi u svojoj procjeni oralnoga zdravlja, a pokazuje intenzitet, odnosno učestalost karijesa (3). Prevalencija karijesa u svijetu bilježi pad u razvijenim zemljama zbog bolje organizacije dentalne zdravstvene zaštite, dostupnosti fluoridnih preparata, poboljšanja oralne higijene i bolje svijesti o nastanku karijesa (2,4). Zapadne i sjeverne europske zemlje bilježe trend smanjenja karijesa, a u državama istočne i srednje Europe ostaje i dalje javnozdravstveni problem (5, 6). Reorganizacija dentalne zdravstvene zaštite te dugogodišnji nedostatak preventivnih postupaka i promocije oralnoga zdravlja razlozi su koji su Hrvatsku svrstali u zemlje s visokim KEP indeksom. Prelazak specijalista dječje i

#### Introduction

According to the World Health Organization (WHO), dental caries is a localized post-eruptive pathological process of external origin, with a progressive, irreversible nature and insufficiently clear aetiology (1). It affects hard dental tissues where microorganisms act to cause their demineralization, which consequently leads to the development of cavity causing pain and, if not treated, tooth loss. Over the years, studies have shown that tooth decay can be prevented and controlled, but reliable epidemiological data on its distribution are a prerequisite which would allow the implementation of measures that could be used in caries prevention (2). Since 1938, the DMF index has become a relevant tool in monitoring of distribution trends concerning dental caries; applied by the WHO in their assessment of oral health, reflecting the intensity or frequency of dental caries (3). Caries prevalence in the world has decreased in developed countries due to improved organization of dental health care, available fluoride products, improved oral hygiene and higher awareness concerning caries occurrence (2, 4). Western and Northern European countries have recorded a decrease in caries, but in the countries of Eastern and Central Europe caries has remained a public health problem (5, 6). The restructuring of organized dental health care, years of insufficient preventative actions and the lack of pro-

preventivne dentalne medicine u polivalentnu dentalnomedicinsku djelatnost, rezultirao je gubitkom sustavne skrbi o oralnome zdravlju, odnosno praćenja i prevencije dentalnog karijesa kod djece. Prije su se Hrvatskoj povremeno provodila istraživanja o epidemiologiji dentalnog karijesa, a obuhvaćala su skupine različite dobi u pojedinim gradovima i područjima te su upozoravala na veliku aktivnost/pojavnost karijesa i nekonzistentnost podataka. Jedinstvena baza podataka o KEP indeksu u Hrvatskoj dosad nije postojala, a podatci koje SZO ima o KEP/kepu u Republici Hrvatskoj temelje se na objavljenim znanstvenim radovima (7).

Svrha je ovoga rada prikazati kretanje vrijednosti KEP/kep indeksa u Republici Hrvatskoj (RH) na temelju prikupljenih i sažetih podataka o epidemiologiji zubnog karijesa objavljenih u literaturi posljednjih trideset godina te ih usporediti s drugim europskim zemljama. Također će se predložiti planovi i ciljevi koji su usmjereni prema provođenju prevencije karijesa, smanjenju KEP indeksa i poboljšanju oralnoga zdravlja te predstaviti podatci o KEP-u iz baze podataka Hrvatskoga zavoda za zdravstveno osiguranje od 2013. do 2015. godine.

## Materijal i metode

Podatci su prikupljeni pretraživanjem baze podataka u Pub Medu i Google Scholaru. U elektroničkom pretraživanju koristili smo se sljedećim ključnim riječima: *dental caries, prevalence, DMFT, Croatia*. Provjereni su svi dobiveni rezultati te su odabrani objavljeni radovi i članci vezani za pretražene podatke u razdoblju od 1985. do 2015. godine koji su sadržavali podatke o karijesu djece i odraslih. S namjerom je izabrana dječja populacija u dobi od 5 do 6 godina te 12 godina, jer su to preporučene dobne skupine kojima se SZO koristi za praćenje oralnoga zdravlja (8). Podatci o KEP indeksu u RH od 2013. do 2015. godine dobiveni su prikupljanjem podataka o dentalnom statusu, a utvrđivao se tijekom kliničkog pregleda u ordinacijama dentalne medicine koje imaju sklopljene ugovore s Hrvatskim zavodom za zdravstveno osiguranje/ugovorni subjekti HZZO-a (9). Pregledi i dentalni statusi bilježili su se u sklopu Centralnoga zdravstvenog informacijskog sustava Republike Hrvatske (CEZIH), a podatci su objavljeni na internetskoj stranici Ministarstva zdravlja u srpnju 2015. Dentalni karijes kod djece i prikaz traženih podataka te učestalost i ozbiljnost bolesti izneseni su s pomoću standardnih epidemioloških indikatora, KEP-a (broj karioznih, izvađenih i plombiranih zuba u mlječnoj denticiji) i kep indeksa (broj karioznih, izvađenih i plombiranih zuba u trajnoj denticiji) (8). Rezultati pretraživanja obrađeni su u programu Microsoft Access 2.0. te su prikazani grafički.

## Rezultati

### Karijes kod šestogodišnjaka

Pregledom literature o prevalenciji karijesa kod šestogodišnjaka zapažene su visoke vrijednosti KEP/kep indeksa i mali udjel djece bez karijesa. U gradu Zagrebu se, od 1985.

emotional oral health campaigns are the reasons why Croatia has been listed among countries with a high DMF index. The transition of paediatric dentists into the system of polyvalent dental care practice has led to the downfall of the systematic oral health care, i.e., the monitoring and dental caries prevention in children in Croatia. Earlier studies, which were conducted in Croatia, relating to the epidemiology of dental caries were sporadic, covering various age groups in individual cities and regions of Croatia, indicating intensified expansion of dental caries with, however, inconsistent data. A uniform database of the DMF index has not yet been developed in Croatia, while the DMF data for Croatia presented by WHO have been based on the data obtained from published scientific papers (7).

The objective of this paper was to show the trends in the DMF index in Croatia, based on the data collected and summarized relating to the epidemiology of dental caries, found in the literature published in the last thirty years and in comparison with other European countries. Plans and goals will be presented also, aiming at the implementation of caries prevention, the DMF reduction and the improvement of oral health. Moreover, we will show the DMF index related data, kept in the database of the Croatian Health Insurance Fund, collected in the period from 2013 to 2015.

## Methods and materials

Data were collected through search in Pub Med and Google Scholar databases. The following key words were used in the electronic search: dental caries, prevalence, DMF, Croatia. All search results were checked; papers and articles published relating to the searched data in the period from 1985 to 2015 were selected, giving the information on caries in children and caries in adults. Our intention was to select the children population of 5 to 6-year olds and of 12-year olds as recommended age groups used for oral health surveillance by WHO (8). For the period from 2013 to 2015, the DMF index data for Croatia were obtained by retrieving dental status data collected during clinical examinations carried out by dental practitioners who had signed the contracts with the Croatian Health Insurance Fund (9). Clinical examinations and status of the teeth were recorded in the Central Health Information System of Croatia (CEZIH) and the data were published on the website of the Ministry of Health in July 2015. Regarding dental caries among children and presentation of searched data, the prevalence and severity of disease was reported in terms of the standard epidemiological indicators, DMF (number of decayed, missing due to caries and filled teeth in the primary dentition) and dmft index (number of Decayed, Missing due to caries, and Filled Teeth in the permanent dentition)(8). The statistical analysis of the resulting data was made and presented via graphs in Microsoft Access 2.0.

## Results

### Caries in 6-Year-Old Children

A review of the literature on the prevalence of dental caries among 6-year-old children has shown high DMF index figures and a small proportion of children without caries. In

do 1992. godine tijekom provođenja programa preventivne karijesa (dvanaestogodišnje iskustvo; od 1980. do 1992. godine), u vrtićima povećao postotak šestogodišnjaka bez karijesa sa 16 na 27 posto, a vrijednost kepi indeksa pala je s 5,9 na 4,4 (10). U istraživanju provedenom 1994. godine u zagrebačkim vrtićima zabilježeno je 9,4 posto šestogodišnjaka bez karijesa, što govori u prilog porastu prevalencije karijesa u odnosu na ranije godine (11). U istraživanju provedenom 1997. u gradu Zaboku, kako bi se procijenio utjecaj ratnih uvjeta na stanje oralne higijene, kepi indeks šestogodišnjaka bio je 6 (12). Sljedećih godina i dalje se uočava trend porasta prevalencije karijesa zbog neprovođenja preventivne dentalne zaštite. U razdoblju od 2008. do 2009. godine podatci prikupljeni među djecom u Primorskoj-goranskoj županiji pokazuju vrijednosti kepi indeksa 4,68 i znatan udjel djece s karijesom (74,5 %) (13). Pregled djece od 6 godina u gradu Rijeci od rujna 2012. do svibnja 2013. godine, pokazao je kepi indeks od 3,68 i 22 posto djece bez karijesa (14) (slika 1., slika 2.). Kepi indeks kod šestogodišnjaka koji je zabilježen u CEZIH-u od 2013. do 2015. godine bio je 4,14. Najmanji Kepi indeks u toj dobi zabilježen je u Međimurskoj (3,25) i Virovitičko-podravskoj županiji (3,10), a najveći u Sisačko-moslavačkoj (5,77) i Ličko-senjskoj županiji (5,65) (15) (tablica 1.).

the period from 1985 to 1992, as a result of the implementation of the preventative dental caries programme (twelve years experience; from 1980 to 1992) in kindergartens in the city of Zagreb, the percentage of 6-year-old caries-free children increased from 16 to 27 %, while the value of the dmft index decreased from 5.9 to 4.4 (10). In the study conducted in 1994 also in Zagreb kindergartens, 9.4 % of 6-year-old children without caries was recorded, which indicates the increasing prevalence of dental caries in comparison to previous years (11). In the survey conducted in 1997 in the town of Zabok, to assess the impact of war life circumstances on oral hygiene, the dmft index of 6-year-old children was 6 (12). In the following years, the trend of increasing dental caries prevalence continued, reflecting the absence of preventive dental care campaigns. In the period from 2008 to 2009, the data collected among 6 year-old school children in the Primorsko-Goranska County showed the dmft index of 4.68 and a significant proportion of children with caries (74.5 %) (13). Clinical examinations of 6 year-old children in the city of Rijeka, carried out from September 2012 to May 2013, showed dmft of 3.68 and 22 % of caries-free children (14) (Figure 1, Figure 2). The DMF index in 6 year-old children registered in the Central Health Information System, for the period from 2013 to 2015, was 4.14. The lowest DMF index was recorded in the Međimurje County (3.25) and the Virovitičko-Podravska County (3.10) and the highest in the Sisačko-Moslavačka County (5.77) and the Ličko-Senjska County (5.65) (15), Table 1.

Tablica 1. Kepi indeks prema podatcima CEZIH-a  
Table 1 DMFT index according to Central Health Information System

Dobna skupina • Age Group	Država/Regija • Country/Area	KEP • DMF	Godina • Year
6 godina • 6 Year Old	Hrvatska • Croatia	4.14	2013-2015*
	Međimurska županija • Međimurska County	3.25	
	Virovitičko-podravska županija • Virovitičko-Podravska County	3.1	
	Sisačko-moslavačka županija • Sisačko-Moslavačka County	5.77	
	Ličko-senjska županija • Ličko-Senjska County	5.65	
12 godina • 12 Year Old	Hrvatska • Croatia	4.18	
18-65 godina • 18-65 Year Old	Hrvatska • Croatia	12.5	

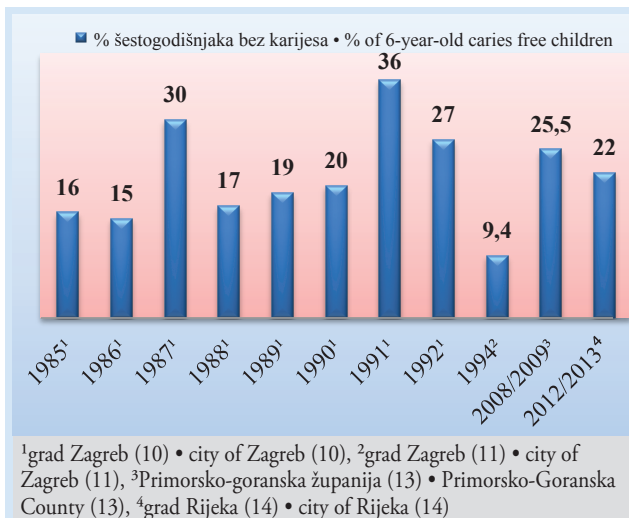
\*CEZIH- Centralni zdravstveni informacijski sustav Hrvatske

### Karijes kod dvanaestogodišnjaka

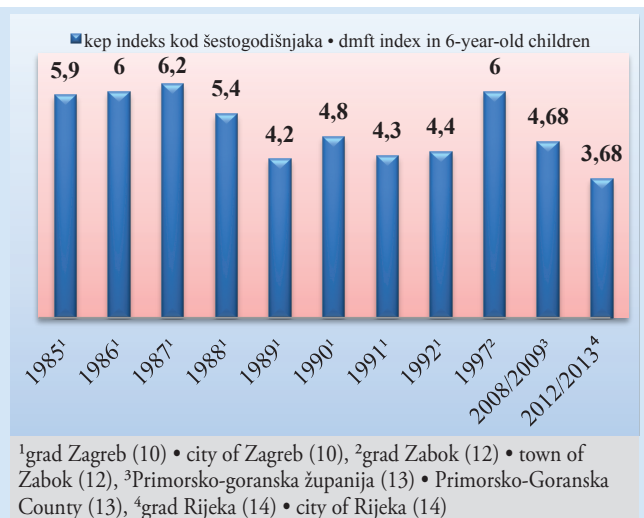
Godine 1985. karijes je kod dvanaestogodišnjaka bio 5,9 (16). Zahvaljujući programima edukacije o oralnome zdravlju koji su se provodili u školama i dječjim vrtićima te zbog redovite fluoridacije poboljšala se oralna higijena, što je rezultiralo smanjenjem kepi indeksa tijekom godina. Od 1985. trend je smanjenja kepi indeksa, pa je tako 1986. u istraživanju provedenom u gradu Zagrebu iznosio 4,6 (17). Do 1990. godine smanjio se na 3,4. Najveće poboljšanje postignuto je 1991. godine kada je kepi indeks bio 2,6 (16). Visoke vrijednosti kepi indeksa (4,1) zabilježene su 1997. godine u studiji provedenoj među dvanaestogodišnjacima u gradu Zaboku (12). Promjene u sustavu zdravstvene zaštite i ratno razdoblje uzrokovali su rast kepi indeksa, pa je u 1999. iznosio 3,5 (16). U istraživanju provedenom u Šibenskoj-kninskoj županiji u 2003. godini bio je 3,85 (18). Od

### Caries in 12-Year-Old Children

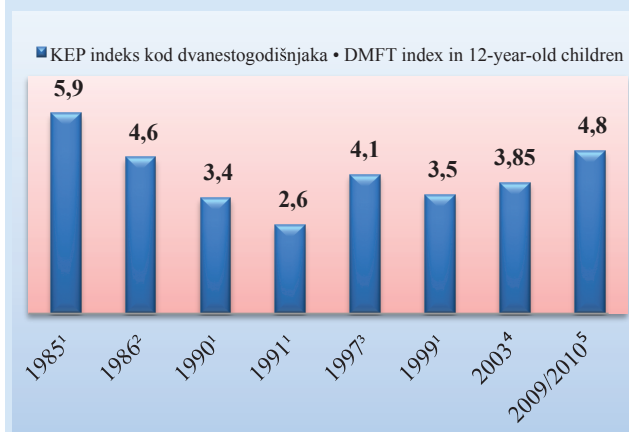
In 1985, the DMF index of 12-year-old children was 5.9 (16). Years of educational and oral health programmes, which were conducted in schools and kindergartens and regular tooth fluoridation resulted in an improved oral hygiene and decreased DMF index through the years. From 1985, DMF's declining trend continued, in such a way that the 1986 survey conducted in the city of Zagreb showed it at 4.6 (17). By 1990, DMF decreased to 3.4. The highest improvement results were achieved in 1991 when the DMF index was 2.6 (16). In 1997, the high DMF value (4.1) was noted in the study performed in the town of Zabok among 12 year-old children (12). In 1999, it amounted to 3.5 and it has been observed that changes in the health care system and the war period have led to the increase in the DMF index (16). In the survey conducted in the Šibensko-kninska County in



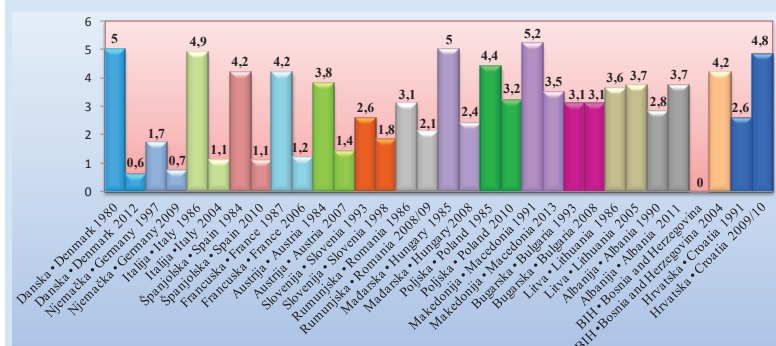
Slika 1. Postotak šestogodišnjaka bez karijesa  
Figure 1 Percentage of 6 year-old caries free children



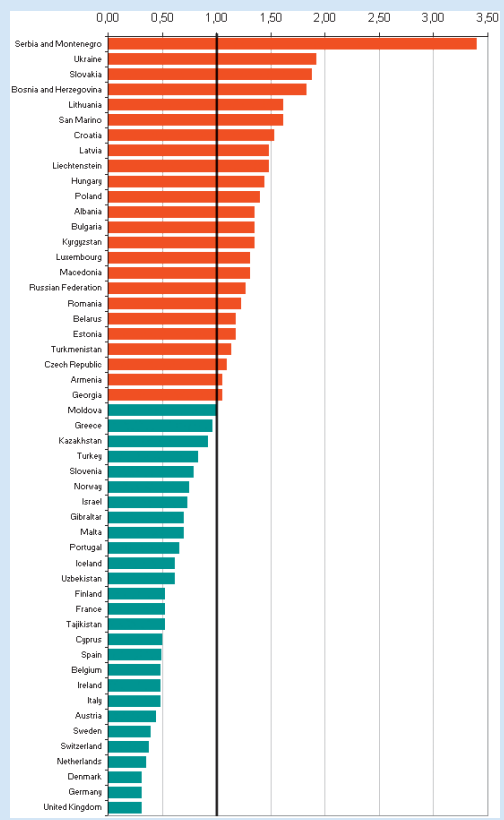
Slika 2. Kep indeks kod šestogodišnjaka  
Figure 2 dmft index in 6 year-old children



Slika 3. KEP indeks kod dvanaestogodišnjaka  
Figure 3 DMFT index in 12 year-old children



Slika 4. Prikaz promjena u kretanju KEP indeksa kod dvanaestogodišnjaka u europskim zemljama  
Figure 4 Trends in DMFT scores in 12 year-old children in European countries



Slika 5. RR za karijes u zemljama europske regije prema SZO-u  
Figure 5 RR caries according to the countries of the Euro region



2003. godine pa do 2015. i dalje se prati trend povećanja koji je, u istraživanju provedenom među školskom djecom u Zagrebu u razdoblju od 2009. do 2010. godine, bio 4,8 (19) (slika 3.). U istraživanju provedenom među djecom s poteškoćama u razvoju i zdravom djecom u dobi od 3 do 17 godina u gradu Rijeci, prosječna vrijednost KEP-a bila je 6,39 kod djece s poteškoćama u razvoju, a 4,76 kod zdravih dječaka i djevojčica (20). Prema podacima CEZIH-a u Hrvatskoj je od 2013. do 2015. godine KEP indeks kod djece do 12 godina iznosio 4,18 (15) (tablica 1.).

### Karijes kod odrasle populacije

Prema istraživanju koje je 1986. godine provedeno u gradu Zagrebu, kod odraslih u dobi od 35 do 44 godine KEP indeks bio je 16,2, a u najstarijoj dobnoj skupini (više od 64 godine) iznosio je 20 (17). Godine 2003. u uzorku odrasle populacije (35 – 44 godine) u Šibensko-kninskoj županiji KEP indeks iznosio je 21,7, a kod starije populacije (65 –74 godina) 23,7 (18). U istraživanju provedenom na uzorku novaka Hrvatske vojske u dobi od 19 do 27 godina, vrijednost KEP-a bila je 7,76 (21). Drugo istraživanje koje je provedeno 2004. godine, također na uzorku vojnika ročnika u četirima hrvatskim regijama (dob 18 –28 godina), pokazalo je visoke vrijednosti KEP-a (8,6) (22). Godine 2010. vrijednost KEP-a za ispitivanu populaciju u dobi od 18 do 65 godina u gradu Kninu bila je 17,3 (23). Procjenom dentalnoga i oralnoga zdravlja starije populacije u dobi od 58 do 99 godina koji su bili u institucijskoj skrbi grada Zagreba, zabilježeni KEP indeks iznosio je 27 (24) (tablica 2.). Prosječni KEP indeks za odrasloga građanina Hrvatske, prema podacima CEZIH-a, iznosi 12,5 (tablica 1.). Kod žena je njegova vrijednost veća – 13,2 (15).

the 2003, the index was at 3.85 (18). From 2003 until 2015, the increase in caries prevalence could still be noted and the study conducted among school children in the city of Zagreb in the period from 2009 to 2010 showed it at 4.8 (19) (Figure 3). The study conducted among disabled and healthy children aged 3-17 years in the city of Rijeka showed the average DMF index score of 6.39 for disabled children and 4.76 for healthy children (20).

According to the Central Health Information System of Croatia, in the period from 2013 to 2015, the DMF index of children under 12 years was 4.18 (15) (Table 1).

### Caries in Adults

According to the survey conducted in the city of Zagreb in 1986 among 35-44 year-old adults, the DMF index was 16.2, while the DMF value in the oldest age group (over 64 years) was 20 (17). In 2003, the sample of 35-44 year-old population of the Šibensko-Kninska County had the DMF value of 21.7 while the elderly population (65-74) had it at 23.7 (18). The survey conducted among Croatian army recruits aged 19-27 years, showed the DMF value of 7.76 (21). Another study, conducted in 2004, also among army recruits in four Croatian regions (18-28 years old) showed high DMF value (8.6) (22). In 2010, the DMF index of 18-65 years old subjects in the town of Knin was 17.3 (23). The assessment of oral health among institutionalised elderly subjects in the city of Zagreb, in the 58-99 years age group, showed the DMF index value of 27 (24) (Table 2). According to the Central Health Information System, the average DMF index for adult Croatian citizens was 12.5 (Table 1). In the female population, it had a higher value of 13.2 (15).

Tablica 2. KEP indeks kod odrasle populacije  
Table 2 DMFT index in adults

	Dobna skupina • Age Group	KEP • DMFT	Godina • Year
	35-44	<b>16.2</b>	1986 <sup>1</sup>
	≥64	<b>20</b>	
	35-44	<b>21.7</b>	2003 <sup>2</sup>
	65-74	<b>23.7</b>	
	18-28	<b>8.6</b>	2004 <sup>3</sup>
	18-65	<b>17.3</b>	2010 <sup>4</sup>
	19-27	<b>7.76</b>	n.a. <sup>5</sup>
	58-99	<b>27</b>	n.a. <sup>6</sup>

<sup>1</sup>grad Zagreb (17) • city of Zagreb (17), <sup>2</sup>Šibensko-kninska županija (18) • Šibensko-Kninska County (18), <sup>3</sup>vojni centri u Puli, Sinju, Koprivnici, Požezi (22) • military training camps in Pula, Sinj, Koprivnica, Požega (22), <sup>4</sup>grad Knin (23) • town of Knin (23), <sup>5</sup>vojni centar u Koprivnici (21) • military training camp in Koprivnica (21), <sup>6</sup>grad Zagreb (24) • city of Zagreb (24)  
n.a.-not available

### Rasprava

Prema podacima SZO-a, od 60 do 90 posto školske djece i velika većina odraslih imala je karijes, što upućuje na njegovu rasprostranjenost i javnozdravstveni problem koji se pojavljuje u većini industrijaliziranih zemalja (25). Djeca u dobi od 5 do 6 godina interesna su skupina zbog karijesa koji se pojavljuje u mlječnoj denticiji i promjena koje nastaju u kraćem razdoblju u odnosu na trajnu denticiju kod djece starije dobi. Dvanaestogodišnjaci su osobito važna dobna skupina jer ih se može pouzdano pratiti tijekom školovanja tako da

### Discussion

According to the WHO Report, dental caries affects 60-90 % of schoolchildren and the vast majority of adults, indicating how massive the extent of this public health problem actually is so that it emerges in the majority of industrialized countries (25). Children population from 5 to 6 year-old are of interest in relation to caries levels in the primary dentition, which may exhibit changes over a shorter timespan than in the permanent dentition at ages. Twelve-year old children are a particularly important age group because reliable data

su i odabrani kao globalna dobna skupina kojom se SZO koristi za praćenje i nadzor trendova bolesti u svijetu. Iskustva zapadnoeuropskih zemalja pokazala su da su škole značajne platforme za kontrolu oralnoga zdravlja djece i relevantni pokazatelji promicanja zdravlja usne šupljine (5). Primjer su skandinavske zemlje koje imaju dugogodišnju praksu školske dentalnozdravstvene zaštite za svu djecu i mladež do 18 godina (26). U Danskoj je još od 1911. godine uspostavljena preventivna i kurativna dentalna zdravstvena zaštita koja se uglavnom provodila u školskim klinikama. Od tada se provode i aktivnosti koje su se usmjerile na školu i obitelji te promocije zdravlja u školi i lokalnoj zajednici (27). Sustavna skrb o oralnome zdravlju u skandinavskim zemljama u konačnici je rezultirala niskim vrijednostima KEP indeksa kod dvanaestogodišnjaka u Danskoj (0,6), Švedskoj (0,8) i Norveškoj (1,7). Hrvatska je imala trend smanjenja KEP indeksa kod dvanaestogodišnjaka koji se pratio od 1985. do 1991. godine kada je i postignut jedan od ciljeva koji su 1981. godine SZO i FDI postavili za 2000. godinu – da dvanaestogodišnjaci ne bi smjeli imati više od tri karijesa, tri izvadena i tri plombirana zuba (28). Od 1991. pa do danas Hrvatska je, zbog visokoga KEP indeksa (4,18) daleko od cilja koji je SZO postavila za 2020. godinu kao dio *Health21 Policyja* za Europu (KEP indeks kod dvanaestogodišnjaka u prosjeku ne veći od 1,5 i najmanje 80 % šestogodišnjaka bez karijesa) (5, 29). Prateći prevalenciju karijesa u visoko industrijaliziranim zemljama, Kunzel ističe podjelu europskih zemalja na dvije regije: na zapadnu europsku regiju (niskorizične zemlje) s prosječnim KEP indeksom od 1,7 i 40 posto dvanaestogodišnjaka bez karijesa te istočnu europsku regiju (visokorizične zemlje) s KEP indeksom od 4,1 i 10 posto dvanaestogodišnjaka bez karijesa (30). U skladu s podjelom i podacima o KEP indeksu Hrvatska se ubraja u zemlje s visokom prevalencijom karijesa. Dostupni podatci iz baze podataka o oralnome zdravlju SZO-a pokazuju također velike vrijednosti KEP indeksa u mnogim zemljama poput Bosne i Hercegovine – 4,2, Albanije – 3,7, Makedonije – 3,5, Poljske – 3,2 i Bugarske – 3,1 (7). Slika 4. prikazuje značajno smanjenje prevalencije karijesa kod dvanaestogodišnjaka u zapadnoeuropskim zemljama i određena poboljšanja u istočnim europskim državama posljednjih 30-ak godina, dok Hrvatska zauzima posljedno mjesto s obrnutim trendom kretanja KEP indeksa. Potrebno je istaknuti da direktna usporedba vrijednosti KEP indeksa između europskih zemalja nije primjerena upravo zato što su podatci dobiveni različitim metodologijama te prikupljeni u različitim razobljima (31). Također se uočava sveukupan pozitivan trend u smanjenju karijesa, koji je prikriven, i velikim nejednakostima među određenim zemljama. Na primjer, Poljska ima iskustvo sa sporijim poboljšanjem, što se uočava i u ostalim istočnoeuropskim zemljama, a može se objasniti promjenom u zdravstvenome sustavu nastalom nakon ekonomskih i političkih promjena u Europi (5,32). Naime, privatizacija u zdravstvenom sustavu rezultirala je smanjenjem korištenja besplatne dentalne zdravstvene zaštite djece i odraslih te nemogućnošću plaćanja privatnih zdravstvenih usluga.

Prema Silveiri ,prosječan KEP indeks za europsku regiju od 1973. do 2008. godine bio je 2,3, s kretanjem vrijedno-

are accessible and trackable through the school system. For these reasons, this age group has been chosen by WHO as a global indicator age group for the global tracking and monitoring of disease trends. The experience of Western European countries has shown that schools provide a significant platform for the control of oral health in children and relevant indicators for oral health promotion (5). Scandinavian countries are the example of a long-standing practice of dental care service in schools, for all the children and youth up to the age of 18 years (26). The preventive and curative dental health care program was introduced in Denmark back in 1911 and it was mainly carried out in school-based clinics. Since then initiatives and activities have been implemented with the focus on schools and families and school and community oriented health promotion (27). The systematic dental health care in the Scandinavian countries has in the end given low DMF figures for 12-year-olds in Denmark (0.6), Sweden (0.8) and Norway (1.7). From 1985 to 1991, Croatia had a decreasing trend in DMF of 12-year-old children, reaching one of the joint WHO and FDI objectives set in 1981 for the year 2000, for 12-year-old children, who should not have had more than 3 carious teeth, 3 extracted and 3 filled teeth (28). Since 1991 (to date) Croatia has remained far from the objectives set by WHO for 2020 as part of the "Health21 Policy" for Europe (on average no more than 1.5 DMF should be observed in 12-year-olds and at least 80 % of 6-year-olds should be caries free) (5, 29). Kunzel has followed caries trends in industrialized countries and has divided the countries of Europe in two European regions: the Western European region (low-risk countries), with the DMF average of 1.7 and 40 % caries-free 12-year-old children and the Eastern European region (high-risk countries) with 4.1 DMF and 10 % caries-free 12-year-old children (30). According to the mentioned division and the DMF data, Croatia belongs to the countries with high caries prevalence. The data from the available oral health database kept by WHO also show high DMF index values in many countries such as Bosnia and Herzegovina 4.2, Albania 3.7, Macedonia, 3.5, Poland 3.2 and Bulgaria 3.1 (7). Figure 4 shows a significant reduction in the prevalence of dental caries in 12 year-olds in west European countries and some improvements in Eastern European countries in the last thirty years, but Croatia ranks last on the list with a reversed DMF index trend. It should be noted that it is not appropriate to make a direct comparison of the DMF scores among individual European countries because of different methodologies and different periods used to obtain the data (31). In addition, the overall positive trend in the reduction of dental caries is concealed by considerable inequalities among certain countries. For example, Poland has experienced a slower rate of improvement, reflected also by other East European countries, which could be explained by changes in health systems as a result of economic and political changes in Eastern Europe (5, 32). The privatization in the health system has led to the diminished use of public dental care services among children and adults and the inability to pay private health care.

According to Silveira, the average DMF index for the European region from 1973 to 2008 was 2.3, ranging from 0.7 to 7.8 (33). He also pointed out that the majority of Western

sti od 0,7 do 7,8 (33). Također navodi da većina zapadnoeuropskih zemalja ima manji relativni rizik (RR) u usporedbi s prosjekom europske regije, a 24 europske zemlje imaju vrijednost veću od prosječne. Crna Gora i Srbija prve su dvije zemlje s relativnim rizikom 3,4 i posljednje s rizikom koji je 1,9 puta veći od prosjeka. U zemlje s najmanjim rizikom ubrajaju se Ujedinjeno Kraljevstvo, Njemačka i Danska (0,3) (slika 5.). Pozitivan trend u smanjenju prevalencije karijesa zabilježen je u susjednoj Mađarskoj i Sloveniji gdje je postignut nakon uvođenja preventivnih programa u škole i edukacijama o oralnom zdravlju (34). Mađarska je od 1980. do 2001. smanjila vrijednost KEP-a sa 6,6 na 3,3, a najveći raspon u padu prevalencije karijesa zabilježen je u Njemačkoj i Nizozemskoj (35). U Sloveniji se od 1987. do 1998. godine postotak dvanaestogodišnjaka bez karijesa povećao sa 6 posto na 40 posto, a KEP indeks se s 5,1 smanjio na 1,8 (36). Hrvatska je bila dobar primjer kad je riječ o smanjenju prevalencije karijesa koji se dogodio nakon provođenja kontrolirane fluoridacije zuba kada je poboljšana oralna higijena, ali su promjene u organizaciji primarne zdravstvene zaštite i politički uvjeti nažalost doveli do gubitka kontinuiteta prevencije, dok je Slovenija nastalim promjenama uspjela zadržati i poboljšati preventivne postupke zahvaljujući školskoj dentalnoj zdravstvenoj zaštiti. Zemlje istočne europske regije također imaju velik postotak predškolske djece s karijesom, u odnosu na zapadnoeuropske države (5,37). Nizozemska je tijekom nacionalnog programa epidemioloških istraživanja ocijenila program oralnozdravstvene edukacije u razdoblju od 1965. do 1980. godine. Dobiveni rezultati pokazali su smanjenje KEP-a kod šestogodišnjaka s 18 na 6, te kod dvanaestogodišnjaka s 9 na 4 (38). KEP indeks šestogodišnjaka u Hrvatskoj, koji je u rasponu od 3,25 do 5,65, može se pripisati socijalno-ekonomskim uvjetima u pojedinim dijelovima zemlje, kao što su razina edukacije i obiteljski prihodi kao važne odrednice u razvoju i napretku dentalnog karijesa (39, 40, 41). U Hrvatskoj se, osim smanjenih preventivnih mjera i loših socijalno-ekonomskih uvjeta, ne smiju zanemariti ni potpuno novi trendovi u prehrani djece te iznimno visoka učestalost konzumiranja erozivnih napitaka.

Mnoge europske zemlje zabilježile su pad prevalencije karijesa među odraslima. Odrasla populacija u Hrvatskoj ima visoke vrijednosti KEP-a, sa značajnim razlikama u odnosu na dobne skupine. Tijekom 2003. i 2004. godine provedeno je nacionalno istraživanje u Mađarskoj koje je pokazalo visoke vrijednosti KEP indeksa (11,79 kod najmlađe dobne skupine i 21,0 kod starije populacije) te visoku vrijednost E-parametra indeksa u svim dobnim skupinama (42). Marthaler navodi izrazito smanjenje prevalencije karijesa kod dvadesetogodišnjih novaka u Švicarskoj kod kojih se od 1970. do 1996. godine KEP indeks smanjio sa 16,0 na 4,8 (6). Poznato je da mnogobrojni socijalno-ekonomski i demografski čimbenici, kao što su dob, spol, urbanizacija, ekonomski uvjeti i drugo, utječu na oralni status i prevalenciju karijesa (43, 44). Bonev i ostali objavili su podatke o KEP-u odrasle populacije u Bugarskoj (17,7) koji govore u prilog tome da vrijednosti KEP-a mogu značajno varirati u odnosu na dob, spol i opće zdravstveno stanje (45). Bego i ostali došli su do razlike u pojavnosti karijesa kod odraslih te su ustanovili veći

European countries have a lower relative risk (RR) compared with the European region's average, while 24 European countries have a rate of decay higher than the average for the region. Montenegro and Serbia are the first two countries with a relative risk of 3.4 and the last with a risk that is 1.9 times higher than the average. The countries with the lowest rates are United Kingdom, Germany and Denmark (0.3) (Figure 5).

The positive trend in the reduction of the dental caries prevalence recorded in the neighbouring Hungary and Slovenia has been achieved via introduction of preventive school programmes and oral health education programmes (34). From 1980 to 2001, Hungary reduced DMF from 6.6 to 3.3, while the highest extent of decrease in caries prevalence was observed in Germany and in the Netherlands (35). In Slovenia, from 1987 to 1998, the percentage of caries free 12 year-old children was increased from 6 to 40 % while DMF decreased from 5.1 to 1.8 (36). Croatia, for a while, was a good example of reduced prevalence of dental caries, achieved through controlled teeth fluoridation and improved oral hygiene, but changes in the organization of primary health care and political circumstances contributed, unfortunately, to a disruption in the continuity of preventive activities. On the other hand, Slovenia, despite the changes, has managed to maintain and improve prevention through oral health care initiatives in schools. Countries in the Eastern European region, if compared to Western European countries, also show high percentages of preschool children with caries (5, 37). The Netherlands, through its national epidemiological studies programme, made the evaluation of the oral health education programme for the period from 1965 to 1980. The results showed a decrease of the DMF index among 6 year-old children from 18 to 6 and from 9 to 4 among 12 years old children (38). The observed range of DMF values from 3.25 to 5.65 in 6-year-old children in Croatia can be attributed to socio-economic conditions in individual parts of the country, such as level of education and family income as important factors for the development and progression of dental caries (39, 40, 41). In addition to reduced preventive measures and low socio-economic conditions, the new trends in the dietary children's habits and the extremely high consumption of erosive drinks should not be neglected.

Many European countries have recorded a decrease in caries prevalence among adults. The adult population in Croatia was found to have high DMF values with considerable variations according to the age group. In 2003-2004 a national survey conducted in Hungary showed variations in the value of DMF index (11.79 in the youngest age group and 21.0 in elderly people) and it was noticed that M-component of the index had the highest value in all age groups (42). Marthaler mentioned a significant reduction in the prevalence of caries from 1970 to 1996, among 20 year-old army recruits in Switzerland, with the DMF index decrease from 16.0 to 4.8 (6). It is well known that numerous socio-economic and demographic factors have an impact on the oral status and dental caries prevalence such as age, gender, urbanization, economic conditions and other (43, 44). According to the results shown by Bonev and al. on the DMF index of adults in Bulgaria (17.7), it is evident that DMF val-



KEP indeks kod žena negoli kod muškaraca, što je u korelaciji sa sadašnjim podacima u Hrvatskoj (18).

Iz svega navedenoga očito je da je prijeko potrebno intenzivno djelovanje u praćenju i promicanju oralnoga zdravlja u Hrvatskoj. Ministarstvo zdravlja prihvatilo je u ožujku 2015. *Strateški plan promicanja i zaštite oralnog zdravlja 2015.–2017.* koji proizlazi iz Nacionalne strategije razvoja zdravstva za razdoblje od 2012. do 2020. godine i ključni je dokument kojim se određuju prioriteta u dentalnomedicinskoj zdravstvenoj zaštiti. Pokrenut je Nacionalni program prevencije karijesa iz kojega slijede mnogobrojne aktivnosti sa sljedećim ciljevima: povećati postotak zdravih zuba kod 5-6 godišnjaka na 60 posto, smanjiti KEP indeks dvanaestogodišnjaka na 3,5, povećati primjenu fluoridacijskih i remineralizacijskih preparata te poboljšati oralnihigijenske i prehrambene navike cjelokupne populacije (46). Praćenje i prikupljanje podataka o KEP indeksu u Hrvatskoj putem CEZIH-a iz primarne zdravstvene zaštite u posljednje dvije godine, te napor koji se ulažu u poboljšanje pouzdanosti i valjanosti podataka, velik su napredak koji je usmjeren prema razvoju konzistentne baze podataka o karijesu, odnosno o oralnome zdravlju, što je u svijetu godinama u fokusu istraživačkog interesa u epidemiologiji karijesa. Švedska, Norveška i Danska primjer su zemalja koje su počele prikupljati podatke o karijesu na nacionalnoj razini na temelju javne dentalne zdravstvene zaštite, a do danas su razvile i dalje razvijaju vrijedne sustave kako bi poboljšale kvalitetu podataka i utvrdile indikatore kvalitete u dentalnoj zdravstvenoj zaštiti (47). U skladu s tim, kako bi se postigli očekivani rezultati, pred Hrvatskom je mnogo rada u daljnjem razvoju kvalitetnog sustava praćenja oralnoga zdravlja i njegove zaštite na temelju suradnje mnogobrojnih sudionika u tom procesu, kao što su Ministarstvo zdravlja, Hrvatski zavod za javno zdravstvo, Hrvatski zavod za zdravstveno osiguranje, studiji dentalne medicine i provoditelji dentalne zdravstvene zaštite.

## Zaključak

Podatci o KEP indeksu u Hrvatskoj pokazuju da je dentalni karijes i dalje javnozdravstveni problem koji upozorava da je potrebno djelovati kako na nacionalnoj tako i na regionalnoj razini. Jedinствена baza podataka o oralnom zdravlju, odnosno KEP/kep indeksu i dobro razumijevanje čimbenika u nastanku dentalnoga karijesa važni su za određivanje ciljeva i planiranje preventivnih programa vezanih za oralno zdravlje. Programi i akcije promicanja oralnoga zdravlja i prevencije karijesa koji se počinju provoditi na nacionalnoj razini trebali bi omogućiti promjene, upozoriti na važnost preventivnog djelovanja te potaknuti na revitalizaciju preventivne dentalne zdravstvene zaštite u predškolskoj i školskoj dobi.

## Sukob interesa

Nije bilo sukoba interesa.

ues can vary significantly depending on age, gender and general health (45). Bego et al. have found the difference in the incidence of dental caries in adults and higher DMF index values in women than in men, which corresponds to the current data in Croatia (18).

All the above-mentioned data show evidently that it is necessary to intensify actions of control and promotion of oral health in Croatia. In March 2015, the Ministry of Health adopted the "2015-2017 Strategy Plan for the Promotion and Protection of Oral Health" derived from the "2012-2020 National Strategy for Health" as a key document setting the priorities of dental health care. The national programme for caries prevention has been launched, setting in motion a great number of activities with the following objectives: to increase the percentage of healthy teeth in 5-6 year-old children to 60 %, reduce the DMF index of 12-year-old children to 3.5, increase the application of products for fluoridation and remineralisation and improve oral hygiene and dietary habits of the entire population (46). The monitoring and creation of DMF databases in Croatia through CEZIH, based on primary health care data obtained in the past two years and efforts invested in improving the reliability and validity of data constitute a great progress oriented towards the development of consistent caries and oral health databases, contributing also to years of global research of the epidemiology of dental caries. Sweden, Norway and Denmark are examples of countries that have begun to collect DMF data at national level through public dental health care programmes. They have developed and continue to develop valuable systems to improve the quality of data and identify indicators of quality in dental health care (47). Along these lines, Croatia also needs to continue and intensify efforts towards further development of the system of oral-health monitoring and protection, in compliance with appropriate quality standards, through cooperation of numerous participants such as the Ministry of Health, the Croatian Institute of Public Health, the Croatian Health Insurance Fund, the schools of dental medicine and providers of dental health care, all with the aim to achieve the anticipated results.

## Conclusion

The DMF index data in Croatia show that dental caries is still a public health problem indicating that actions must be taken at national and local level. The establishment of dental health and DMF index databases and the appropriate understanding of factors that lead to occurrence of dental caries are important for objectives to be set and preventive programmes to be planned in the domain of oral health. The implementation of programmes and actions towards oral health promotion and dental caries prevention, started at national level, should lead to changes and demonstrate the importance of preventative approach, encouraging also the revitalization of the preventive dental health care among pre-school and school children.

## Conflict of Interest

None declared.



**Abstract**

Dental caries is the most common oral disease affecting all age groups and a major cause of tooth loss. Although a decrease in the prevalence of dental caries has been marked across the globe, in many countries it has remained a major oral-health problem. **Aim:** The objective of this paper was to show the trends in the DMF index in Croatia, compare it with European countries and present further courses of action oriented towards promotion of oral health and decrease in caries prevalence. **Material and Methods:** The DMF index databases have been generated based on online database searches for the period from 1985 to 2015. **Results:** Croatia is one of European countries with a high DMF index relating to 12-year old children (4.18). The experience of countries with a low DMF index has shown that dental caries can be controlled through education and prevention activities, which eventually lead to diminished financial costs, at individual and national level, improving overall health and quality of life. **Conclusion:** Tracking and monitoring of oral health i.e. dental caries need to be improved in terms of creation of data base systems on the prevalence of dental caries, determining multi-factorial causes of its occurrence and with respect to the implementation of national oral-health prevention programs.

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**Key words**

Dental Caries; DMF index; Croatia; Europe

**References**

- WHO Expert Committee on Dental Health; World Health Organization. Standardization of reporting of dental diseases and conditions: report of an expert committee on dental health [Internet]. Geneva: World Health Organization; 1962 [cited 2015 August 21]. Available from: [http://apps.who.int/iris/bitstream/10665/38150/1/WHO\\_TRS\\_242.pdf](http://apps.who.int/iris/bitstream/10665/38150/1/WHO_TRS_242.pdf).
- Abhishek M. Comprehensive review of caries assessment systems developed over the last decade. *RSBO*. 2012;9(3):316-21.
- Klein H, Palmer C. Studies on dental caries vs. familial resemblance in the caries experience of siblings. *Public Health Rep*. 1938;53:1353-64.
- Frazao P. Epidemiology of dental caries: when structure and context matter. *Braz Oral Res*. 2012;26(1):108-114.
- Petersen PE. Changing oral health profiles of children in Central and Eastern Europe: challenges for the 21st century. *IC Digest* [Internet]. c2003 [cited 2015 August 15];(12):[about 3 screens]. Available from: [http://www.who.int/oral\\_health/media/en/orh-eastern\\_europe.pdf?ua=1](http://www.who.int/oral_health/media/en/orh-eastern_europe.pdf?ua=1).
- Marthaler T. Changes in Dental Caries 1953–2003. *Caries Res*. 2004; 38:173-181.
- World Health Organization [Internet]. Geneva: World Health Organization; 2015 [cited 2015 Aug 21]. Available from: <http://www.mah.se/CAPP/Country-Oral-Health-Profiles/EURO/Croatia/Oral-Diseases/Dental-Caries/>.
- World Health Organization: Oral Health Surveys-Basic Methods. 5th ed. Geneva: World Health Organization; 2013.
- Hrvatski zavod za zdravstveno osiguranje [Internet]. Zagreb: Hrvatski zavod za zdravstveno osiguranje; c2013 [cited 2015 Aug]. HZZO vodič kroz prijedlog Novog modela prihoda vanja PZZ dentalna zdravstvena zaštita (polivalentna); [about 9 p.]. Available from: [http://cdn.hzzo.hr/wp-content/uploads/2014/01/HZZO\\_Vodic\\_kroz\\_ponudu\\_NM\\_za\\_DEN\\_v11\\_03\\_13.pdf](http://cdn.hzzo.hr/wp-content/uploads/2014/01/HZZO_Vodic_kroz_ponudu_NM_za_DEN_v11_03_13.pdf).
- Krsnik R. Mogućnosti kontrole karijesa provedom preventivnog programa u vrtićima. 12 godišnje iskustvo [master thesis]. Zagreb: Stomatološki fakultet Sveučilišta u Zagrebu; 1994.
- Lulić-Dukić O, Kisić S. Pojavnost karijesa kod djece predškolske dobi u Zagrebu. *Acta Stomatol Croat*. 1996;299-303.
- Janković B, Ciglar I, Knežević A, Jurić H, Buković D, Stančić T. Caries and oral hygiene in children in postwar Novi Travnik (Bosnia and Herzegovina) and Zabok (Croatia). *Coll Antropol*. 2004;28(1):439-45.
- Ivančić Jokić N, Bakarčić D, Janković S, Malatestinić G, Dabo J, Majstorović M, Vuksan V. Dental caries experience in Croatian school children in Primorsko-goranska county. *Cent Eur J Public Health*. 2013;21(1):39-42.
- Mirčeta D, Gržić R, Bakarčić D, Ivančić Jokić N. Caries prevalence of the 6-year schoolchildren in Rijeka [Internet]. Dubrovnik: IADR General Session and Exhibition; c2014 [cited 2015 Aug 18]. Available from: <https://iadr.confex.com/iadr/per14/webprogram/Paper192247.html>.
- Ministarstvo zdravlja [Internet]. Zagreb: Ministarstvo zdravlja; c2015 [cited 2015 Aug 17]. Oralno zdravlje u Hrvatskoj; [about 1 screen]. Available from: [http://www.zdravlje.hr/zdravlje/oralno\\_zdravlje](http://www.zdravlje.hr/zdravlje/oralno_zdravlje).
- Rajić Z, Radionov D, Rajić-Meštrović S. Trends in dental caries in 12-year old children in Croatia. *Coll Antropol*. 2000;24(1):21-4.
- Plančak D, Aurer-Koželj J. Parodontne bolesti, dentalni karijes i stomatološka zaštita u stanovnika Zagreba. *Acta Stomatol Croat*. 1988;22(3):195-202.
- Bego K, Njemirovskij V, Pelivan I. Epidemiološko istraživanje oralnog zdravlja u srednjoj Dalmaciji: pilot studija. *Acta Stomatol Croat*. 2007;41(4):337-44.
- Dukić W, Delija B, Lulić Dukić O. Caries prevalence among school-children in Zagreb, Croatia. *Croat Med J*. 2011;52:665-71.
- Ivančić Jokić N, Majstorović M, Bakarčić D, Katalinić A, Sziovicza L. Dental caries in disabled children. *Coll Antropol*. 2007;31(1):321-4.
- Badel T, Azinović Z, Keros J, Dulčić N, Mehulić K. Karijes u novaka Hrvatske vojske. *Acta Stomatol Croat*. 2003;37(4):433-37.
- Špalj S, Špalj VT, Ivanković L, Plančak D. Oral health-related risk behaviours and attitudes among Croatian adolescents-multiple logistic regression analysis. *Coll Antropol*. 2014;38(1):261-7.
- Marić R, Ivanišević Malčić A, Matijević J, Jukić Krmek S. Oralni status odrasle populacije u hrvatskom gradu Kninu: prosječno istraživanje. *Acta Stomatol Croat*. 2015;49(2):92-103.
- Kraljević Šimunković S, Vučićević Boras V, Pandurić J, Alajbeg Žilić I. Oral health among institutionalised elderly in Zagreb, Croatia. *Gerodontology*. 2005;22(4):238-41.
- Petersen PE, Lennon MA. Effective use of fluorides for the prevention of dental caries in the 21st century: the WHO approach. *Community Dent Oral Epidemiol*. 2004; 32: 319-21.
- Fathalla LH. Caries prevention strategies practiced in Scandinavia: a literature study: bachelor thesis [Internet]. Malmö: Malmö University, Faculty of Odontology; 2011 [cited 2015 July 8]. Available from: <http://dspace.mah.se/bitstream/handle/2043/12362/Kandidatuppsats%20Lait%20Hassan%20Fathalla.pdf>.
- Jürgensen N, Petersen PE. Promoting oral health of children through schools: results from a WHO global survey 2012. *Community Dent Health*. 2013;30:204-18.
- World Dental Federation FDI World Health Organization WHO: global goals for oral health in the year 2000. *FDI Int Dent J*. 1982;32:74-7.
- Hobdell M, Petersen PE, Clarkson J, Johnson N. Global goals for oral health 2020. *Int Dent J*. 2003;53:285-88.
- Kunzel W. Zur Konversion der epidemiologischen Zucker/Cariesrelation in Europe. *Oralprophylaxe*. 2001;23:66-70.
- Eaton KA, Newman HN, Bulman JS. National mean DMFT scores for Western European 12 years-olds: are they comparable? *J Dent Res*. 2003;334. 82 C-519.
- Widström E, Eaton KA, Borutta A, Dybizbánska E, Broukal Z. Public dental health: oral healthcare in transition in Eastern Europe. *BDJ*. 2001;190:580-4.
- Silviera Moreira R. Epidemiology of dental caries in the world [Internet]. In: Singh Viridi M, editor. Oral health care-Pediatric, Research, Epidemiology and Clinical Practices. Rijeka: In TechOpen; c2012 [cited 2015 Jun 30]. Available from: [http://www.researchgate.net/profile/Rafael\\_Moreira3/publication/221926013\\_Epidemiology\\_of\\_Dental\\_Caries\\_in\\_the\\_World/links/0c960536c1b24c368a000000.pdf](http://www.researchgate.net/profile/Rafael_Moreira3/publication/221926013_Epidemiology_of_Dental_Caries_in_the_World/links/0c960536c1b24c368a000000.pdf).
- Szoke J, Petersen PE. Evidence for dental caries decline among children in an East European country (Hungary). *Community Dent Oral Epidemiol*. 2000;28(2):155-160.

35. OECD. Health at the glance 2009: OECD indicators [Internet]. Paris: OECD publishing; c2009 [cited 2015 Aug 20]. Available from: <http://www.oecd-ilibrary.org/docserver/download/8109111e.pdf?expires=1446723706&id=id&acname=guest&checksum=EA33AEC1BAF8BE477C188D16A62574B8>.
36. Vrbič V. Reasons for the caries decline in Slovenia. *Community Dent Oral Epidemiol.* 2000;28:126-32.
37. AK Holm. Caries in the preschool child international trends. *J Dent.* 1990; 18(6):291-5.
38. Glass RL. Fluoride dentifrices: basis for the decline in caries prevalence. *J R Soc Med.* 1986;79(14):15-7.
39. Corrêa-Faria P, Martins-Júnior PA, Vieira-Andrade RG, Marques LS, Ramos-Jorge ML. Factors associated with the development of early childhood caries among Brazilian preschoolers. *Braz Oral Res.* 2013;27(4):356-62.
40. Saldūnaitė K, Bendoraitienė E.A, Slabšinskienė E, Vasiliauskienė I, Andruškevičienė V, Zūbienė J. The role of parental education and socioeconomic status in dental caries prevention among Lithuanian children. *Medicina.* 2014;20(3):156-61.
41. Cypriano S, Hugo FN, Sciamarelli MC, Tôrres LH, Sousa Mda L, Wada RS. Factors associated with the incidence of dental caries among schoolchildren living in a municipality with low prevalence of dental caries. *Ciênc Saúde colet.* 2011; 16(10):4095-4106.
42. Madléna M, Hermann P, Jahn M, Fejérdy P. Caries prevalence and tooth loss in Hungarian adult population: results of a national survey. *BMC Public Health* [Internet]. 2008 Oct [cited 2015 Sept 24];364(8):[about 7 p.]. Available from: <http://www.biomedcentral.com/1471-2458/8/364>.
43. Skudutyte S, Aleksejuniene J, Eriksen HM. Dental caries in Lithuanians. *Acta Odontol Scand.* 2000;58:143-47.
44. Miura H, Araki Y, Haraguchi K, Arai Y, Umenai T. Socioeconomic factors and dental caries in developing countries: a cross-national study. *Soc Sci Med.* 1997;44(2):269-72.
45. Bonev B, Avramova N, Yaneva K, Filchev D. Dental caries and associated socio-demographic factors in adult people in Bulgaria. *Balk J Dent Med.* 2015;19:33-7.
46. Ministarstvo zdravlja [Internet]. Zagreb: Ministarstvo zdravlja; c2015 [cited 2015 July 28]. Strateški plan promicanja i zaštite oralnog zdravlja 2015-2017; [about 21 p.]. Available from: <http://www.zdravlje.hr/content/download/15326/113571/version/10/file/Strate%C5%A1ki+plan%2C+final%2C+o%C5%BEujak+2015.pdf>.
47. Skeie M. S, Klock K. S. Scandinavian systems monitoring the oral health in children and adolescents; an evaluation of their quality and utility in the light of modern perspectives of caries management. *BMC Oral Health* [Internet]. 2014 Apr [cited 2015 Aug 21];43(14):[about 9 p.]. Available from: <http://www.biomedcentral.com/1472-6831/14/43>.