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# Bibliometric Analysis of Papers from the School of Dental Medicine, University of Zagreb, Indexed in the Web of Science Core Collection Database (2006–2022)

## *Bibliometrijska analiza radova Stomatološkog fakulteta Sveučilišta u Zagrebu indeksiranih u bazi podataka Web of Science Core Collection (2006. – 2022.)*

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### Abstract

This paper presents the results of a bibliometric analysis of the scientific production of authors from the School of Dental Medicine, University of Zagreb, indexed in the Web of Science Core Collection database from 2006 to 2022. **Material and methods:** The sample consists of 1,521 papers analyzed according to parameters such as author's address and affiliation, followed by productivity indicators (document types, publication years, journals, languages, WoSCC subject categories, open access, authors, and co-authors) and citation metrics (citations, h-index, JCR quartiles, key topics), using WoSCC tools, InCites, VOSviewer, and Excel. **Results:** Most of the papers are categorized as articles (86%), while other document types account for 14%. The analysis has shown a continuous growth of scientific production during the observed period, and the publication of papers is concentrated in a small number of journals (5% of journals publish 53% of papers). Analyzing the representation of individual journals, the largest number of papers was published in Acta Stomatologica Croatica (20%), but overall, 59% of papers were published in journals of international publishers with a major increase in the number of papers in MDPI journals. The majority of papers (65%) are indexed in the WoSCC SCI-Expanded database. Since 2019, a significant shift towards publishing in higher-quality JCR Q1 and Q2 journals has been observed, as well as an increase in the number of open access papers. A substantial number of papers are in some form of open access (44%), paid open access predominates (51%) and citations of open access papers account for 46%. The largest number of open access papers was published in the journal Acta Stomatologica Croatica (176; 27%). The largest number of papers (26%) involved collaboration among six authors per paper, which is also the average number of authors per paper. Papers resulting from international collaboration account for 27%, and within the School of Dental Medicine, teams of two to four authors collaborate most frequently. Citation analysis has shown that the selected papers received a total of 19,128 citations, with an average of 13 citations per paper, while the h-index is 53. Only 13% of the papers had no citations, and the highest number of citations is scattered across a large number of papers. **Conclusion:** Scientific output of authors from the School of Dental Medicine in the observed period is characterized by a continuous increase in the number of published papers and greater representation in higher-quality foreign scientific journals, stronger international collaboration, increased citation rates and significant adoption of open access publishing.

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## Introduction

Scientific communication within the academic community takes place through various channels, with journals remaining the primary medium despite their migration to digital platforms. These digital media have fostered new publishing models that enable faster dissemination of information, leading to the emergence of digital repositories, open-

## Uvod

Znanstvena komunikacija u akademskoj i znanstvenoj zajednici temelji se na različitim informacijsko-komunikacijskim kanalima pri čemu su časopisi i dalje na prvom mjestu bez obzira na njihov prelazak u digitalni medij. Digitalni medij potaknuo je nove oblike objavljivanja koji omogućuju bržu diseminaciju znanstvenih informacija, pa su se tako po-

access platforms, and academic social networks. While these new models sparked predictions about the demise of printed formats and the journals themselves, this transition has not yet fully occurred. Although electronic journals initially fully retain the form of printed journals, those published exclusively in electronic format introduce new formal characteristics: papers are assigned an identification number, uniquely identified through the Digital Object Identifier (DOI) system, and pages are no longer numbered (1).

Publishing papers in journals has become an imperative for scientific career advancement, which has led to a hyperproduction of papers. This situation, in which authors want to publish their work as quickly and easily as possible, is exploited by so-called predatory journals for profit. Publishing a paper in a journal is no longer sufficient in itself; it has become conditional on whether the journal is indexed in relevant bibliographic and citation databases. These databases calculate the journal's impact and quality within a specific scientific field, thus serving authors as a guide to high-quality and verified journals.

The system of academic and scientific advancement in Croatia relies on the indexing of journals and papers in the Web of Science Core Collection (WoSCC) and Scopus bibliographic and citation databases. In the fields of natural sciences, biomedicine, and healthcare, the Current Contents Connect, Medline, and PubMed databases are also relevant (2,3).

The evaluation of scientific production based on indexing in databases and the number of citations is called quantitative and is considered an objective method, which, however, cannot assess the quality of the paper itself. Apart from academic and scientific advancement, it is widely applied for various other purposes, such as awarding prizes, achieving professional status, employment, statistical reports, determining institutional rankings, scoring scientific activities in postgraduate studies, gaining membership, and so on. When evaluating the quality of universities and their constituent units, the excellence of scientists and scientific projects is also an important factor for allocating financial support (4–6).

According to the Ordinance on the requirements for election to scientific titles (hereinafter referred to as the Ordinance), the quantitative data prescribed by the regulations are determined by the libraries of higher education and scientific institutions, which issue a bibliometric certificate to the applicant. Although the tools integrated into the databases make it easier for librarians to analyze and compare data on the scientific production of authors and institutions, databases often contain incorrectly assigned data (mainly related to author affiliation and identity). This requires search knowledge, skills, and significant time to clean and retrieve all the necessary data (2,7).

According to the Ordinance, the main bibliometric indicator of journal quality is the Journal Impact Factor (JIF), which is calculated by Journal Citation Reports (JCR) using citation data from the Web of Science Core Collection. As a metric counterpart, the SCImago Journal Rank (SJR) is also utilized; this indicator ranks journals based on citation data indexed in the Scopus database. The journal rank in both

javili digitalni repozitoriji, platforme s časopisima u otvorenome pristupu, akademske društvene mreže i slično. S tim novim oblicima pojavila su se i predviđanja o ukidanju tradicionalnog formata tiskanih časopisa i, u krajnjoj liniji, samih časopisa, no to se još nije dogodilo.

Premda elektronički časopisi na početku potpuno zadržavaju formu tiskanoga časopisa, oni koji izlaze isključivo u elektroničkom obliku uvode nove formalne značajke: radovima se dodjeljuje identifikacijski broj, jednoznačno se identificiraju s pomoću sustava digitalnog identifikatora objekta (DOI), a stranice se više ne numeriraju (1).

Objavljivanje radova u časopisima postalo je imperativ za napredovanje u znanstvenoj karijeri što je rezultiralo hiperprodukcijom radova. Takvu situaciju u kojoj autori žele što brže i jednostavnije objaviti rad iskorištavaju tzv. predatorski časopisi za ostvarivanje profita. Objavljivanje rada u časopisu nije dovoljno samo po sebi, nego je postalo uvjetovano i time je li časopis indeksiran u relevantnim bibliografskim i citatnim bazama podataka koje izračunavaju utjecaj časopisa i kvalitetu unutar određenoga znanstvenog područja pa samim time autorima služe i kao putokaz do kvalitetnih i provjerenih časopisa.

Sustav znanstveno-nastavni i znanstvenog napredovanja u Hrvatskoj temelji se na indeksiranosti časopisa, odnosno radova u bibliografskim i citatnim bazama Web of Science Core Collection (WoSCC) i Scopus, a u područjima prirodnih znanosti, biomedicine i zdravstva relevantne su i baze podataka Current Contents, Medline i PubMed (2, 3).

Vrjednovanje znanstvene produkcije prema indeksiranosti u bazama podataka i prema broju citata naziva se kvantitativnim i smatra se objektivnom metodom, no na taj se način ipak ne može procijeniti kvaliteta samoga rada. Osim za znanstveno-nastavno i znanstveno napredovanje široko se primjenjuje i u razne druge svrhe, kao što je dodjeljivanje nagrada, postizanje profesionalnog statusa, zapošljavanje, statističko izvješćavanje, utvrđivanje ranga ustanove, bodovanje znanstvenih aktivnosti na poslijediplomskom studiju, ostvarivanje članstva i slično. Pri vrjednovanju kvalitete sveučilišta i njihovih sastavnica vrsnoća znanstvenika i znanstvenih projekata važan je čimbenik i za dodjelu financijske potpore (4 – 6).

Prema Pravilniku o uvjetima za izbor u znanstvena zvanja (u daljnjem tekstu *Pravilnik*) kvantitativne podatke propisane odredbama utvrđuju knjižnice visokoškolskih i znanstvenih ustanova koje pristupniku daju bibliometrijsku potvrdu. Premda alati koji su dio baza podataka knjižničarima olakšavaju analizu i usporedbu podataka o znanstvenoj produkciji autora i ustanova, baze često sadržavaju pogrešno pridružene podatke (poglavito vezane uz afilijaciju i identitet autora), što zahtijeva znanja i vještine u pretraživanju te mnogo vremena kako bi se pročistili i dohvatili svi potrebni podatci (2, 7).

Glavni bibliometrijski pokazatelji kvalitete časopisa prema *Pravilniku* jesu faktor utjecaja (Journal Impact Factor – JIF) koji se izračunava u citatnoj bazi Journal Citation Reports (JCR) na temelju podataka o citiranosti časopisa u bazi Web of Science Core Collection. Kao metrički pandan koristi se i citatna baza SCImago Journal & Country Rank (SJR) čiji se indikator ranga časopisa izračunava na temelju poda-

databases is expressed in four quartiles, with the first quartile containing the highest-ranked journals with the highest impact factor within the subject category. Publishing a paper in a highly-ranked journal contributes to the reputation of the paper itself, the author, and the institution on an international level (8,9).

With the development of digital publishing, Web 2.0, and especially social networks, quantitative evaluation has expanded to alternative, unofficial methods of assessing scientific impact, known as altmetrics. In addition to citations in scientific and non-scientific papers, altmetric indicators include the number of downloads, views, comments, likes, reactions, and shares on social networks, as well as tracking online news and blogs. Their main advantage is that, after a paper is published, they quickly display its „popularity,” whereas traditional bibliometric indicators only show this after a longer time lag (5).

The main obstacle to the acceptance of altmetrics is the potential for manipulation (for example, purchasing view and download traffic), but traditional metric indicators also have disadvantages, such as a certain elitism and commercialization. Citations are also problematic from the aspects of self-citation, manipulation with multiple authorship, selective and arbitrary citation, and the number of citations is not necessarily a reflection of higher research quality.

Ultimately, bibliographic and citation databases are commercial products that function in a way like a „VIP club,” in which different types of publications, disciplines, geographical areas, and language regions are unequally represented. Furthermore, databases sometimes introduce new metric indicators to justify the constant rise in subscription prices, which actually confuse the average user (for instance, since 2023, JCR also displays the Journal Citation Indicator, which users often do not distinguish from the Journal Impact Factor) (9–11).

The regulations for advancement within the Croatian scientific and academic community have, through their propositions, ensured the continuous renewal of subscriptions to the Web of Science Core Collection and Scopus databases, thereby securing their monopoly in any ranking and evaluation processes within the science and higher education system, which encourages a kind of „scientific publishing engineering” among authors (9).

It is difficult for Croatian authors to reconcile the requirements of European and domestic open science initiatives—which encourage publishing in open-access journals—with the criteria of the Ordinance, where indexing in specific bibliographic databases and journal quartiles remains crucial. Consequently, authors often avoid open-access journals that do not meet these prescribed bibliometric criteria, opting instead for journals that charge high Article Processing Charges (APCs). For example, this trend has led to a sudden and significant increase in papers published by Croatian scientists in MDPI (Multidisciplinary Digital Publishing Institute) journals (12).

Quantitative evaluation through bibliometric analyses, despite its limitations, represents an important tool in the assessment of scientific papers and scientific production in gen-

taka o citiranosti iz baze Scopus. Rang časopisa u obje se baze iskazuje s četiri kvartila, pri čemu su u prvom kvartilu najbolje rangirani časopisi s najvišim faktorom utjecaja unutar predmetnog područja. Objavljivanje rada u visoko rangiranome časopisu pridonosi ugledu samoga rada, autora i ustanove na međunarodnoj razini (8, 9).

S razvojem digitalnog izdavaštva, weba 2.0 i pogotovo društvenih mreža, kvantitativno vrjednovanje proširuje se na alternativne, neslužbene metode procjene znanstvenoga utjecaja, tzv. altmetriju. Altmetrijski pokazatelji, uz citiranje u znanstvenim i neznastvenim radovima, obuhvaćaju broj preuzimanja, pregleda, komentara, svidanja, reakcija i dijeljenja na društvenim mrežama te praćenje vijesti na mreži i mrežnih dnevnika (blog). Njihova je glavna prednost da nakon objavljivanja rada vrlo brzo pokazuju njegovu *popularnost*, a ona se prema tradicionalnim bibliometrijskim pokazateljima prikazuje tek s dužim vremenskim odmakom (5).

Glavna prepreka za prihvaćanje altmetrije jesu mogućnosti manipulacije (primjerice, kupnja prometa pregleda i preuzimanja), ali i tradicionalni metrički pokazatelji imaju nedostatke kao što su svojevrsni elitizam i komercijalizacija. Problematično je i citiranje s aspekta samocitiranja, manipulacije s višestrukim autorstvima, selektivno i proizvoljno citiranje, a i broj citata nije nužno odraz veće kvalitete istraživanja.

U konačnici, bibliografske i citatne baze podataka komercijalni su proizvodi koji na određeni način funkcioniraju poput *VIP kluba*, a u kojima su nejednako zastupljene različite vrste publikacija, različite discipline, geografska i govorna područja. Također, baze podataka katkada uvode nove metričke pokazatelje kao opravdanje za stalno poskupljenje pretplate, a to zapravo zbunjuje prosječnoga korisnika (primjerice, JCR od 2023. godine prikazuju i Journal Citation Indicator koji korisnici često ne razlikuju od Journal Impact Factor) (9 – 11).

Pravilnici za napredovanje u hrvatskoj znanstvenoj i akademskoj zajednici svojim su propozicijama osigurali stalno produljenje pretplata na baze podataka Web of Science Core Collection i Scopus, čime im je osiguran monopol u bilo kakvim procesima rangiranja i evaluacije u sustavu znanosti i visokoga školstva, što kod autora potiče svojevrsni *inženjering znanstvenoga publiciranja* (9).

Hrvatskim autorima teško je pomiriti zahtjeve europskih i domaćih inicijativa za otvorenu znanost, koje potiču objavljivanje radova u časopisima s otvorenim pristupom, s kriterijima *Pravilnika* prema kojemu je ključna indeksiranost u odgovarajućoj bibliografskoj i citatnoj bazi i kvartil časopisa. Autori zbog toga često izbjegavaju časopise u otvorenome pristupu koji ne ispunjavaju propisane bibliometrijske kriterije i biraju one koji skupo naplaćuju objavljivanje u otvorenome pristupu kroz tzv. *Article Processing Charges* – APC. To je, primjerice, rezultiralo iznenadnim i značajnim porastom objavljivanja radova hrvatskih znanstvenika u časopisima izdavačke kuće *Multidisciplinary Digital Publishing Institute* (MDPI) (12).

Kvantitativno vrjednovanje s bibliometrijskim analizama, unatoč ograničenjima, važan je alat u procjeni znanstvenih radova i znanstvene produkcije općenito. Bibliometrijske

eral. Bibliometric analyses are complemented by other, qualitative criteria, which are much more difficult to define in terms of their impartiality and objectivity. When selecting candidates for advancement into scientific titles according to the Ordinance, expert committees and field committees determine and evaluate such criteria. The greatest disadvantage of bibliometric analyses lies in equating quantitative metric indicators of journals with the quality of the scientific work of authors, institutions, and scientific fields (2,6).

Conducting long-term bibliometric analyses provides valuable insight into research trends within a scientific community and helps evaluate its academic contributions. Furthermore, these results can guide future research by project development, forming research teams, and shaping the scientific strategy of the home institution.

## Materials and Methods

In this paper, a bibliometric analysis was conducted on the entire scientific production of authors from the School of Dental Medicine, University of Zagreb (hereinafter referred to as: School of Dental Medicine), indexed in the Web of Science Core Collection (WoSCC) database for the period from 2006 to 2022. The structure and methodology of the paper rely on a previous bibliometric analysis of the scientific production of the School of Dental Medicine for the period from 1976 to 2005 (13).

In contrast to the previously mentioned bibliometric analysis, which included three indexes - Science Citation Index Expanded (SCI-Expanded), Social Sciences Citation Index (SSCI), Arts & Humanities Citation Index (AHCI), this analysis also includes data from the Emerging Sources Citation Index (ESCI), which began indexing journals in 2015.

In the WoSCC database, a search field for affiliation is provided; however, as the data connecting papers to the institution in that field were not organized, the database search was conducted in the same manner as in the previously mentioned study: in the Address field, the search parameters *dent\* AND Zagreb\**, *stom\* AND Zagreb\**, and *zahn\* AND Zagreb\** were entered. Since this field includes the addresses of all co-authors, the set query retrieved parts of addresses from various institutions, which is why all results had to be manually reviewed and those not associated with the School of Dental Medicine were excluded.

A total of 2355 bibliographic records covering all categories of papers were reviewed, and duplicates were removed. A total of 1521 records were selected in which the address of the School of Dental Medicine was identified, and these records were extracted into a separate list (Marked List) within the WoSCC database itself to facilitate further data and citation analyses.

The analysis did not include papers without the address of the School of Dental Medicine, which is frequent in the case of papers by part-time employees, nor papers resulting from collaborations in which group members and their addresses were not clearly highlighted on the paper itself, but only in the appendix. Group papers (seven of them) were included only when a group member was individually listed

analize nadopunjuju se i drugim, kvalitativnim kriterijima koje je mnogo teže definirati u smislu njihove nepristranosti i objektivnosti. Pri izboru u znanstvena zvanja prema *Pravilniku*, stručna povjerenstva i matični odbori određuju i procjenjuju takve kriterije. Najveći nedostatak bibliometrijskih analiza jest u poistovjećivanju kvantitativnih metričkih pokazatelja o časopisima s kvalitetom znanstvenoga rada autora, ustanova i znanstvenih područja (2, 6).

Obavljanje bibliometrijskih analiza za dulje razdoblje svakako je korisno s obzirom na to da daje uvid u istraživačke trendove unutar pojedine znanstvene zajednice te vrjednuje njezin znanstveni doprinos, a rezultati mogu usmjeriti daljnji znanstveni rad poput projekata, formiranja istraživačkih timova i kreiranja znanstvene strategije matične ustanove.

## Materijali i metode

U ovom radu provedena je bibliometrijska analiza cjelokupne znanstvene produkcije autora sa Stomatološkog fakulteta Sveučilišta u Zagrebu (u daljnjem tekstu Stomatološki fakultet) koja je indeksirana u bazi podataka Web of Science Core Collection (WoSCC) za razdoblje od 2006. do 2022. godine. Struktura i metodologija rada oslanjaju se na prethodnu bibliometrijsku analizu znanstvene produkcije Stomatološkog fakulteta za razdoblje od 1976. do 2005. godine (13).

Za razliku od prije navedene bibliometrijske analize koja je obuhvaćala tri indeksa – Science Citation Index Expanded (SCI-Expanded), Social Sciences Citation Index (SSCI), Arts & Humanities Citation Index (AHCI) – ovom su analizom obuhvaćeni podatci i iz Emerging Sources Citation Indexa (ESCI) koji je počeo indeksirati časopise 2015. godine.

U bazi podataka WoSCC predviđeno je polje za pretraživanje prema afilijaciji, no kako podatci o povezanosti radova s ustanovom u tom polju nisu bili uređeni, pretraživanje baze obavljeno je kao i u prije spomenutom istraživanju: u polje *Adresa* upisani su parametri pretraživanja *dent\* AND Zagreb\**, *stom\* AND Zagreb\** i *zahn\* AND Zagreb\**. Budući da to polje sadržava adrese svih suautora, postavljenim upitom dohvaćeni su dijelovi adresa različitih ustanova pa su se svi rezultati morali ručno pregledati i izdvojiti one koji nisu povezani sa Stomatološkim fakultetom.

Ukupno je pregledano 2355 bibliografskih zapisa koji obuhvaćaju sve kategorije radova, pri čemu su isključeni duplikati. Izdvojen je 1521 zapis s identificiranom adresom Stomatološkog fakulteta te su ti zapisi, radi lakše provedbe daljnjih analiza podataka i citiranosti u samoj WoSCC bazi, izdvojeni na zasebnu listu (*Marked List*).

Analizom nisu obuhvaćeni radovi bez adrese Stomatološkog fakulteta, što je često u radovima zaposlenika u parcijalnome radnom odnosu, te oni nastali u suradnjama u kojima članovi grupe i njihove adrese nisu jasno istaknuti u radu, nego samo u dodatku. Grupni radovi (njih sedam) obuhvaćeni su samo kada je član grupe naveden pojedinačno i povezan sa svojom adresom.

Obuhvaćene su sve kategorije radova: rad u časopisu (Article), pregledni rad (Review Article), kongresni sažetak

and linked to their address.

All categories of papers were included: article, review article, meeting abstract, letter, proceedings paper, editorial material, news item, biographical item, correction, early access and bibliography.

The following parameters were analyzed:

1. authors' addresses and affiliations
2. productivity indicators (types of papers, publication years, journals, languages, WoSCC subject categories, open access, authors and co-authors)
3. citation metrics (number of citations, h-index of authors and journals, JCR quartiles, key topics)

The data were analyzed using analytical tools integrated within the WoSCC database, the bibliometric tools InCites and VOSviewer and Excel (14–16).

The main and continuous difficulty in bibliometric analyses for individual institutions is the inconsistency in institution names and addresses provided by authors in their papers. Although WoSCC unifies addresses and assigns a standardized form of affiliation to a separate field, this has not been implemented for all institutions.

When indexing papers into the database, all addresses listed on the paper are transferred into a single field and separated by semicolons, and based on this data, papers are linked to the institution in the affiliation field. However, it is sometimes impossible to match a specific author with their address because the original data imported into the database lacks a clear link between them. Consequently, authors may be left without an associated address or affiliation in the paper's bibliographic record. Furthermore, prior to 2008, the WoSCC database lacked a system for linking authors to their addresses via superscripts, which frequently introduces errors when exporting data to Excel. We requested the database provider to add the standardized affiliation form *University of Zagreb, School of Dental Medicine* alongside the generic name *University of Zagreb* to the bibliographic records that belong to the School of Dental Medicine according to the address, in order to enable the precise singling out of results exclusively from the School of Dental Medicine. Additionally, following an initiative by the Central Dental Library in 2023, the database provider enabled searching for the School of Dental Medicine as a distinct organizational unit of the University of Zagreb. Consequently, it is now possible to retrieve all papers included in this analysis through a single institutional affiliation query. Following a detailed manual review of the data in the *Address* and *Affiliation* fields, a total of 1521 papers with at least one author associated with the School of Dental Medicine were selected.

The analysis of co-authorship by institution was conducted based on data in the affiliation field, during which we encountered the previously described problems, among which the inconsistent naming of hospital institutions stands out in particular. At the level of the University of Zagreb, apart from the School of Dental Medicine, only two other constituent units (Faculty of Kinesiology and Faculty of Mechanical Engineering & Naval Architecture) have their own standardized affiliation in the WoSCC database, while the remaining constituent units are listed under the generic af-

(Meeting Abstract), pismo (Letter), rad u zborniku radova s konferencije (Proceeding Paper), urednički materijal (Editorial Material), novosti (News Item), biografija (Biographical Item), ispravak (Correction), rani pristup (Early Access) i bibliografija (Bibliography).

Analizirani su sljedeći parametri:

1. adrese i afilijacije autora
2. pokazatelji produktivnosti (vrste radova, godine objavljivanja, časopisi, jezici, predmetne kategorije, otvoreni pristup, autori i suautori)
3. citiranost (broj citata, h-indeks autora i časopisa, kvartili JCR, ključne teme)

Podatci su analizirani analitičkim alatima integriranim u bazi WoSCC, bibliometrijskim alatima InCites i VOSviewer te u programu Excel (14 – 16).

Glavna i stalna poteškoća tijekom bibliometrijskih analiza za pojedine ustanove jest neujednačenost naziva ustanove i adresa koje autori navode u radovima. Premda WoSCC ujedinjuje adrese te dodjeljuje standardizirani oblik afilijacije u zasebno polje, to nije provedeno za sve ustanove.

Pri indeksiranju radova u bazu sve adrese navedene u radu prenose se u jedno polje i odvajaju znakom točka-zarez i na temelju tih podataka radovi se povezuju s ustanovom u polju afilijacija. No, katkad se ne može ustanoviti koja adresa pripada kojemu autoru jer u izvornom sadržaju koji se preuzima u bazu, autor i njegova adresa nisu jasno povezani. Zbog toga autori u bibliografskom zapisu rada mogu ostati bez pridružene adrese, a time i bez afilijacije. Također, prije 2008. godine u WoSCC-u nije postojao sustav povezivanja autora i njegove adrese superskriptom, što uzrokuje i pogreške pri prijenosu podataka u program Excel.

Od proizvođača baze zatražili smo da se uz generički naziv *University of Zagreb* u bibliografske zapise, koji prema adresi pripadaju Stomatološkom fakultetu, doda standardizirani oblik afilijacije *University of Zagreb, School of Dental Medicine*, kako bi se omogućilo precizno izdvajanje isključivo rezultata Stomatološkog fakulteta. Također, na inicijativu Središnje stomatološke knjižnice, 2023. godine proizvođač baze omogućio je pretraživanje Stomatološkog fakulteta kao zasebne organizacijske jedinice Sveučilišta u Zagrebu te je sada pretraživanjem polja afilijacije jednim upitom moguće dohvatiti sve radove obuhvaćene ovom analizom.

Nakon detaljnoga ručnog pregleda podataka u poljima adresa (Address) i afilijacija (Affiliation) izdvojen je ukupno 1521 rad s barem jednim autorom povezanim sa Stomatološkim fakultetom.

Analiza suautorstva prema ustanovama obavljena je na temelju podataka u polju afilijacija, pri čemu smo se susreli s već opisanim problemima, među kojima se posebno ističe neujednačeno navođenje naziva bolničkih ustanova. Na razini Sveučilišta u Zagrebu, osim Stomatološkog fakulteta, još samo dvije sastavnice (Faculty of Kinesiology i Faculty of Mechanical Engineering & Naval Architecture) imaju normiranu vlastitu afilijaciju u bazi WoSCC, a ostale sastavnice vode se pod generičkom afilijacijom Sveučilište u Zagrebu. Zbog toga su podatci za suautorstva s Medicinskim fakultetom u Zagrebu dobiveni pretragom prema adresi (Univ Zagreb, Sch Med), uz mogućnost da nisu obuhvaćeni radovi

filiation *University of Zagreb*. For this reason, data for co-authorships with the School of Medicine in Zagreb were obtained through an address search (*Univ Zagreb, Sch Med*), with the possibility that some papers were not included due to a differently listed address. By filtering the selected papers according to affiliations, a total of 1079 names of domestic and foreign institutions were recorded, which were manually reviewed, and different affiliations for the same institution were consolidated. These results were also compared with the address search results to include papers that lacked data in the affiliation field.

For the analysis of collaboration and connections among authors, VOSviewer bibliometric research software was used, which created an author network based on data uploaded from the WoSCC database. Author productivity was calculated using the full counting method, where each co-author signed on a publication is assigned full credit. Different threshold values directly affect the final structure and density of the resulting network; therefore, to obtain a clearer network and ensure a more realistic representation of collaborative links, papers with more than 20 authors were excluded, and the minimum number of papers per author was set to 10 to focus on authors with a continuity of publishing. The stated criteria were met by 158 authors, and the total link strength of co-authorship links with other authors in the network was calculated for each of them; based on this, the authors with the highest total link strength were selected and visualized in the co-authorship network (15,16).

The visual representation of key topics was generated from the uploaded selected papers using the InCites tool. It is based on the names of Clarivate's global citation clusters (Micro Citation Topics) into which the institution's papers are classified according to citation links, where the word size represents the number of papers in an individual cluster. The same tool was used to generate data on international collaboration and the analysis of papers by journal quartile.

The results presented in the paper are reproducible; however, due to subsequent indexing and potential differences in the categorization of papers, especially those categorized as Early Access, it is not possible to obtain completely identical results over a period of time, and minimal deviations are possible.

## Results

### Address and affiliation

Addresses referring to the School of Dental Medicine in the selected papers appear a total of 2,021 times across 544 unique variations. According to the standardized address structure prescribed by the University of Zagreb guidelines, the university should be listed first, followed by the faculty, the lowest organizational unit (department, chair, clinic, etc.), and finally the city and country (17). However, in several cases, the department, clinic, or hospital is listed immediately after the university, with the School of Dental Medicine appearing only at the end. In other variants, the School of Dental Medicine is omitted entirely after the sub-unit. Notably, one record contained an incorrectly assigned facul-

ty zbog drukčije navedene adrese. Filtriranjem izdvojenih radova prema afilijacijama zabilježeno je ukupno 1079 naziva domaćih i stranih ustanova koje su ručno pregledane te su objedinjene različite afilijacije za istu ustanovu. Ti su rezultati uspoređivani i s rezultatima pretraživanja prema adresi kako bi se obuhvatili i radovi koji nemaju podatak u polju za afilijaciju.

Za analizu suradnje i veza među autorima korišten je softver VOSviewer za bibliometrijska istraživanja koji je na temelju podataka učitanih iz baze WoSCC kreirao mrežu autora. Produktivnost autora izračunata je metodom potpunoga brojenja (*full counting*) kojom se svakom suautoru potpisanim na publikaciji dodjeljuje puni doprinos. Različite granične vrijednosti izravno utječu na konačnu strukturu i gustoću dobivene mreže pa su, da bi se dobila preglednija mreža i osigurao realniji prikaz suradničkih veza, isključeni radovi s više od 20 autora, a minimalni broj radova po autoru postavljen je na 10 kako bi se istaknuli autori s kontinuitetom objavljivanja. Navedene kriterije zadovoljava 158 autora te je za svakoga od njih izračunata ukupna snaga (*total link strength*) suautorskih veza s ostalim autorima u mreži, a temeljem toga odabrani su autori s najvećom ukupnom snagom veza koji su vizualizirani u mreži suautorstva (15, 16).

Vizualni prikaz ključnih tema generiran je iz učitanih izdvojenih radova s pomoću alata InCites. Temelji se na nazivima Clarivateovih globalnih citatnih grozdova (*Micro Citation Topics*) u koje su radovi ustanove svrstani prema vezama citiranosti, pri čemu je veličina riječi pokazatelj broja radova u pojedinom grozdu. Istim alatom generirani su podaci o međunarodnoj suradnji te analiza radova prema kvartilu časopisa.

Rezultati prikazani u radu ponovljivi su, no zbog naknadne indeksacije te mogućih razlika u kategorizaciji radova, osobito onih kategoriziranih kao rani pristup (*Early Access*), s vremenskim odmakom nije moguće dobiti potpuno identične rezultate, već su moguća minimalna odstupanja.

## Rezultati

### Adresa i afilijacija

Ukupno je 2021 adresa vezana za Stomatološki fakultet u izdvojenim radovima i to čak u 544 jedinstvena oblika. Uobičajena struktura adrese, kako je to propisano i u uputama Sveučilišta u Zagrebu, trebala bi na prvome mjestu imati navedeno sveučilište, zatim ustanovu i najnižu strukturu jedinicu (zavod, katedra, odjel itd.), te na kraju grad i državu (17). No katkad se nakon sveučilišta na prvome mjestu navodi zavod/odjel/bolnica/klinika i tek na kraju Stomatološki fakultet, a pojavljuje se i varijanta u kojoj se iza zavoda/odjela, Stomatološki fakultet uopće ne navodi. Spomenimo još i jednu adresu s pogrešno pripojenim fakultetom – *Klinische Abteilung für Zahnerhaltungskunde und*

ty name: Klinische Abteilung für Zahnerhaltungskunde und Endodontie der Medizinischen Universität Zagreb, Zagreb, Kroatien

The correct address structure, in which the university is listed first, followed by the faculty and, where applicable, a lower organisational unit, is found in 1,529 addresses (*Univ Zagreb, Sch Dent Med* with or without mentioning a lower organisational unit).

Due to the great diversity of addresses and for easier systematization and analysis, we disregarded details and their order in the addresses (department, city, street, street number and country). In this way, 29 unique forms of the name of the School of Dental Medicine were identified (1,875 single-institution addresses), and 58 unique forms of multi-institution addresses that include the name of the School of Dental Medicine (146 addresses) (Table 1, Table 2).

Affiliation with the University of Zagreb is stated in various forms (*Univ Zagreb, Croatia; Univ Zagreb; Uniwers Zagreb; Univ Zagabria; Sveucilista Zagrebu; Sveuciliste Zagrebu; Zagreb Univ*).

The most frequent form of the standalone address of the School of Dental Medicine is *Univ Zagreb, Sch Dent Med*

Endodontie der Medizinischen Universität Zagreb, Zagreb, Kroatien.

Ispravnu strukturu adrese u kojoj je najprije navedeno sveučilište, pa fakultet i, ako postoji, niža ustrojbenja jedinica, nalazimo u 1529 adresa (*Univ Zagreb, Sch Dent Med* s navedenom nižom ustrojbenom jedinicom ili bez nje).

Zbog velike raznolikosti adresa te lakše sistematizacije i analize zanemarili smo pojedinosti i njihov redoslijed u adresama (zavod, grad, ulicu, kućni broj i država). Tako je ustanovljeno 29 jedinstvenih oblika naziva Stomatološkog fakulteta (1875 jednoinstitucijskih adresa) i 58 jedinstvenih oblika višeinstitucijskih adresa koje sadržavaju i naziv Stomatološkog fakulteta (146 adresa) (tablica 1. i 2.).

Pripadnost sveučilištu u Zagrebu navedena je u različitim oblicima (*Univ Zagreb, Croatia; Univ Zagreb; Uniwers Zagreb; Univ Zagabria; Sveucilista Zagrebu; Sveuciliste Zagrebu; Zagreb Univ*).

Najčešći oblik samostalne adrese Stomatološkog fakulteta jest *Univ Zagreb, Sch Dent Med* (1706 adresa, 91 %), a kod višeinstitucijskih *Univ Zagreb, Univ Hosp Ctr Zagreb, Sch Dent Med* (19 adresa, 13 %). Sveučilište je u jednoinstitucijskim adresama izostavljeno u njih 75, u 3 adrese nakon

**Tablica 1.** Oblici imena Stomatološkog fakulteta u jednoinstitucijskim adresama  
**Table 1.** Forms of the School of Dental Medicine's name in single-institution addresses

| Ime Stomatološkog fakulteta • Name of the School of Dental Medicine | Broj adresa • Number of addresses | %           |
|---------------------------------------------------------------------|-----------------------------------|-------------|
| Croatia Univ Zagreb, Sch Dent Med                                   | 2                                 | 0%          |
| Fac Zagreb, Sch Dent Med                                            | 1                                 | 0%          |
| Gundulićeva 5, Zagreb 10000                                         | 1                                 | 0%          |
| Sch Dent                                                            | 3                                 | 0%          |
| Sch Dent Med                                                        | 66                                | 4%          |
| Sch Med, Gundulićeva Ul 5,                                          | 1                                 | 0%          |
| Sveucilista Zagrebu, Stomatol Fak                                   | 2                                 | 0%          |
| Sveucilista Zagrebu, Stomatoloski Fak                               | 5                                 | 0%          |
| Sveucilista Zagrebu, Stomatoloskog Fak                              | 2                                 | 0%          |
| Sveuciliste Zagrebu, Stomatoloski Fak                               | 1                                 | 0%          |
| Uniwers Zagreb, Sch Dent Med                                        | 1                                 | 0%          |
| Univ Sch Dent Med                                                   | 2                                 | 0%          |
| Univ Zagabria, Sch Dent Med                                         | 2                                 | 0%          |
| Univ Zagreb, Dent Sch                                               | 2                                 | 0%          |
| Univ Zagreb, Dept Endocrinol & Restorat Dent                        | 1                                 | 0%          |
| Univ Zagreb, Dept Endodont & Restorat Dent                          | 2                                 | 0%          |
| Univ Zagreb, Fac Dent                                               | 8                                 | 0%          |
| Univ Zagreb, Fac Dent Med                                           | 1                                 | 0%          |
| Univ Zagreb, Fac Dent, Sch Dent Med                                 | 1                                 | 0%          |
| Univ Zagreb, Fac Med Dent                                           | 4                                 | 0%          |
| Univ Zagreb, Sch Dent                                               | 48                                | 3%          |
| Univ Zagreb, Sch Dent Dent                                          | 1                                 | 0%          |
| <b>Univ Zagreb, Sch Dent Med</b>                                    | <b>1706</b>                       | <b>91%</b>  |
| Univ Zagreb, Sch Dent Med & Endodont                                | 1                                 | 0%          |
| Univ Zagreb, Sch Dental Med                                         | 2                                 | 0%          |
| Univ Zagreb, Sch Med & Dent                                         | 1                                 | 0%          |
| Univ Zagreb, Sveuciliste Zagrebu, Stomatol Fak                      | 1                                 | 0%          |
| Zagreb Sch Dent Med                                                 | 3                                 | 0%          |
| Zagreb Univ, Sch Dent Med                                           | 4                                 | 0%          |
| <b>Ukupno • Total</b>                                               | <b>1875</b>                       | <b>100%</b> |

**Tablica 2.** Višeinstitucijske adrese  
**Table 2.** Multiinstitutional addresses

| Ustanove • Institutions                                              | Broj adresa •<br>Number of addresses | %           |
|----------------------------------------------------------------------|--------------------------------------|-------------|
| Clin Hosp Ctr Sisters Mercy, Sch Dent Med                            | 1                                    | 1%          |
| Clin Hosp Ctr Zagreb, Sch Dent Med                                   | 2                                    | 1%          |
| Dent Clin Apolonia, Sch Dent Med                                     | 1                                    | 1%          |
| Sestre Milosrdnice Univ, Sch Dent Med                                | 1                                    | 1%          |
| Univ Hosp Ctr Sestre Milosrdnice, Sch Dent Med                       | 4                                    | 3%          |
| Univ Hosp Dubrava, Sch Dent Med                                      | 3                                    | 2%          |
| Univ Zagreb, Clin Hosp Ctr Zagreb, Sch Dent                          | 1                                    | 1%          |
| Univ Zagreb, Clin Hosp Ctr Zagreb, Sch Dent Med                      | 1                                    | 1%          |
| Univ Zagreb, Clin Hosp Ctr, Sch Dent Med                             | 1                                    | 1%          |
| Univ Zagreb, Ctr Hosp, Sch Dent Med                                  | 1                                    | 1%          |
| Univ Zagreb, Dent Clin Apolonia, Sch Dent Med                        | 1                                    | 1%          |
| Univ Zagreb, Dent Clin Hosp, Sch Dent Med                            | 1                                    | 1%          |
| Univ Zagreb, Dr Fran Mihaljev Univ Hosp Infect Dis, Sch Dent Med     | 3                                    | 2%          |
| Univ Zagreb, Dubrava Univ Hosp, Sch Dent Med                         | 2                                    | 1%          |
| Univ Zagreb, Fac Dent, Univ Hosp Sisters Mercy                       | 1                                    | 1%          |
| Univ Zagreb, Med & Dent Fac, Sestre Milosrdnice Univ Hosp Ctr        | 4                                    | 3%          |
| Univ Zagreb, Sch Dent Med, Clin Hosp Ctr                             | 2                                    | 1%          |
| Univ Zagreb, Sch Dent Med, Clin Hosp Ctr Sestre Milosrdnice          | 2                                    | 1%          |
| Univ Zagreb, Sch Dent Med, Croatian Acad Sci & Arts                  | 1                                    | 1%          |
| Univ Zagreb, Sch Dent Med, Dent Private Off                          | 2                                    | 1%          |
| Univ Zagreb, Sch Dent Med, Dubrava Univ Hosp                         | 1                                    | 1%          |
| Univ Zagreb, Sch Dent Med, Sch Publ Hlth Andrija Stampar             | 1                                    | 1%          |
| Univ Zagreb, Sch Dent Med, Sestre Milosrdnice Univ Hosp              | 1                                    | 1%          |
| Univ Zagreb, Sch Dent Med, Sestre Milosrdnice Univ Hosp Ctr          | 3                                    | 2%          |
| Univ Zagreb, Sch Dent Med, Univ Clin Hosp Zagreb                     | 1                                    | 1%          |
| Univ Zagreb, Sch Dent Med, Univ Hosp Ctr Sestre Milosrdnice          | 2                                    | 1%          |
| Univ Zagreb, Sch Dent Med, Univ Hosp Ctr Zagreb                      | 1                                    | 1%          |
| Univ Zagreb, Sch Dent Med, Univ Hosp Dubrava                         | 17                                   | 12%         |
| Univ Zagreb, Sch Dent Med, Univ Hosp Infect Dis Dr Fran Mihaljevic   | 1                                    | 1%          |
| Univ Zagreb, Sch Dent, Clin Hosp Dubrava                             | 1                                    | 1%          |
| Univ Zagreb, Sch Dent, Univ Hosp, Sisters Mercy Univ Med Ctr         | 1                                    | 1%          |
| Univ Zagreb, Sch Med & Dent Med, Sestre Milosrdnice Univ Hosp Ctr    | 1                                    | 1%          |
| Univ Zagreb, Sch Med, Sch Dent Med, Univ Hosp Ctr Sestre Milosrdnice | 1                                    | 1%          |
| Univ Zagreb, Sch Med, Sch Med & Dent                                 | 1                                    | 1%          |
| Univ Zagreb, Sestre Milosrdnice Clin Hosp Ctr, Sch Dent Med          | 1                                    | 1%          |
| Univ Zagreb, Sestre Milosrdnice Clin Hosp, Med & Dent Sc             | 1                                    | 1%          |
| Univ Zagreb, Sestre Milosrdnice Hosp, Sch Dent Med                   | 1                                    | 1%          |
| Univ Zagreb, Sestre Milosrdnice Univ Hosp Ctr, Med & Dent Fac        | 3                                    | 2%          |
| Univ Zagreb, Sestre Milosrdnice Univ Hosp Ctr, Sch Dent Med          | 6                                    | 4%          |
| Univ Zagreb, Sestre Milosrdnice Univ Hosp Ctr, Sch Med & Dent Med    | 1                                    | 1%          |
| Univ Zagreb, Sisters Charity Univ Hosp Ctr, Sch Dent Med             | 1                                    | 1%          |
| Univ Zagreb, Univ Clin Hosp Ctr Zagreb, Sch Dent Med                 | 1                                    | 1%          |
| Univ Zagreb, Univ Clin Hosp Sestre Milosrdnice, Sch Dent Med         | 1                                    | 1%          |
| Univ Zagreb, Univ Clin Hosp Zagreb, Sch Dent Med                     | 4                                    | 3%          |
| Univ Zagreb, Univ Dent Clin, Sch Dent Med                            | 1                                    | 1%          |
| Univ Zagreb, Univ Dent Clin, Univ Hosp Ctr, Sch Dent Med             | 1                                    | 1%          |
| Univ Zagreb, Univ Hosp Ctr Sestre Milosrdnice, Sch Dent Med          | 3                                    | 2%          |
| Univ Zagreb, Univ Hosp Ctr Sisters Mercy, Sch Dent Med               | 1                                    | 1%          |
| <b>Univ Zagreb, Univ Hosp Ctr Zagreb, Sch Dent Med</b>               | <b>19</b>                            | <b>13%</b>  |
| Univ Zagreb, Univ Hosp Ctr, Sch Dent Med                             | 4                                    | 3%          |
| Univ Zagreb, Univ Hosp Dubrava, Sch Dent Med                         | 17                                   | 12%         |
| Univ Zagreb, Univ Hosp Infect Dis Dr Fran Mihaljevic, Sch Dent Med   | 1                                    | 1%          |
| Univ Zagreb, Univ Hosp Infect Dis, Sch Dent Med                      | 2                                    | 1%          |
| Univ Zagreb, Zagreb Univ Hosp Ctr, Sch Dent Med                      | 3                                    | 2%          |
| Zagreb Univ, Clin Hosp Ctr Sestre milosrdnice, Sch Dent Med          | 1                                    | 1%          |
| Zagreb Univ, Hosp Ctr, Sch Dent Med                                  | 2                                    | 1%          |
| Zagreb Univ, Sestre Milosrdnice Univ Hosp Ctr, Sch Dent Med          | 1                                    | 1%          |
| Zagreb Univ, Univ Hosp Ctr Sestre Milosrdnice, Sch Dent Med          | 2                                    | 1%          |
| <b>Ukupno • Total</b>                                                | <b>146</b>                           | <b>100%</b> |

(1,706 addresses, 91%), and for multi-institution addresses *Univ Zagreb, Univ Hosp Ctr Zagreb, Sch Dent Med* (19 addresses, 13%). The university is omitted in 75 single-institution addresses; in 3 addresses, after the university only the department is listed and one address *Sch Dent Med* is linked to the name of the department – *Univ Zagreb, Sch Dent Med & Endodont*.

The Croatian-language form of the name of the School of Dental Medicine appears rarely, but it should not be overlooked when searching: *Sveucilista* or *Sveuciliste Zagrebu*, *Stomatol* or *Stomatološki*, or *Stomatološkog Fak*.

Name variations do not arise solely from different ways of writing the institutional name in the papers themselves, but errors also occur in the database. An obvious error, for example, is the university name *Uniwers Zagreb*, which is correctly given in the paper itself, and there is clearly an error with the address *Sch Med, Gundulićeva Ul 5, Zagreb 10000, Croatia*, which in the paper is given as *University of Zagreb School of Dental Medicine and School of Medicine, Gundulićeva Ulica 5, 10000 Zagreb, Croatia*. In addition, for eight addresses, the merging of the School of Medicine and the School of Dental Medicine into a single institution, as it is written in the papers (*Sch Med & Dent, Sch Med & Dent Med, Med & Dent Fac*), is questionable.

Multi-institution addresses create particular confusion; for example, there are as many as 25 variants of names in which the Sestre milosrdnice University Hospital Center and the School of Dental Medicine are listed together.

A brief analysis of the lower organizational units reveals that their names have changed over time, making longitudinal tracking and analysis highly challenging. These units appear in a substantial number of addresses, with the most frequent names including Dept Endodont & Restorat Dent (288 addresses), Dept Oral Med (179), Dept Prosthodont (169), Dept Oral Surg (141), Dept Dent Anthropol (105), Dept Orthodont (83), Dept Removable Prosthodont (82), Dept Periodontol (69), Dept Fixed Prosthodont (41), Dept Paediat & Prevent Dent (27 addresses). For the listed department names, variants with the added word *Med* at the end are also present, as well as numerous other variants (Table 3).

### Analysis of papers

Among the 1,521 selected papers, according to WoSCC categorization, most are articles (1,306; 86%), followed by review articles (80; 5%), meeting abstracts (4%), letters (3%), proceedings papers (2%), editorial materials (1%), news items (0.3%), corrections (0.2%), bibliographies (0.07%) and papers categorized as Early Access (0.07%). Papers may be assigned to more than one category: proceedings papers are most often simultaneously categorized as articles (26 papers), and the same applies to papers in early access. The analysis also included papers categorized as Early Access (nine papers) that were finally published in 2023, but WoSCC indexed them in 2021 and 2022 and their citations were included in the citation analysis up to and including 2022.

The largest number of papers was published in 2021 (169 papers), and in the last few years around 100 or more papers have been published annually (Table 4). The growth

Sveučilišta naveden je samo zavod, a jedna adresa *Sch Dent Med* povezana je s nazivom zavoda – *Univ Zagreb, Sch Dent Med & Endodont*.

Rijetko se pojavljuje oblik naziva Stomatološkog fakulteta na hrvatskome jeziku koji ipak ne treba zaboraviti pri pretraživanju: *Sveucilista* ili *Sveuciliste Zagrebu*, *Stomatol* ili *Stomatološki* ili pak *Stomatološkog Fak*.

Inačice naziva nisu posljedica isključivo različitih načina pisanja naziva ustanove na samim radovima, nego se pogreške pojavljuju i u samoj bazi. Očita je pogreška, primjerice, naziv sveučilišta *Uniwers Zagreb* koje je točno navedeno na samome radu, a pogreška se očito dogodila i kod adrese *Sch Med, Gundulićeva Ul 5, Zagreb 10000, Croatia* koja je na samome radu navedena kao *University of Zagreb School of Dental Medicine and School of Medicine, Gundulićeva Ulica 5, 10000 Zagreb, Croatia*. Također je na osam adresa upitno spajanje Medicinskoga i Stomatološkoga fakulteta u jednu ustanovu, kako je to napisano na radovima (*Sch Med & Dent, Sch Med & Dent Med, Med & Dent Fac*).

Posebnu zbrku unose višeinstitucijske adrese; primjerice ukupno je čak 25 varijanti naziva u kojima se zajedno navode Klinički bolnički centar Sestre milosrdnice i Stomatološki fakultet.

Kratko ćemo spomenuti i niže ustrojbene jedinice koje su s vremenom mijenjale svoje nazive pa je zahtjevno pratiti ih i analizirati, a navode se u mnogobrojnim adresama. Najbrojniji nazivi su: Dept Endodont & Restorat Dent (288 adresa), Dept Oral Med (179), Dept Prosthodont (169), Dept Oral Surg (141), Dept Dent Anthropol (105), Dept Orthodont (83), Dept Removable Prosthodont (82), Dept Periodontol (69), Dept Fixed Prosthodont (41), Dept Paediat & Prevent Dent (27 adresa). Za navedene nazive zavoda postoje i varijante s pridodanom riječju *Med* na kraju naziva, ali i mnogobrojne druge inačice (tablica 3.).

### Analiza radova

Među 1521 izdvojenim radom, prema kategorizaciji WoSCC-a, najviše je znanstvenih radova (1306; 86 %), slijede pregledni radovi (80; 5 %), sažetci s konferencija čine 4 %, pisma 3 %, radovi s konferencija 2 %, urednički materijali 1 %, novosti 0,3 %, korekcije 0,2 %, bibliografije (0,07 %) i radovi kategorizirani kao rani pristup (*Early Access*) (0,07 %). Radovi mogu biti svrstani u više kategorija: radovi s konferencija najčešće su istodobno i u kategoriji znanstvenih radova (26 radova), a to vrijedi i za radove u ranom pristupu. U analizi su obuhvaćeni i radovi kategorizirani kao rani pristup (devet radova) koji su konačno objavljeni 2023. godine, no WoSCC ih je indeksirao 2021. i 2022. godine te su njihovi citati uključeni u citatnu analizu zaključno s 2022. godinom.

Najveći broj radova objavljen je 2021. godine (169 radova), a posljednjih nekoliko godina objavljujvano je oko 100 i više radova na godinu (tablica 4.).

**Table 3.** Examples of the department's name form  
**Tablica 3.** Primjeri oblika naziva zavoda

| Zavod za dentalnu antropologiju •<br>Department of Dental Anthropology | Zavod za dječju stomatologiju •<br>Department of Pediatric Dentistry |
|------------------------------------------------------------------------|----------------------------------------------------------------------|
| Zavod Dent Antropol                                                    | Dept Paediat & Prevent Dent                                          |
| Zavod Dent Antropologiju                                               | Zavod Djecju & Preventivnu Stomatologiju                             |
| Dept Dent Antropol                                                     | Dept Childrens & Prevent Dent                                        |
| Dept Dent Antropol                                                     | Dept Paediat Dent                                                    |
| Dept Antropol                                                          | Pediat Dent Dept                                                     |

**Table 4.** Number of papers by year of publication and paper type  
**Tablica 4.** Broj radova prema godini objavljivanja i vrsti rada

| Godina •<br>Year | Radovi (N) •<br>Papers | Znanstveni rad •<br>Article | Pregledni rad •<br>Review Article | Pismo • Letter | Rad s konferencije •<br>Proceeding Paper | Sažetak s konferencije •<br>Meeting Abstract | Bibliografija •<br>Bibliography | Novosti •<br>News item | Urednički materijal •<br>Editorial Material | Korekcija •<br>Correction | Rani pristup •<br>Early access | Biografija •<br>Biographical Item |
|------------------|------------------------|-----------------------------|-----------------------------------|----------------|------------------------------------------|----------------------------------------------|---------------------------------|------------------------|---------------------------------------------|---------------------------|--------------------------------|-----------------------------------|
| 2022.            | 153                    | 131                         | 11                                | 5              | 2                                        | 6                                            |                                 |                        |                                             |                           |                                |                                   |
| 2021.            | 169                    | 143                         | 15                                | 4              |                                          | 5                                            |                                 |                        | 2                                           |                           |                                |                                   |
| 2020.            | 114                    | 96                          | 10                                | 6              |                                          |                                              |                                 |                        | 2                                           |                           |                                |                                   |
| 2019.            | 106                    | 94                          | 4                                 | 3              | 2                                        | 3                                            |                                 |                        | 1                                           | 1                         | 1                              |                                   |
| 2018.            | 110                    | 97                          | 3                                 | 4              | 1                                        | 4                                            |                                 |                        | 2                                           |                           |                                |                                   |
| 2017.            | 71                     | 58                          | 6                                 | 2              |                                          | 2                                            |                                 |                        | 2                                           | 1                         |                                |                                   |
| 2016.            | 103                    | 85                          | 3                                 | 6              | 6                                        | 6                                            |                                 |                        | 3                                           |                           |                                |                                   |
| 2015.            | 84                     | 76                          | 3                                 | 1              |                                          | 4                                            |                                 |                        |                                             |                           |                                |                                   |
| 2014.            | 69                     | 58                          | 5                                 | 2              |                                          | 1                                            |                                 |                        | 3                                           |                           |                                |                                   |
| 2013.            | 81                     | 67                          | 5                                 | 1              | 1                                        | 1                                            |                                 | 5                      | 2                                           |                           |                                |                                   |
| 2012.            | 88                     | 78                          | 2                                 |                |                                          | 5                                            |                                 |                        | 1                                           |                           |                                | 2                                 |
| 2011.            | 86                     | 74                          | 3                                 | 4              |                                          | 2                                            |                                 |                        | 2                                           |                           |                                | 1                                 |
| 2010.            | 60                     | 45                          | 3                                 |                |                                          | 11                                           |                                 |                        | 1                                           |                           |                                |                                   |
| 2009.            | 59                     | 55                          |                                   | 1              | 2                                        | 3                                            |                                 |                        |                                             |                           |                                |                                   |
| 2008.            | 64                     | 60                          | 1                                 | 1              | 8                                        | 2                                            |                                 |                        |                                             |                           |                                |                                   |
| 2007.            | 47                     | 41                          | 2                                 |                | 1                                        | 4                                            |                                 |                        |                                             |                           |                                |                                   |
| 2006.            | 57                     | 48                          | 4                                 | 3              | 3                                        |                                              | 1                               |                        |                                             | 1                         |                                |                                   |
| Ukupno           | 1521                   | 1306                        | 80                                | 43             | 26                                       | 59                                           | 1                               | 5                      | 21                                          | 3                         | 1                              | 3                                 |

trend in the number of articles (1,306) in the observed period shows several substantial increases compared to the previous year: in 2008 (+46%), 2011 (+64%), 2018 (+67%) and 2021 (+49%). Considering the number of articles published between 2006 and 2022, a long-term upward trend was recorded, with an overall increase of nearly threefold (+173%) (Figure 1).

According to WoSCC subject categories, the largest number of papers is categorized under Dentistry Oral Surgery Medicine (673; 44%), followed by Medicine General Internal (200; 13%) and Anthropology (113; 7%).

#### Journal analysis

The analysed papers were published in a total of 365 journals, with Croatian journals predominating: Acta stomatologica Croatica (307; 20% of papers), Acta clinica Croatica (122; 8%) and Collegium antropologicum (103; 7%). The largest number of articles was also published in Croatian journals Acta stomatologica Croatica (271; 21%), Acta clinica Croatica (100; 8%) and Collegium antropologicum (100; 8%). The largest number of conference abstracts was published in the foreign journal Oral Diseases (17; 29%), while the largest number of proceedings papers was published in the journal Collegium antropologicum (7; 27%). It should be kept in mind that meeting abstracts are also published in Acta stomatologica Croatica, but WoSCC does not index them.

Only one paper by authors from the School of Dental Medicine was published in as many as 212 journals (58%),

Trend rasta broja znanstvenih radova (1306) u promatranom razdoblju pokazuje nekoliko velikih porasta u usporebi s prethodnom godinom: 2008. godine (+ 46 %), 2011. godine (+ 64 %), 2018 (+ 67 %) i 2021. (+ 49 %). Promatrajući broj znanstvenih radova objavljenih od 2006. do 2022. godine zabilježen je dugoročni uzlazni trend i ukupni porast od gotovo tri puta (+ 173 %) (slika 1.).

Prema predmetnim kategorijama WoSCC-a, najveći broj radova kategoriziran je u područje Dentistry Oral Surgery Medicine (673; 44 %), zatim Medicine General Internal (200; 13 %) i Anthropology (113; 7 %).

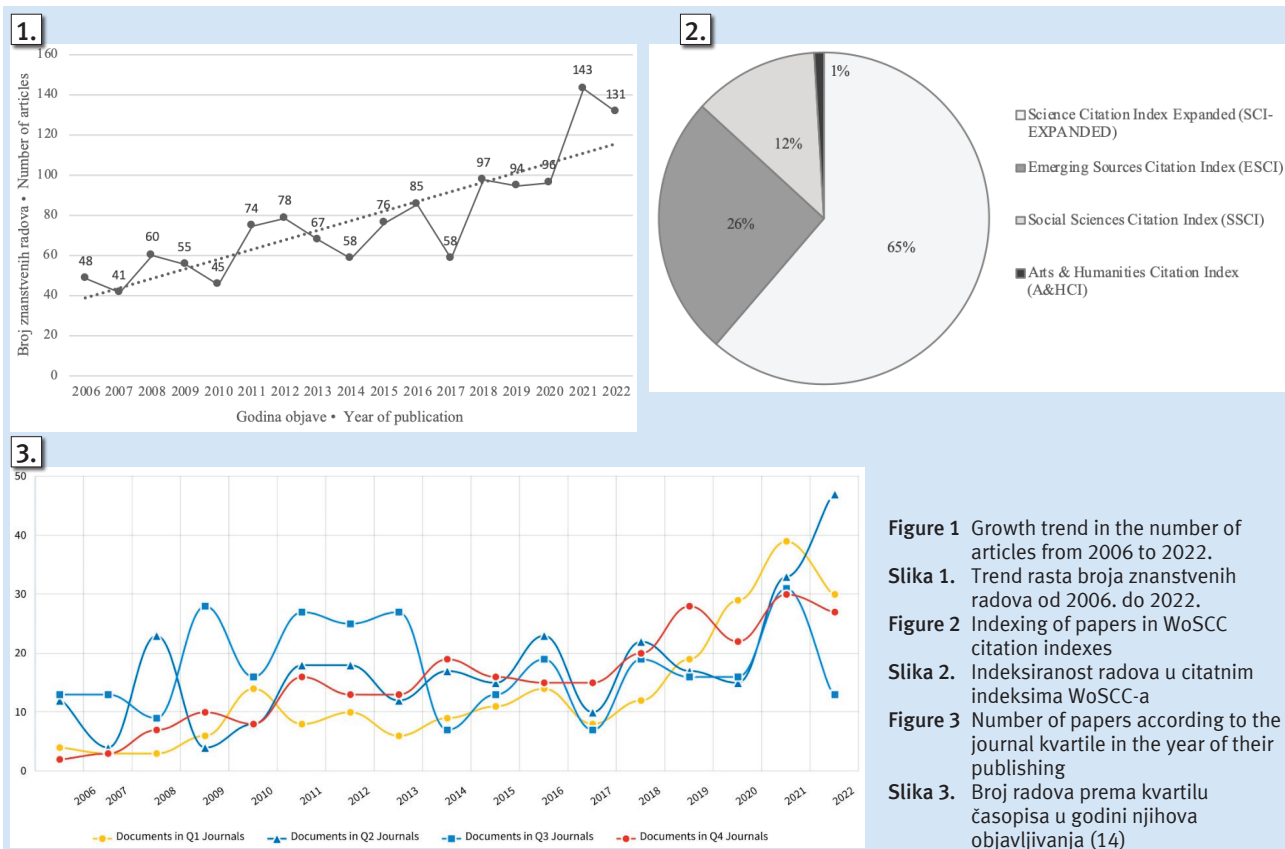
#### Analiza časopisa

Analizirani radovi objavljeni su u ukupno 365 časopisa, a prednjače domaći: Acta stomatologica Croatica (307; 20 % radova), Acta clinica Croatica (122; 8 %) i Collegium antropologicum (103; 7 %). Najveći broj znanstvenih radova također je objavljen u domaćim časopisima Acta stomatologica Croatica (271; 21 %), Acta clinica Croatica (100; 8 %) i Collegium antropologicum (100; 8 %). Najveći broj sažetaka s konferencija objavljen je u stranom časopisu Oral Diseases (17; 29 %), a najveći broj radova s konferencija tiskan je u časopisu Collegium antropologicum (7; 27 %). Pritom treba imati na umu da se sažetci s konferencija objavljuju i u časopisu Acta stomatologica Croatica, ali ih WoSCC ne indeksira.

U promatranom razdoblju samo po jedan rad autora sa Stomatološkog fakulteta objavljen je u 212 časopisa (58 %), u

**Table 5.** Journals in which ten and more papers are published  
**Tablica 5.** Časopisi u kojima je objavljeno deset i više radova

| Naziv časopisa • Journal title                                      | Broj radova • Number of papers | %          |
|---------------------------------------------------------------------|--------------------------------|------------|
| Acta stomatologica Croatica                                         | 307                            | 20%        |
| Acta clinica Croatica                                               | 122                            | 8%         |
| Collegium antropologicum                                            | 103                            | 7%         |
| Oral Diseases                                                       | 29                             | 2%         |
| Research Journal of Pharmaceutical Biological And Chemical Sciences | 26                             | 2%         |
| Materials                                                           | 25                             | 2%         |
| Croatian Medical Journal                                            | 24                             | 2%         |
| Acta Dermatovenereologica Croatica                                  | 24                             | 2%         |
| Clinical Oral Investigations                                        | 22                             | 1%         |
| Psychiatria Danubina                                                | 19                             | 1%         |
| Dentistry Journal                                                   | 19                             | 1%         |
| Photomedicine And Laser Surgery                                     | 18                             | 1%         |
| Journal of Dentistry                                                | 14                             | 1%         |
| Archives of Oral Biology                                            | 11                             | 1%         |
| Scientific Reports                                                  | 11                             | 1%         |
| Dental Materials                                                    | 10                             | 1%         |
| Operative Dentistry                                                 | 10                             | 1%         |
| Central European Journal of Public Health                           | 10                             | 1%         |
| <b>Ukupno • Total</b>                                               | <b>804</b>                     | <b>53%</b> |



**Figure 1** Growth trend in the number of articles from 2006 to 2022.

**Slika 1.** Trend rasta broja znanstvenih radova od 2006. do 2022.

**Figure 2** Indexing of papers in WoSCC citation indexes

**Slika 2.** Indeksiranost radova u citatnim indeksima WoSCC-a

**Figure 3** Number of papers according to the journal quartile in the year of their publishing

**Slika 3.** Broj radova prema kvartilu časopisa u godini njihova objavljivanja (14)

between two and nine papers were published in 135 journals (37%), and ten or more papers in 18 journals (5%) during the observed period. However, in these 18 journals a total of 804 papers were published, accounting for 53% of all published papers (Table 5).

135 časopisa (37 %) objavljeno je između dva i devet radova, a u 18 časopisa (5 %) deset ili više. Međutim, u tih 18 časopisa ukupno su objavljena 804 rada koji čine 53 % svih objavljenih radova (tablica 5).

A total of 1,512 (99%) papers were published in English (many are bilingual, in Croatian and English, especially papers in *Acta stomatologica Croatica*); one paper is in German and one in Italian. Only seven papers were published exclusively in Croatian.

### Indexing and ranking of journals

Of the 1,521 considered papers, 995 (65%) were indexed in the Science Citation Index Expanded (SCI-Expanded), 204 papers (13%) in the Social Sciences Citation Index (SSCI), 8 papers (1%) in the Arts & Humanities Citation Index (A&HCI), and 405 (27%) in the Emerging Sources Citation Index (ESCI), whereby papers may simultaneously be indexed in the first three of the mentioned indexes (Figure 2).

Using the InCites tool, the papers were analysed according to the Journal Citation Reports quartile (JCR Q1–Q4) in which the journal was ranked in the year of their publication. The least represented are papers published in journals in the first quartile (225, 15%), followed by papers in second-quartile journals (298; 20%), then in third-quartile (299, 20%) and fourth-quartile journals (264, 17%). The largest share of papers (435, 29%) was published either in journals indexed in ESCI and A&HCI—for which quartiles were not yet calculated during that period—or in SCIE and SSCI journals that lacked an assigned quartile for certain years. In total, 1,080 papers (71%) were published in journals with a calculated quartile.

The most visible trend is the growth in the number of papers in Q1 and Q2 journals in more recent years, starting from 2019, while publication in Q3 and Q4 journals is relatively stable with minor fluctuations. The peak in the number of papers in Q1 journals is evident in 2021, and in Q2 journals in 2022 (Figure 3).

### Publishers

An overview of journal publishers shows that, out of a total of 114 publishers, 97 (85%) are foreign, while 17 (15%) are Croatian publishers. Although the share of Croatian publishers is smaller, a substantial number of papers have been published in their journals, a total of 627 (41%), while 894 (59%) papers were published in journals of foreign publishers.

Ranked first by the number of published papers is the institutional journal issued by the School of Dental Medicine, with a total of 307 papers (20%). Elsevier journals follow in second place with 179 papers (12%), while Wiley journals rank third with 145 papers (10%). MDPI journals—in which papers have been published only since 2019—occupy fifth place with 107 papers (7%). Between 2019 and 2022, a rapid expansion was recorded from 3 to 49 papers per year, representing a sixteen-fold increase. On an annual basis, MDPI publications grew from an initial 3 papers (3%) in 2019, to 12 (11%) in 2020, 43 (25%) in 2021, and 49 (32%) in 2022.

### Subject categories of journals

The distribution of journals and papers across 114 subject categories (Web of Science categories) shows that the largest number of journals covers the field of Dental medicine and

Ukupno 1512 (99 %) radova objavljeno je na engleskome jeziku (mnogi su dvojezični na hrvatskome i engleskome jeziku, poglavito radovi u časopisu *Acta stomatologica Croatica*); jedan je rad na njemačkome i jedan na talijanskome. Isključivo na hrvatskom jeziku objavljeno je samo sedam radova.

### Indeksiranost i rangiranje časopisa

Od 1521 razmatranog rada, 995 (65 %) indeksirano je u Science Citation Index Expanded (SCI-Expanded), 204 rada (13 %) u Social Sciences Citation Indexu (SSCI), 8 radova (1 %) u Arts & Humanities Citation Indexu (A&HCI) te 405 (27 %) u Emerging Sources Citation Indexu (ESCI), pri čemu radovi mogu istodobno biti indeksirani u tri prva navedena indeksa (slika 2.).

S pomoću alata InCites (14) radovi su analizirani prema kvartilu Journal Citation Reports (JCR Q1–Q4) u kojemu je časopis bio rangiran u godini njihova objavljivanja. Najmanje su zastupljeni radovi objavljeni u časopisima u prvo-m kvartilu (225; 15 %), slijede oni u časopisima u drugome kvartilu (298; 20 %), a zatim u trećem (299; 20 %) i četvrtom kvartilu (264; 17 %). Najveći broj radova (435; 29 %) objavljen je u časopisima indeksiranim u indeksima ESCI i A&HCI za koje se kvartili tada još nisu izračunavali te u indeksima SCIE i SSCI koji za pojedine godine još nisu imali izračunati kvartil. Ukupno je 1080 (71 %) radova objavljeno u časopisima s iskazanim kvartilom.

Najvidljiviji trend je rast broja radova u Q1 i Q2 časopisima posljednjih nekoliko godina, počevši od 2019., a objavljivanje u časopisima Q3 i Q4 razmjerno je stabilno s manjim promjenama. Kulminacija radova u časopisima Q1 vidljiva je 2021. godine, a radova u časopisima Q2 2022. (slika 3.).

### Izdavači

Pregled izdavača časopisa pokazuje da je od ukupno njih 114 u stranom vlasništvu 97 (85 %), a domaćih je 17 (15 %). Iako je udio domaćih izdavača manji, u njihovim je časopisima objavljen znatan broj radova, ukupno 627 (41 %), a u stranim su objavljena 894 rada (59 %).

Na prvome mjestu prema broju objavljenih radova je časopis u izdanju Stomatološkog fakulteta s ukupno 307 (20 %) radova. Na drugome mjestu su Elsevierovi časopisi sa 179 (12 %) radova, a na trećemu Wileyjevi sa 145 (10 %) radova. Časopisi izdavača MDPI, u kojima se objavljuje tek od 2019. godine, na petom su mjestu sa 107 (7 %) radova. U razdoblju od 2019. do 2022. zabilježen je snažan porast s 3 na 49 radova na godinu, što je skok od 16 puta. Na godišnjoj razini radovi MDPI-ja porasli su s početna 3 rada (3 %) u 2019. godini na 12 (11 %) u 2020., 43 (25 %) u 2021. i 49 (32 %) u 2022. godini.

### Predmetne kategorije časopisa

Raspodjela časopisa i radova prema 114 predmetnih kategorija (*Web of science categories*) pokazuje da najviše časopisa pokriva područje dentalne medicine i oralne kirurgije

oral surgery (87, 76%), followed by General internal medicine (24, 21%) and Surgery (23, 20%). Accordingly, the largest number of papers has been published in journals belonging to the categories of Dental medicine (673, 35%) and General medicine (200, 10%), and Anthropology, where a large number of papers (113, 6%) has been published in only six journals. Most of the other subject categories are represented by just one or two journals and by less than 2% of papers.

It should be kept in mind that journals and papers can simultaneously be categorized in several different subject categories, and that the subject category of a journal does not necessarily describe the content of each individual article, but primarily the profile of the journal in which the paper is published. It is also noticeable that in certain subject categories with a small number of journals a disproportionately large number of papers can be published: Physics condensed matter (25 published papers in one journal), Chemistry physical (28 papers in two journals), Metallurgy, metallurgical engineering (26 papers in two journals), Multidisciplinary sciences (44 papers in three journals) (Figure 4).

### Open access

Models of publishing papers in journals include closed access, i.e. the traditional subscription-based model with restricted access to papers, and open access which enables readers' free and unrestricted access to full texts.

Of the analysed papers, a total of 662 (44%) are in some form of open access (the same paper may be published in a journal that charges readers for access, but its peer-reviewed version (i.e. postprint), may be available in open access without charge through repositories, authors' personal website, social networks for researchers, etc.).

In the Web of Science Core Collection database, six levels of open access are distinguished, which we, with respect to publication costs, divided into two groups:

1. Open access with payment: authors, their institutions or research funding agencies through projects pay the costs of publication (Article Processing Charges – APC) for immediate open access to papers.
2. Open access without payment: alternative publishing models without direct costs for authors, most often involving self-archiving in repositories. However, there are also so-called diamond journals that do not charge authors for publishing in open access because they are financed through subscriptions, donations or by the parent institution, the state, associations, etc.

Data show that the number of papers in these two groups of open access is almost equal, but open access with payment still slightly predominates (51%) (Figure 5).

From 2006 to 2012 a slower growth in the number of papers published in open access was recorded (from 3 to 15 papers per year), while a faster growth started in 2013 (26 papers), 2015 (33 papers) and 2016 (48 papers). The largest increase in open access papers is visible from 2019 (57 papers), then 2020 (85 papers), 2021 (124 papers) and 2022 (123 papers), so in those years the share of open access among the total number of papers is also the highest (Figure 6).

(87; 76 %), zatim područje opće interne medicine (24; 21 %) te kirurgije (23; 20 %). U skladu s tim, najveći broj radova objavljen je u časopisima koji pripadaju kategorijama dentalne (673; 35 %) i opće medicine (200; 10 %), te antropologije u kojoj je velik broj radova (113; 6 %) objavljen u samo šest časopisa. Većina ostalih predmetnih kategorija zastupljena je s tek jednim do dva časopisa i s manje od 2 % radova. Treba imati na umu da časopisi i radovi istodobno mogu biti kategorizirani u više različitih predmetnih kategorija te da predmetna kategorija časopisa ne opisuje nužno sadržaj svakoga članka, nego profil časopisa u kojemu je rad objavljen. Također je zamjetno da u određenim predmetnim kategorijama s malim brojem časopisa može biti objavljen nerazmjerno veći broj radova: *Physics condensed matter* (25 objavljenih radova u jednom časopisu), *Chemistry physical* (28 radova u dva časopisa), *Metallurgy, metallurgical engineering* (26 radova u dva časopisa), *Multidisciplinary sciences* (44 rada u tri časopisa) (slika 4.).

### Otvoreni pristup

Modeli objavljivanja radova u časopisima podrazumijevaju zatvoreni pristup, odnosno tradicionalni pretplatnički model s ograničenim pristupom radovima te otvoreni pristup koji čitateljima omogućuje slobodan i besplatan pristup cjelovitim tekstovima.

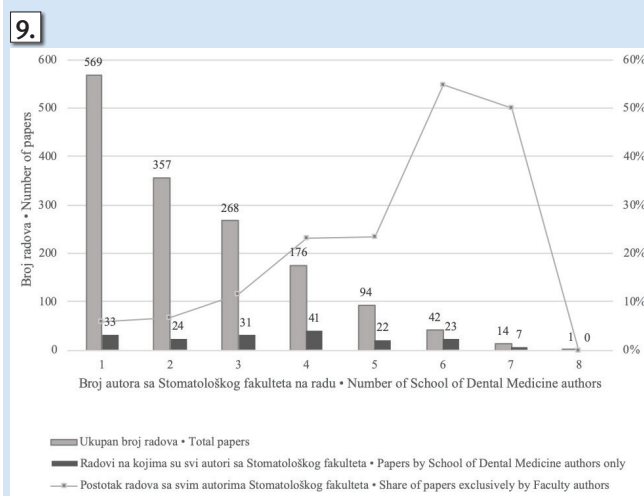
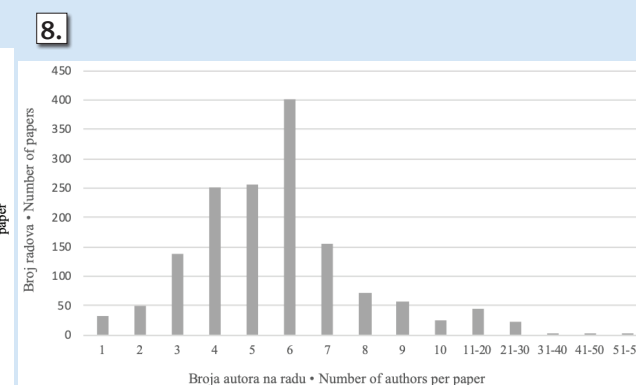
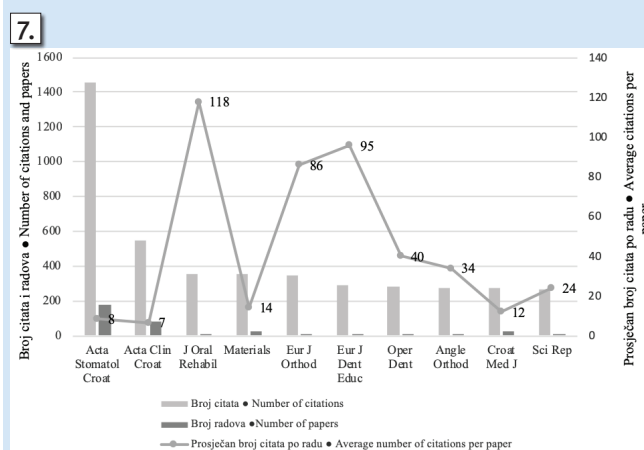
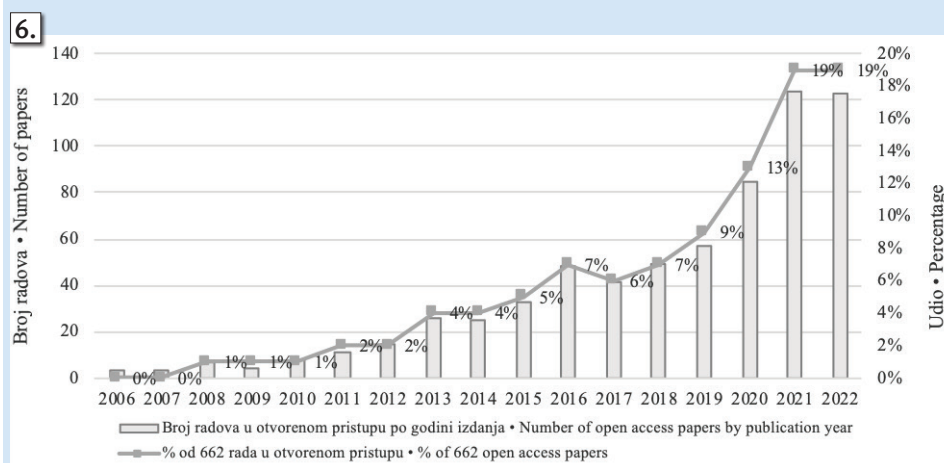
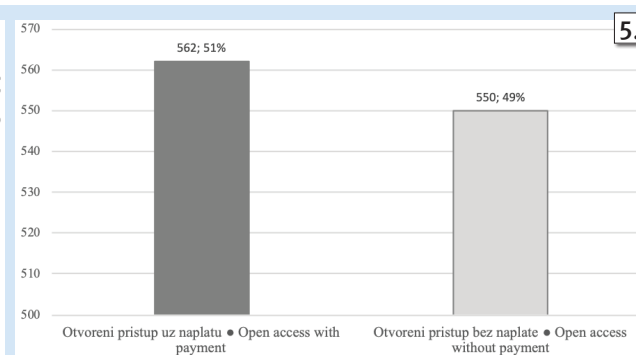
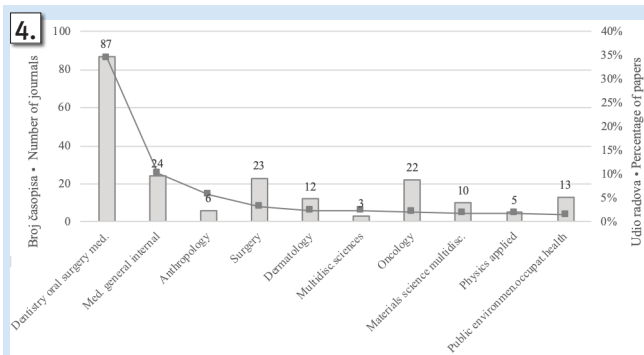
Od analiziranih radova ukupno su 662 (44 %) u nekoj vrsti otvorenoga pristupa (isti rad može biti objavljen u časopisu koji čitateljima naplaćuje pristup, ali njegova recenzirana verzija (postprint) može biti i u otvorenome pristupu bez naplate dostupna putem repozitorija, osobnih mrežnih stranica autora, društvenih mreža za znanstvenike i dr.).

U bazi Web of Science Core Collection razlikuje se šest razina otvorenoga pristupa koje smo, s obzirom na troškove objavljivanja radova, podijelili u dvije skupine:

1. otvoreni pristup uz naplatu: autori, njihove ustanove ili agencije za financiranje znanosti putem projekata plaćaju troškove objavljivanja (Article Processing Charges - APC) za trenutnu otvorenost radova
2. otvoreni pristup bez naplate: alternativni modeli bez izravnih troškova koji najčešće podrazumijevaju samoarhiviranje u repozitorijima; no, postoje i tzv. dijamantni časopisi koji autorima ne naplaćuju objavljivanje u otvorenome pristupu jer se financiraju iz pretplata, donacija ili ih financijski podupire matična ustanova, država, udruga i slično.

Podatci pokazuju da je broj radova u tim dvjema skupinama otvorenoga pristupa gotovo izjednačen, no ipak preteže otvoreni pristup uz naplatu (51 %) (slika 5.).

Od 2006. do 2012. godine zabilježen je sporiji porast radova objavljenih u otvorenome pristupu (od 3 do 15 radova na godinu), a počeo je rasti 2013. (26 radova), 2015. (33 radova) i 2016. godine (48 radova). Najveće povećanje u otvorenome pristupu dogodilo se 2019. (57 radova), zatim 2020. (85 radova), 2021. (124 rada) i 2022. (123 radova), pa je stoga tih godina i najveći udio u ukupnom broju radova u otvorenome pristupu (slika 6.).



**Figure 4** Relationship between the number of journals and the percentage of papers (top 10) by Web of Science subject categories

**Slika 4.** Odnos broja časopisa i udjela radova (top 10) prema predmetnim kategorijama Web of Science

**Figure 5** Number of open access papers with or without payment

**Slika 5.** Broj radova u otvorenome pristupu uz naplatu i bez naplate

**Figure 6** Number and share of papers in open access by year of publication

**Slika 6.** Broj i udio radova u otvorenome pristupu prema godini objavljivanja

**Figure 7** Ten journals with open access papers with the highest number of citations

**Slika 7.** Deset časopisa s radovima u otvorenome pristupu s najvećim brojem citata

**Figure 8** Number of authors per paper

**Slika 8.** Broj autora na radu

**Figure 9** Number of authors from the School of dental medicine

**Slika 9.** Broj autora na radu sa Stomatološkog fakulteta

Of the total number of open access papers, the largest number has been published in the journal *Acta stomatologica Croatica* (176 papers; 27%), followed by *Acta clinica Croatica* (83 papers; 13%) and the MDPI journal *Materials* (25 papers; 4%). These data correspond to the distribution by publisher, where, after the School of Dental Medicine in Zagreb, open access papers in MDPI journals follow (107 papers, 16%).

#### Citations of open access papers

Open-access papers have been cited a total of 8,885 times (8,399 excluding self-citations), averaging 13.42 citations per paper with an h-index of 40. These citations account for 46% of the total citation count across all analyzed papers. Papers published in *Acta Stomatologica Croatica* received 1,457 citations, representing 16% of all open-access citations (and 8% of the total citation count across all papers), with an average of 8 citations per paper. *Acta Clinica Croatica* follows with 549 citations (6%), while the *Journal of Oral Rehabilitation* ranks third with 353 citations (4%). The latter journal charges for open-access publication, and its high average of 118 citations per paper is driven by only three papers. Aside from *The Angle Orthodontist* and the *Croatian Medical Journal*, all other venues among the top ten most-cited journals charge article processing charges (APCs) for open access (Figure 7). From the perspective of publishers, the most cited papers are those in journals published by MDPI, which charge for open access publication (1,515 citations; 17% of all citations to open access papers, with an average of 14 citations per paper). They are followed by the School of Dental Medicine, which as publisher does not charge for publication (1,457 citations; 16%; an average of 8 citations per paper), and journals of the publisher Wiley, which also charge for open access publication (1,188 citations; 13%) but achieve the highest average of 41 citations per paper.

#### Analysis of authors

Summing all contributors across individual papers yields a total pool of 9,456 authors. The maximum number of authors on a single paper is 54, followed by two separate papers with 52 and 51 authors, respectively. On the largest number of papers, 402 (26%), six authors collaborated, which also represents the average number of authors per paper. Next are papers with five (257, 17%) and four (251, 17%) authors, 156 (10%) papers with seven authors, and 137 (9%) papers with three authors. A smaller share is made up of papers with eight (72, 5%) and nine authors (56, 4%), 50 (3%) are two-author papers and 33 (2%) single-author papers, while ten authors participated in writing 26 (2%) papers (Figure 8).

There are seven group-authored papers belonging to the following groups: Croatian Registry Renal Biopsies; Croatian Soc Nephrology Dialysis; SWEET Study Grp; MRSA Surveillance Worldwide Study; ESCMID Study Grp Nosocomial Infect; ESCMID Study Grp Staphylococci Sta; Croatian Comm Antibiotic Resistanc.

#### Co-authorship

By analysing addresses in the total number of papers, at least one foreign author collaborated on 411 papers (27%).

Od ukupnoga broja radova u otvorenome pristupu, najviše ih je objavljeno u časopisu *Acta stomatologica Croatica* (176 radova; 27 %), zatim u *Acta clinica Croatica* (83 radova; 13 %) te u MDPI-jevu časopisu *Materials* (25 radova; 4 %). Ti se podatci podudaraju s raspodjelom prema izdavaču u kojoj, nakon Stomatološkog fakulteta u Zagrebu, slijede radovi u otvorenome pristupu u MDPI-jevim časopisima (107 radova, 16 %).

#### Citiranost radova u otvorenome pristupu

Radovi u otvorenome pristupu ukupno su citirani 8885 puta (8399 bez samocitata), s prosječno 13,42 citata po radu i h-indeksom 40 te čine 46 % od ukupnoga broja citata svih radova.

Radovi objavljeni u časopisu *Acta stomatologica Croatica* ostvaruju 1457 citata, što čini 16 % u ukupnome broju citata svih radova u otvorenome pristupu, odnosno 8 % u ukupnome broju citata svih radova, i s prosječno 8 citata po radu. Slijede radovi u časopisu *Acta clinica Croatica* (549 citata; 6 %), a treći su po citiranosti oni iz časopisa *Journal of oral rehabilitation* (353 citata; 4 %). Posljednji časopis naplaćuje objavljivanje u otvorenome pristupu, a visoki prosjek od 118 citata po radu odnosi se na samo tri rada. Ostali časopisi koji ulaze u top-10 časopisa s najcitiranijim radovima i visokim prosječnim brojem citata po radu naplaćuju troškove objavljivanja u otvorenome pristupu (osim *Angle orthodontist* i *Croatian medical journal*) (slika 7). S aspekta izdavača najcitiraniji su radovi u časopisima u izdanju MDPI-ja koji naplaćuju objavu radova u otvorenome pristupu (1515 citata; 17 % ukupnih citata radova u otvorenome pristupu, s prosjekom od 14 citata po radu). Slijedi Stomatološki fakultet koji kao izdavač ne naplaćuje objavljivanje (1457 citata; 16 %; prosječno 8 citata po radu) te časopisi izdavača Wileyja koji također naplaćuju objavljivanje (1188 citata; 13 %), ali ostvaruju i najviši prosjek od 41 citata po radu.

#### Analiza autora

Zbrajanjem svih autora prema pojedinačnim radovima dobiven je ukupan broj od 9456 autora. Najveći broj autora na jednome radu jest 54, slijedi jedan rad s 52 autora i jedan s 51 autorom.

Na najvećem broju radova, njih 402 (26 %), surađivalo je šest autora, što je ujedno prosječan broj autora na radu. Slijede radovi s pet (257; 17 %) i četiri (251; 17 %) autora, 156 (10 %) radova sa sedam autora te 137 (9 %) radova s tri autora. Manji udio čine radovi s osam (72; 5 %) i devet autora (56; 4 %), 50 (3 %) je dvoautorskih i 33 (2 %) su jednoautorska rada, a deset autora sudjelovalo je u pisanju 26 (2 %) radova (slika 8.).

Sedam je skupnih radova sljedećih grupacija: Croatian Registry Renal Biopsies; Croatian Soc Nephrology Dialysis; SWEET Study Grp, MRSA Surveillance Worldwide Study; ESCMID Study Grp Nosocomial Infect; ESCMID Study Grp Staphylococci Sta, Croatian Comm Antibiotic Resistanc.

#### Suautorstvo

Analizirajući adrese na ukupnom broju radova, barem jedan strani autor surađivao je na 411 radova (27 %). Ukupno

Overall, collaboration was established with authors from 80 foreign countries, with the highest number of papers resulting from cooperation with authors from the United States of America (95; 10%), Italy (74; 8%) and Germany (68; 7%), followed by the United Kingdom (61; 6%), Slovenia (53; 5%), Switzerland (48; 5%) and Bosnia and Herzegovina (46; 5%), where at least one author from the mentioned foreign countries was present on the papers.

Monitoring mutual collaboration among authors from the School of Dental Medicine shows that only one author from the School participated in 569 (37%) papers (of which 33 (6%) are single-author papers). Most papers have two authors from the School (357, 23%), of which 24 (7%) are two-author papers. Next are papers with three internal authors (268, 18%), among which 31 (12%) are three-author papers, and papers with four authors (176, 12%), of which 41 (23%) are four-author papers. Further distribution shows that on 94 (6%) papers five authors from the School of dental medicine participated, of which 22 (23%) are five-author papers; on 42 (3%) papers there are six authors (23, 55% are six-author papers), while seven internal authors participated in 14 (1%) papers, of which as many as 7 (50%) are seven-author papers. The largest number of eight authors from the School of Dental Medicine was recorded on one paper produced in cooperation with authors from other institutions. Overall, on 181 (12%) papers all authors are from the School of Dental Medicine (Figure 9).

#### Co-author institutions

In interpreting collaborations, only institutions with ten or more co-authored papers were included. The largest number of collaborations was achieved with authors from Sestre milosrdnice University Hospital Center (337 papers, 22%), the University Hospital Centre Zagreb (256, 17%) and the School of Medicine, University of Zagreb (224, 15%). Collaboration with dental practices in primary health care centres is also noticeable (7%), as well as with private dental clinics (6%). Significant collaborations were established with other higher-education institutions, i.e. universities (Rijeka 10%, Split 8% and Osijek 6%), and to a somewhat lesser extent cooperation is present with scientific institutions such as the Ruđer Bošković Institute (4%) and the Institute of Physics (2%). Among foreign institutions, the largest number of papers was produced in collaboration with the University of Ljubljana (36 papers, 2%), the University of Zurich (32; 2%) and the University of London (29, 2%) (Table 6).

Through international collaboration, 411 papers were published (27% of the total number of papers). A significant increase was recorded in 2015 (24 international collaborations, i.e. 29% of papers published that year), while the largest jump was seen in 2021 (63 international collaborations, i.e. 37% of papers published that year and 15% of the total number of international collaborations). After that there is a slight decrease in 2022, but it still remains higher than in earlier years (Figure 10).

#### Productivity and collaboration of authors

Author productivity, measured by the total number of publications, shows that the most prolific researcher is Zrin-

je surađivano s autorima iz 80 stranih zemalja, pri čemu je najviše radova nastalo u suradnji s autorima iz Sjedinjenih Američkih Država (95; 10 %), Italije (74; 8 %) i Njemačke (68; 7 %), zatim Velike Britanije (6; 6 %), Slovenije (53; 5 %), Švicarske (48; 5 %) te Bosne i Hercegovine (46; 5 %); pritom je najmanje jedan autor iz navedenih zemalja.

Praćenje međusobne suradnje autora sa Stomatološkog fakulteta pokazuje da je samo jedan autor s Fakulteta sudjelovao u 569 (37 %) radova [od toga su 33 (6 %) jednoautor-ska]. Najviše je radova s dva autora s Fakulteta (357; 23 %), od kojih su 24 (7 %) dvoautorska. Slijede radovi s tri interna autora (268; 18 %) među kojima je 31 (12 %) troautorski te radovi s četiri autora (176; 12 %) od kojih je 41 (23 %) četveroautorski. Daljnja raspodjela pokazuje da je u 94 (6 %) rada sudjelovalo pet autora sa Stomatološkog fakulteta, od kojih su 22 (23 %) peteroautorska, u 42 (3 %) rada po šest autora (23; 55 % šesteroautorska), a u 14 (1%) radova sudjelovalo je sedam internih autora od kojih je čak 7 (50%) sedmeroautorskih. Najveći broj od osam autora sa Stomatološkog fakulteta zabilježen je u jednom radu nastalom u suradnji s autorima iz drugih ustanova. Ukupno, u 181 (12 %) radu svi su autori sa Stomatološkog fakulteta (slika 9.).

#### Suautorske ustanove

U interpretaciji suradnji obuhvaćene su samo ustanove s deset i više suautorskih radova. Najveći broj suradnji ostvaren je s autorima iz Kliničke bolnice Sestre milosrdnice (337 radova; 22 %), Kliničkoga bolničkoga centra Zagreb (256; 17 %) te Medicinskoga fakulteta Sveučilišta u Zagrebu (224; 15 %). Zamjetna je i suradnja sa stomatološkim ambulanta-ma u domovima zdravlja (7 %), pa i s privatnim stomatološkim ordinacijama (6 %). Značajne su i suradnje s drugim nastavnim ustanovama, odnosno sveučilištima (Rijeka 10 %, Split 8 % i Osijek 6 %), a u nešto manjem opsegu surađivalo se i sa znanstvenim ustanovama poput Instituta Ruđer Bošković (4 %) i Instituta za fiziku (2 %). Od stranih ustanova najveći broj radova ostvaren je u suradnji s University of Ljubljana (36 radova; 2 %), University of Zürich (32; 2 %) i University of London (29; 2 %) (tablica 6.).

Zahvaljujući međunarodnoj suradnji objavljeno je 411 radova (27 % od ukupnoga broja radova). Značajan porast zabilježen je 2015. godine (24 međunarodne suradnje, tj. 29 % radova objavljenih te godine), a najveći skok ostvaren je 2021. (63 međunarodne suradnje, tj. 37 % radova objavljenih te godine i 15 % od ukupnoga broja međunarodnih suradnji). Poslije toga zabilježen je nagli pad u 2022., ali i dalje je ta suradnja viša nego u proteklom godinama (slika 10.).

#### Produktivnost i suradnja autora

Produktivnost autora prema broju objavljenih radova pokazuje da je najproduktivnija Zrinka Tarle s 96 radova (6 %

**Table 6.** Co-authorship with domestic and foreign institutions  
**Tablica 6.** Suautorstvo s domaćim i stranim ustanovama

| Ustanova • Institution                                     | Broj radova • Number of papers | %   | Ustanova • Institution                                     | Broj radova • Number of papers | %  |
|------------------------------------------------------------|--------------------------------|-----|------------------------------------------------------------|--------------------------------|----|
| Klinički bolnički centar Sestre milosrdnice                | 337                            | 22% | University of Ljubljana                                    | 36                             | 2% |
| Klinički bolnički centar Zagreb                            | 256                            | 17% | University of Zurich                                       | 32                             | 2% |
| Sveučilište u Zagrebu Medicinski fakultet                  | 224                            | 15% | University of London                                       | 29                             | 2% |
| Sveučilište u Rijeci                                       | 146                            | 10% | University of Sarajevo                                     | 19                             | 1% |
| Klinička bolnica Dubrava                                   | 136                            | 9%  | Saints Cyril Methodius University of Skopje                | 18                             | 1% |
| Sveučilište u Splitu                                       | 127                            | 8%  | University of Milan                                        | 18                             | 1% |
| Stomatološke ambulante u domovima zdravlja                 | 108                            | 7%  | University of Mostar                                       | 16                             | 1% |
| Sveučilište Josipa Jurja Strossmayera u Osijeku            | 84                             | 6%  | King's College London                                      | 15                             | 1% |
| Privatne stomatološke ordinacije                           | 83                             | 5%  | University of Belgrade                                     | 15                             | 1% |
| Klinika za infektivne bolesti Dr. Fran Mihaljević          | 62                             | 4%  | University of Michigan                                     | 14                             | 1% |
| Institut Ruđer Bošković                                    | 59                             | 4%  | University of Washington                                   | 14                             | 1% |
| Škola narodnog zdravlja Andrija Štampar                    | 57                             | 4%  | Hacettepe University                                       | 12                             | 1% |
| Sveučilište u Zagrebu, Fakultet strojarstva i brodogradnje | 48                             | 3%  | Pennsylvania Commonwealth System of Higher Education Pcshe | 12                             | 1% |
| Institut za fiziku                                         | 37                             | 2%  | University of California System                            | 12                             | 1% |
| Institut za medicinska istraživanja i medicinu rada        | 35                             | 2%  | University of Munich                                       | 12                             | 1% |
| Hrvatsko katoličko sveučilište                             | 25                             | 2%  | University of North Carolina                               | 12                             | 1% |
| Stomatološka poliklinika Zagreb                            | 22                             | 1%  | Pennsylvania State University                              | 11                             | 1% |
| Hrvatska akademija znanosti i umjetnosti                   | 22                             | 1%  | University Medical Center Hamburg Eppendorf                | 11                             | 1% |
| Zdravstveno veleučilište Zagreb                            | 20                             | 1%  | University of Hamburg                                      | 11                             | 1% |
| Opća bolnica Zabok i bolnica hrvatskih veterana            | 20                             | 1%  | Medical University of Graz                                 | 10                             | 1% |
| Hrvatski zavod za javno zdravstvo                          | 20                             | 1%  | National Kapodistrian University of Athens                 | 10                             | 1% |
| Klinička bolnica Merkur                                    | 18                             | 1%  | Showa Medical University                                   | 10                             | 1% |
| Opća bolnica Dr. J. Benčević Slavonski Brod                | 15                             | 1%  | University of Bern                                         | 10                             | 1% |
| Prirodoslovno-matematički fakultet                         | 14                             | 1%  | University of Minnesota System                             | 10                             | 1% |
| Institut za antropologiju                                  | 12                             | 1%  | University of Minnesota Twin Cities                        | 10                             | 1% |
| Institut za turizam                                        | 11                             | 1%  | University of Oslo                                         | 10                             | 1% |

ka Tarle with 96 articles, (6% of the total dataset). She is followed closely by Vanja Vučićević Boras with 95 papers (6%) and Dragana Gabrić with 92 works (6%). When filtering exclusively for articles and review articles, this ranking shifts slightly, placing Dragana Gabrić second and Vanja Vučićević Boras third. To ensure a clear graphical presentation, the 'most productive' category was defined as researchers with 30 or more published papers, yielding a cohort of 32 authors (Figure 11).

Visualization of the author network using VOSviewer software shows that authors have achieved numerous mutual collaborations and that several strong clusters (10 clusters marked with different colours) have formed, which interlace with each other. The clusters represent groups of authors who are more strongly connected through frequent collaborations or similar research topics, and the links between clusters indicate co-authorships between different groups. Central authors by clusters, who have more and/or stronger collaborative ties, are: Tarle, Z. (252); Boras, V. V. (223); Gabrić, D. (180); Badel, T. (180); Čelebić, A. (126); Vodanović, M. (121); Anić, I. (120); Tadin, A. (78); Plančak, D. (68); Šitum,

ukupnog broja radova). Slijede Vanja Vučićević-Boras s 95 (6 %) radova te Dragana Gabrić s 92 (6 %) rada. Ako se u obzir uzmu samo znanstveni radovi i pregledni radovi, redoslijed je nešto drukčiji – na drugom mjestu je Dragana Gabrić, a na trećem Vanja Vučićević-Boras. U prikazu produktivnosti, zbog jasnijega grafičkog prikaza, najproduktivnije autore definirali smo kao skup autora s 30 i više objavljenih radova (32 autora) (slika 11.).

Vizualizacija mreže autora s pomoću softvera VOSviewer pokazuje da su autori često međusobno surađivali te se formiralo nekoliko čvrstih grozdova (10 grozdova označenih različitim bojama) koji se uzajamno prožimaju. Grozdovi su zapravo skupine autora koji su međusobno jače povezani zbog česte suradnje ili sličnih tema istraživanja, a poveznice između grozdova pokazuju suautorstva između različitih grupa. Vodeći autori u grozdovima koji imaju više i/ili jačih suradničkih veza jesu: Tarle, Z. (252); Boras, V. V. (223); Gabrić, D. (180); Badel, T. (180); Čelebić, A. (126); Vodanović, M. (121); Anić, I. (120); Tadin, A. (78); Plančak, D. (68) i Šitum, N. (37). Cijela mreža iznimno je lokalizirana i upućuje na povezanost različitih zavoda i klinika, a tek su na periferi-

**Table 7.** Highest cited articles  
**Tablica 7.** Najcitiraniji znanstveni radovi

| Znanstveni rad • Article                                                                                                                                                                                                                                                                                                               | Broj citata • Number of citations |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| Hearnden V, Sankar V, Hull K, <b>Juras DV</b> , Greenberg M, Kerr AR, et al. New developments and opportunities in oral mucosal drug delivery for local and systemic disease. <i>Adv Drug Deliv Rev.</i> 2012 Jan;64(1):16–28.                                                                                                         | 255                               |
| Divaris K, Barlow PJ, Chendea SA, Cheong WS, Dounis A, Dragan IF, et al.... <b>Vrazic, D.</b> The academic environment: the students' perspective. <i>Eur J Dent Educ.</i> 2008 Feb;12:120–30.                                                                                                                                         | 225                               |
| <b>Prpic V</b> , Schaperl Z, <b>Catic A</b> , <b>Dulcic N</b> , <b>Cimic S.</b> Comparison of Mechanical Properties of 3D-Printed, CAD/CAM, and Conventional Denture Base Materials. <i>J Prosthodont.</i> 2020 July;29(6):524–8.                                                                                                      | 206                               |
| <b>Varga S</b> , Spalj S, <b>Varga ML</b> , <b>Milosevic SA</b> , <b>Mestrovic S</b> , <b>Slaj M.</b> Maximum voluntary molar bite force in subjects with normal occlusion. <i>Eur J Orthodont.</i> 2011 Aug;33(4):427–33.                                                                                                             | 206                               |
| Sanz M, Dahlin C, Apatzidou D, Artzi Z, <b>Bozic D</b> , Calciolari E, et al. Biomaterials and regenerative technologies used in bone regeneration in the craniomaxillofacial region: Consensus report of group 2 of the 15th European Workshop on Periodontology on Bone Regeneration. <i>J Clin Periodontol.</i> 2019 June;46:82–91. | 171                               |
| John MT, Feuerstahler L, Waller N, Baba K, Larsson P, <b>Celebic A</b> , et al. Confirmatory factor analysis of the Oral Health Impact Profile. <i>J Oral Rehabil.</i> 2014 Sept;41(9):644–52.                                                                                                                                         | 148                               |
| John MT, Reissmann DR, Feuerstahler L, Waller N, Baba K, Larsson P, et al... <b>Celebic, A.</b> Exploratory factor analysis of the Oral Health Impact Profile. <i>J Oral Rehabil.</i> 2014 Sept;41(9):635–43.                                                                                                                          | 128                               |
| Sankar V, Hearnden V, Hull K, <b>Juras DV</b> , Greenberg MS, Kerr AR, et al. Local drug delivery for oral mucosal diseases: challenges and opportunities. <i>Oral Dis.</i> 2011 Apr;17:73–84.                                                                                                                                         | 121                               |
| <b>Tarle Z</b> , Attin T, <b>Marovic D</b> , Andermatt L, Ristic M, Tauboeck TT. Influence of irradiation time on subsurface degree of conversion and microhardness of high-viscosity bulk-fill resin composites. <i>Clin Oral Investig.</i> 2015 May;19(4):831–40.                                                                    | 109                               |
| Cameriere R, Ferrante L, Liversidge HM, Prieto JL, <b>Brkic H.</b> Accuracy of age estimation in children using radiograph of developing teeth. <i>Forensic SciInt.</i> 2008 Apr 7;176(2–3):173–7.                                                                                                                                     | 109                               |
| <b>Galic I</b> , <b>Vodanovic M</b> , Cameriere R, Nakas E, Galic E, Selimovic E, et al... <b>Brkic, H.</b> Accuracy of Cameriere, Haavikko, and Willems radiographic methods on age estimation on Bosnian-Herzegovian children age groups 6-13. <i>Int J Legal Med.</i> 2011 Mar;125(2):315–21.                                       | 107                               |
| <b>Brailo V</b> , <b>Vucicevic-Boras V</b> , Lukac J, Biocina-Lukenda D, <b>Alajbeg IZ</b> , Milenovic A, et al. Salivary and serum interleukin 1 beta, interleukin 6 and tumor necrosis factor alpha in patients with leukoplakia and oral cancer. <i>Med Oral Patol Oral Cir Bucal.</i> 2012 Jan;17(1):E10–5.                        | 101                               |

N. (37). The entire network is highly localized and points to connections between different departments and clinics and only on the periphery of the olive-yellow cluster two foreign authors are visible (Tauboeck, T. T. and Attin, T.) (Figure 12).

#### Citation analysis

Citation analysis carried out on 24 October 2025 shows that the selected papers (1,521) had a total of 19,128 citations, or 17,420 citations without self-citations, with an average of 13 citations per paper and an h-index of 53. Carrying out the citation analysis at a later stage ensured it was based on a relatively stable citation count, while also allowing newer papers to already start accumulating citations. The table lists the ten most cited articles with highlighted authors from the School of Dental Medicine (Table 7).

Data on citations by year of publication show that the most cited papers are relatively recent, published in 2020 and 2021, while papers from 2007 are the least cited. Fluctuations in citation counts are visible, with sharp increases in citations to papers published in 2008, 2011, 2014 and 2018, whereas the longest continuous growth in citations is observed for papers published between 2017 and 2021 (Figure 13).

Data on the number of citations per individual paper show that there are several papers with a very high number of citations, while the majority of citations are distributed

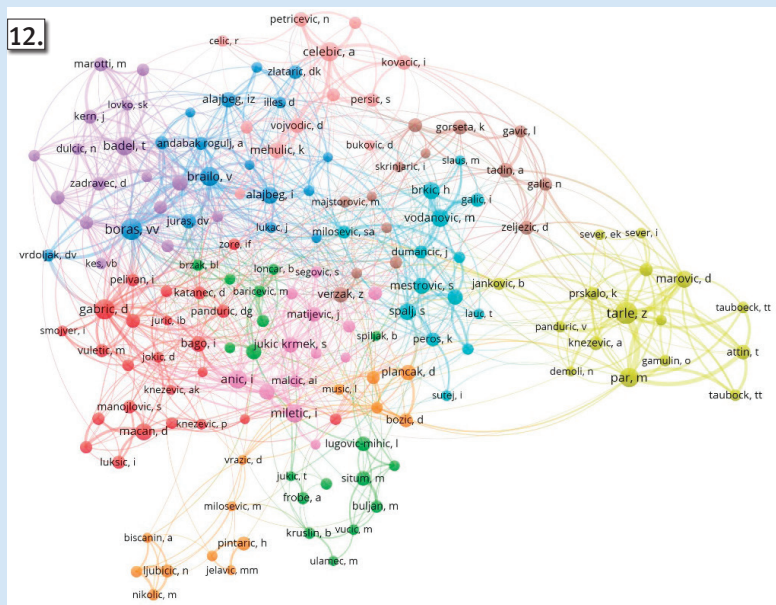
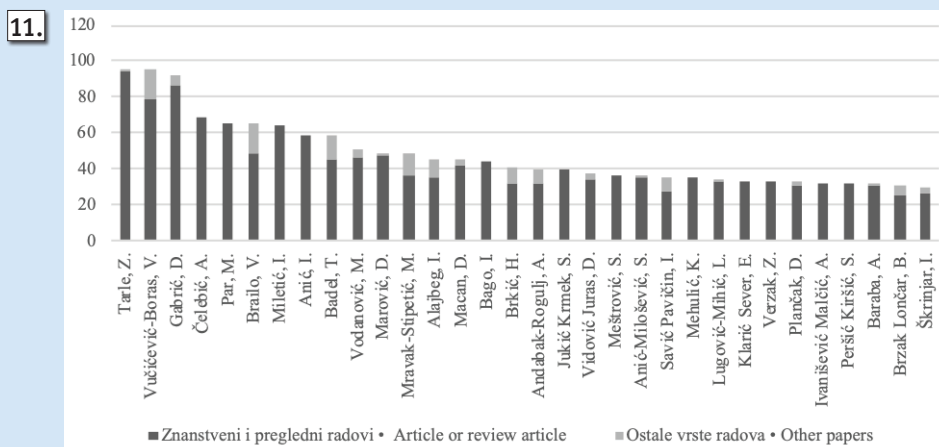
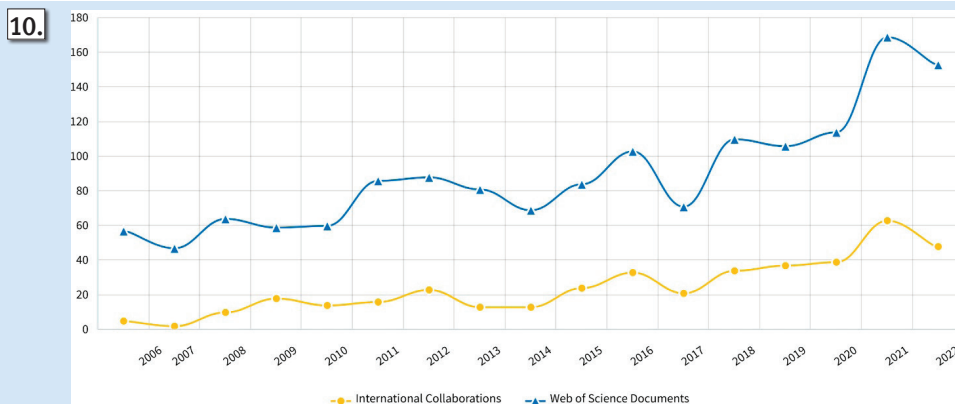
ji maslinasto-žutoga grozda dva strana autora (Tauboeck, T. T. i Attin, T.) (slika 12.).

#### Citatna analiza

Citatna analiza od 24. listopada 2025. godine pokazuje da su izdvojeni radovi (1521) ukupno imali 19 128 citata, odnosno 17 420 bez samocitata, s prosječnim brojem od 13 citata po radu i h-indeksom 53. Kasnija provedba citatne analize omogućila je da se ona temelji na razmjerno stabiliziranom broju citata te da se i noviji radovi već počnu citirati. U tablici je navedeno deset najcitiranijih znanstvenih radova s istaknutim autorima sa Stomatološkog fakulteta (tablica 7.).

Podatci o citiranosti radova po pojedinim godinama objavljivanja pokazuju da su najcitiraniji razmjerno novi radovi objavljeni 2020. i 2021. godine, a najmanje su citirani oni iz 2007. U citiranosti su uočene oscilacije pa se tako bilježi nagli rast citiranosti radova objavljenih 2008., 2011., 2014. i 2018. godine, a najdulji kontinuirani rast citiranosti zabilježen je za radove objavljene od 2017. do 2021. (slika 13.).

Podatci o broju citata po pojedinačnom radu pokazuju da je nekoliko radova vrlo često citirano, a najveći broj citata raspršen je na velik broj radova: 12 (1 %) radova ima između 100 i 255 citata, 279 (18 %) radova citirano je između 20 i 94 puta, a 314 (21 %) između 10 i 19 puta. Većina radova (722;



**Figure 10** Total publication output and international collaboration trends

**Slika 10.** Trend kretanja ukupnoga broja radova i međunarodnih suradnji (14)

**Figure 11** The most productive authors from the School of dental medicine who published thirty or more papers 2006-2022

**Slika 11.** Najproduktivniji autori sa Stomatološkog fakulteta koji su objavili trideset i više radova od 2006. do 2022. godine

**Figure 12** Co-authorship network visualization of authors from the School of dental medicine

**Slika 12.** Vizualizacija mreže suautorstva autora sa Stomatološkog fakulteta

across a large number of papers: 12 (1%) papers have between 100 and 255 citations, 279 (18%) papers have between 20 and 94 citations, and 314 (21%) papers have between 10 and 19 citations. Most papers (722; 47%) have between 1 and 9 citations, but there is also a notable number of papers without a single citation (194; 13%).

The average number of citations per paper is highest for papers published in 2014 (21) and 2008 (18), indicating a significant impact of papers published in those years. The h-in-

47 %) ima između 1 i 9 citata, no zabilježen je i određen broj radova bez ijednog citata (194; 13 %).

Prosječan broj citata po radu najviši je 2014. (21) i 2008. godine (18), što upućuje na znatan utjecaj radova objavljenih tih godina. H-indeks radova po godini objavljivanja pokazuje koliko radova ima najmanje onoliko citata kolika je vrijednost h; najviši je 2015. godine (23), te 2014., 2020. i 2021. godine (22), što upućuje na dobar znanstveni utjecaj i kvalitetu radova (slika 14.).

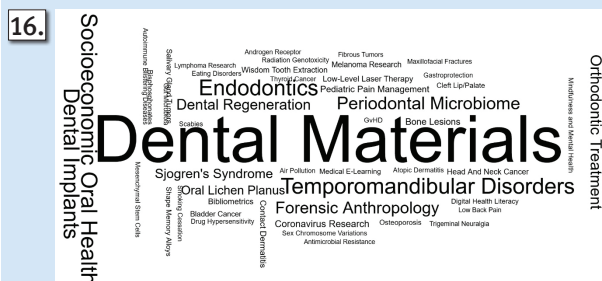
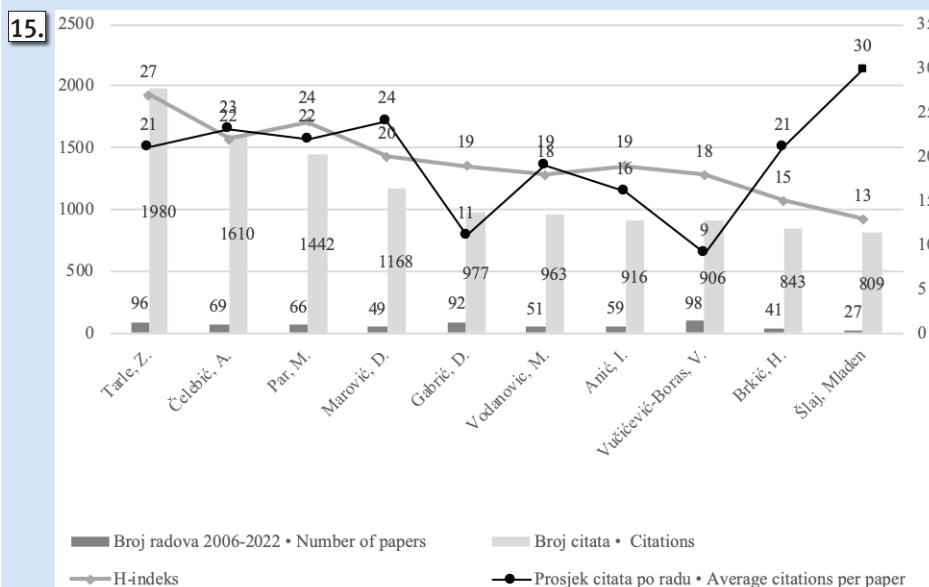
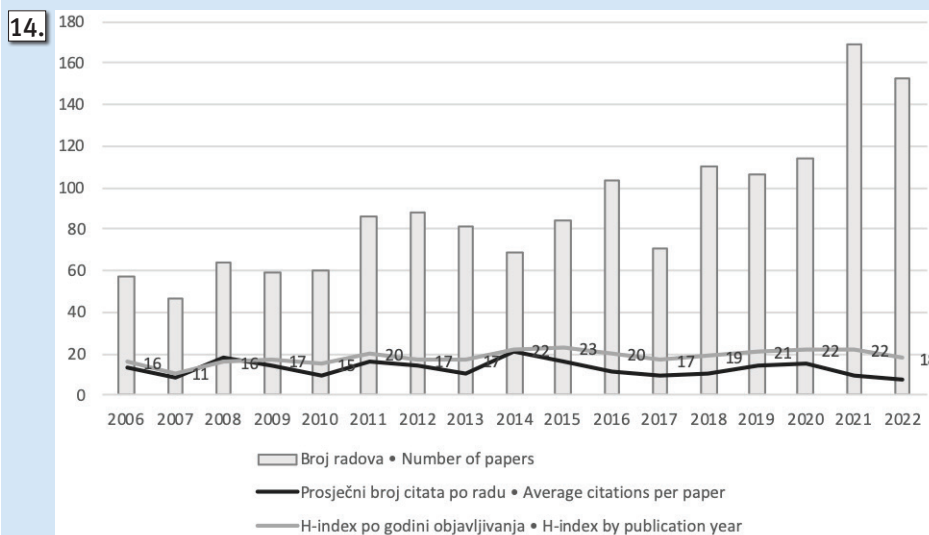
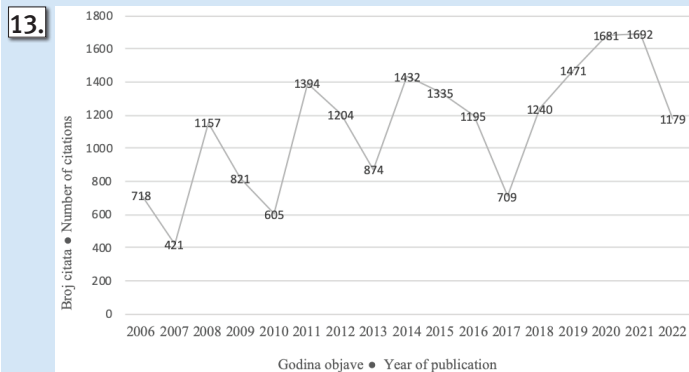


Figure 13 Number of citates per publication year

Slika 13. Broj citata za radove prema godini objavljivanja

Figure 14 Relationship of number of papers published per year, average citations per paper and h-indeks.

Slika 14. Odnos broja radova prema godini objavljivanja, prosječnoga broja citata po radu i h-indeksa

Figure 15 Ten most cited authors from School of dental medicine

Slika 15. Deset najcitiranijih autora sa Stomatološkog fakulteta

Figure 16 Citation topic word cloud

Slika 16. Oblak riječi za vizualizaciju ključnih tema

dex by year of publication shows how many papers have at least as many citations as the value of *h*; it is highest for papers published in 2015 (23), and in 2014, 2020 and 2021 (22), which points to good scientific impact and quality of the papers (Figure 14).

Data on the citation of authors from the School of Dental Medicine show that the most cited authors are Tarle, Z. (1,980 citations), Čelebić, A. (1,610 citations) and Par, M. (1,442 citations) (Figure 15). Leading authors have an *h*-index between 20 and 27, with an average of more than 20 citations per paper. When authors are ranked by total number of citations, a gradual decrease in *h*-index is observed, which indicates a relatively even distribution of citations over a larger number of published papers per author. Although they are lower in the ranking by total number of citations, Šljaj, Mladen has the highest average number of citations per paper (30) for only 27 papers, followed by Marović, D. (24) and Čelebić, A. (23). An average of more than 20 citations per paper is also achieved by Par, M. (22), Brkić, H. (21) and Tarle, Z. (21). The highest *h*-index (27) is held by Tarle, Z., followed by Par, M. (24), Čelebić, A. (22) and Marović, D. (20), while the lowest among the leading authors is that of Šljaj, Mladen (13). A very large number of papers have also been published by Vučićević-Boras, V. (98) and Gabrić, D. (92), with somewhat lower average numbers of citations per paper (9 and 11, respectively), but still with a high total number of citations and a notable *h*-index (18 and 19). The data show balanced scientific output by authors Anić, I., Vodanović, M. and Brkić, H., with a relatively large number of published papers (59, 51 and 41), total and average citation counts, and an *h*-index of 15 or more.

A visual representation of key topics generated using the InCites tool shows the most cited research themes at the institutional level. The most dominant topics are dental materials, socioeconomic aspects of oral health and dental implants, temporomandibular disorders and forensic anthropology. A significant number of papers relates to specialized areas: 1) clinical disciplines – endodontics, orthodontics, periodontology and dental regeneration; 2) oral diseases and conditions – oral lichen planus, Sjögren's syndrome; and 3) current topics such as coronavirus, e-learning and mental health (Figure 16) (14).

## Discussion and conclusions

The aim of this study was to determine the scientific output and impact of papers published by authors from the School of Dental Medicine between 2006 and 2022. Bibliometric data for the analysis were retrieved from the Web of Science Core Collection (WoSCC) database. However, the study was challenged by inconsistent and often unreliable affiliations and addresses, requiring manual data cleaning that may have affected the completeness of the dataset—particularly in cases where author addresses were missing from the publication. Additionally, because the analysis was restricted to papers indexed in WoSCC, it does not cover the complete scientific output of the institution during the specified period. Citation indicators and quartiles also need to be inter-

Podatci o citiranosti autora sa Stomatološkog fakulteta pokazuju da su najcitiraniji Tarle, Z. (1980 citata), Čelebić, A. (1610 citata) i Par, M. (1442 citata) (slika 15.). Vodeći autori ostvaruju *h*-indeks od 20 do 27 s prosječnim brojem većim od 20 citata po radu. Kada autore rangiramo prema ukupnome broju citata, uočava se postupno smanjenje *h*-indeksa, što upućuje na ravnomjernu raspoređenost citata na veći broj objavljenih radova po autoru. Iako su prema ukupnome broju citata niže na ljestvici, najviši prosjek citata po radu ima Šljaj, Mladen (30) za samo 27 radova, a slijede Marović, D. (24) i Čelebić, A. (23). Prosjek veći od 20 citata po radu imaju još Par, M. (22) i Brkić, H. (21) i Tarle, Z. (21). Najviši *h*-indeks (27) ima Tarle, Z., a slijede Par, M. (24), Čelebić, A. (22) i Marović, D. (20), a najniži ima Šljaj, Mladen (13). Vrlo velik broj radova imaju i Vučićević-Boras, V. (98) i Gabrić, D. (92), s nešto nižim prosječnim brojem citata po radu (9, odnosno 11), ali i dalje s visokim brojem citata i značajnim *h*-indeksom (18, odnosno 19). Podatci pokazuju uravnoteženu znanstvenu produkciju autora Anić, I., Vodanović, M. i Brkić, H. s razmjerno velikim brojem objavljenih radova (59, 51 i 41), ukupnim i prosječnim brojem citata te *h*-indeksom 15 i više.

Vizualni prikaz ključnih tema generiran s pomoću alata InCites prikazuje najcitiranije istraživačke teme na razini ustanove. Najdominantnije teme su: stomatološki materijali, socioekonomski aspekti oralnog zdravlja i dentalni implantati, temporomandibularni poremećaji te forenzička antropologija. Značajan broj radova vezan je za specijalizirane grane: 1) kliničke discipline – endodoncija, ortodoncija, parodontologija i dentalna regeneracija; 2) oralne bolesti i stanja – oralni lichen planus, Sjögrenov sindrom i 3) aktualne teme kao što su koronavirus, e-učenje i mentalno zdravlje (slika 16.) (14).

## Rasprava i zaključci

Svrha ovoga rada bila je utvrditi stanje znanstvene produkcije i znanstvenoga utjecaja radova koje su objavili autori sa Stomatološkog fakulteta od 2006. do 2022. godine. Za analizu su korišteni bibliometrijski podatci iz renomirane citatne i bibliografske baze podataka Web of Science Core Collection (WoSCC). Unatoč tomu provedba istraživanja bila je opterećena neujednačenim i često nepouzdanim afilijacijama i adresama, što je zahtijevalo ručno čišćenje podataka koje je moglo utjecati na potpunost analize, osobito u slučaju kada u radu nije bila navedena adresa autora. Uz to, analiza je obavljena samo na radovima indeksiranim u bazi Web of Science Core Collection pa ne obuhvaća cjelokupnu znanstvenu produkciju ustanove u navedenom razdoblju. Tako-

preted with caution, as they reflect the relative rank of journals within a subject category, and not necessarily the quality of each individual paper, and, in general newer papers have had less time to accumulate citations than older ones. Given the extensive variations in address formats, it was deemed essential to link them to the official institutional affiliation (University of Zagreb, School of Dental Medicine) within the WoSCC normative database and to append this data to the bibliographic records. Regrettably, bibliographic records lacking automatically assigned affiliations continue to appear even after 2022. During the observed period, a pronounced upward trend in publication volume was recorded, with several years showing particularly sharp year-over-year increases. Compared to a 2006 study, which documented 428 papers over a 31-year period, this 17-year study recorded 3.6 times as many papers (a 255% increase). This growth was likely driven by enhanced financial support, digitalization, strengthened domestic and international cooperation, research globalization, and the improved availability of scientific information resources in countries on the 'scientific periphery'.

Publication of papers is concentrated in several key journals, but although most papers have been published in the domestic journal *Acta stomatologica Croatica*, overall somewhat more than half of the papers are scattered across foreign journals. The bilingual publication of papers in Croatian and English in this journal not only contributes to the visibility of the papers, but simultaneously stimulates and develops domestic professional terminology. A clear increase is also visible in the publication of papers in JCR Q1 and Q2 journals, which indicates the authors' efforts to increase the visibility and improve the ranking of their scientific work. The observed rise in publishing in higher-quality journals and the increase in international collaborations are in line with the strategic orientations of the University of Zagreb and of the School of Dental Medicine itself towards strengthening international cooperation and visibility (18,19).

The results of the citation analysis confirm substantial citation rates and a good h-index of the published papers, indicating their relevance in the scientific community. In comparison with the previous bibliometric study, where 41% of papers were uncited, in this study only 13% of papers are uncited, and the average number of citations per paper has risen from 3 to 13 (13).

The analysis of authorship and co-authorship demonstrates that in a significant proportion of publications, only a single author from the School of Dental Medicine collaborates with colleagues from external institutions. More frequently, two, three, or four authors from the School participate alongside other co-authors. Interestingly, as the number of internal authors on a manuscript increases, the share of publications where all contributors belong exclusively to the School also grows—a trend that is particularly pronounced in works featuring six or seven authors. Multi-author papers predominate, with pronounced collaboration within the institution itself, with other higher-education and healthcare institutions in Croatia, and especially with large hospital centres whose employees are often partially employed

der, citatni pokazatelji i kvartili trebaju se oprezno tumačiti jer odražavaju relativni rang časopisa unutar predmetnoga područja, a ne nužno kvalitetu pojedinoga rada, te noviji radovi općenito, u usporedbi s onima starijima, imaju manje vremena za prikupljanje citata. Zbog velikog broja različitih oblika adresa navedenih u radovima, njihovo povezivanje s afilijacijom (University of Zagreb, School of Dental Medicine) u normativnoj bazi WoSCC-a, te dodavanje podatka o afilijaciji u bibliografske zapise radova, smatrali smo prijeko potrebnim. Nažalost, uočeno je da se poslije 2022. godine i dalje pojavljuju bibliografski zapisi kojima afilijacija nije automatski pridodana.

U promatranom razdoblju zabilježen je izraziti uzlazni trend u broju objavljenih znanstvenih radova, s nekoliko godina u kojima se bilježe osobito veliki porasti u odnosu prema prethodnoj godini. U usporedbi s istraživanjem iz 2006. godine, kada je u razdoblju od 31 godine ukupno bilo objavljeno 428 radova, u ovom istraživanju koje obuhvaća 17 godina, objavljeno je 3,6 puta više radova (+ 255 %). Na taj su porast vjerojatno utjecali bolja financijska potpora, digitalizacija, jačanje domaće i međunarodne suradnje, globalizacija istraživanja te bolji protok znanstvenih informacija i dostupnost informacijskih izvora u zemljama *znanstvene periferije*. Objavljivanje radova koncentrirano je u nekoliko ključnih časopisa no, premda ih je najviše objavljeno u domaćem časopisu *Acta stomatologica Croatica*, ukupno je nešto više od polovine radova raspršeno u stranim časopisima. Dvojezično objavljivanje radova na hrvatskome i engleskom jeziku u tom časopisu, uz to što pridonosi vidljivosti radova, istodobno potiče i razvija domaću stručnu terminologiju. Očit je i porast objavljivanja radova u časopisima JCR-a Q1 i Q2, što govori o nastojanju autora da povećaju vidljivost i bolje rangiraju svoj znanstveni rad. Uočeni porast objavljivanja radova u kvalitetnijim časopisima te porast međunarodne suradnje u skladu je sa strateškim usmjerenjima Sveučilišta u Zagrebu i samoga Stomatološkog fakulteta prema jačanju međunarodne suradnje i vidljivosti (18, 19).

Rezultati citatne analize potvrđuju značajnu citiranost i dobar h-indeks objavljenih radova što upućuje na njihovu relevantnost u znanstvenoj zajednici. U usporedbi s prethodnim bibliometrijskim istraživanjem kada je bilo 41 % necitiranih radova, u ovom ih je istraživanju samo 13 %, a i prosječni broj citata porastao je s 3 na 13 (13).

Analiza autorstva i suautorstva pokazala je da u znatnom broju radova sudjeluje samo po jedan autor sa Stomatološkog fakulteta u suradnji s kolegama iz drugih ustanova te da najčešće na radu sudjeluje po dva, tri ili četiri autora s Fakulteta među ostalim suautorima. S porastom broja autora sa Stomatološkog fakulteta na radu raste i udio radova u kojima su svi autori s Fakulteta, što je osobito uočljivo kod radova sa šest i sedam autora. Prevladavaju višeautorski radovi, s naglašenom suradnjom unutar same ustanove, s drugim visokoškolskim i zdravstvenim ustanovama u Hrvatskoj te osobito s velikim bolničkim centrima čiji su zaposlenici često parcijalno zaposleni na Stomatološkom fakultetu. Premda je većina suradnji i dalje ostvarena s domaćim ustanovama, posljednjih godina uvelike i kontinuirano raste međunarodna suradnja, što sugerira da je riječ o trajnome trendu. Zastu-

at the School of Dental Medicine. Although most collaborations are still established with domestic institutions, recent years have seen a significant and continuous increase in international partnerships, suggesting a lasting trend. The representation of institutions from different countries reflects a broad international connectivity, but only individual partnerships have been established with a large number of these institutions. In the previous bibliometric study, international collaboration accounted for only 6% (26 papers), whereas in this study the number of such papers was sixteen times higher (13). While such a substantial volume of papers might suggest a higher visibility of foreign researchers, visualization of the co-authorship network demonstrates that primary publishing collaborations still occur within the domestic academic and scientific community. Even though authors are increasingly publishing in international journals, these works remain largely the result of collaboration among domestic peers. Papers originating from international partnerships are sporadic; furthermore, individual foreign authors lack longitudinal consistency and are consequently not visible in the co-authorship network.

The increase in the number of open access papers since 2019 is likely the result of the simultaneous influence of legal and strategic frameworks of the Republic of Croatia and the policies of the European Commission and the European Research Council (Plan S), institutional promotion of open science, greater orientation of authors towards higher-quartile journals that often support fee-based open access models, as well as the sharp rise in the number of papers published in MDPI journals. Although the School of Dental Medicine does not have an independent open access and open science policy, it operates within the Open science policy of the University of Zagreb, which encourages the publication of results in open and internationally recognized journals, as well as in open repositories (12,20–22). When considering the relationship between open access and citations, open-access papers account for almost half of the total citation count, confirming the substantial impact of open access on publication visibility and citation rates. Ultimately, however, journals and publishers that do not charge for open-access publishing yield a lower average number of citations per paper than those that require article processing charges. It would be interesting to investigate the cost-effectiveness of spending public funds to pay for open access publication. Given that, in the period considered, 562 papers were published in open access with payment, and that the average APC ranges around 900–1,500 EUR, the total cost at the lowest assumed price amounts to around 505,000 EUR, or approximately 30,000 EUR per year (12,23). For comparison, in the journal *Materials* (MDPI), which has the highest number of papers by authors from the School of Dental Medicine among journals with fee-based open access, the publication fee is around 2,800 EUR per paper, which for a total of 25 published papers amounts to 70,000 EUR (24). Since actual prices are often significantly higher, the potential cost of public funds spent on these fees could be considerably greater, raising the question of the rational allocation of the School of Dental Medicine's scientific budget as well as in Croatia. In this con-

pljenost ustanova iz različitih zemalja pokazuje široku međunarodnu povezanost, ali s velikim brojem ustanova ostvarene su tek pojedinačne suradnje. U prethodnome bibliometrijskom istraživanju međunarodna suradnja iznosila je samo 6 % (26 radova), a u ovom istraživanju broj takvih radova bio čak 16 puta veći (13). Iako bi se zbog tako velikoga broja radova očekivala veća vidljivost stranih autora, vizualizacija mreže suautorstva pokazuje da se primarna suradnja u objavljivanju i dalje ostvaruje unutar domaće akademske i znanstvene zajednice. Premda autori sve češće objavljuju u stranim časopisima, ti su radovi i dalje rezultat suradnje domaćih autora. Radovi nastali kao plod međunarodne suradnje sporadični su, odnosno pojedinačni strani autori nemaju kontinuitet pa zato nisu niti vidljivi u mreži suautorstva.

Porast broja radova u otvorenome pristupu od 2019. godine vjerojatno je posljedica istodobnog djelovanja zakonskih i strateških okvira Republike Hrvatske te politika Europske komisije i Europskoga istraživačkoga vijeća (Plan S), institucionalnoga poticanja otvorene znanosti, jačega usmjerenja autora prema časopisima viših kvartila koji često podržavaju model objavljivanja uz naplatu u otvorenome pristupu, te naglog porasta broja radova objavljenih u MDPI-ju.

Premda Stomatološki fakultet nema samostalnu politiku otvorenoga pristupa i otvorene znanosti, djeluje u sklopu Politike otvorene znanosti Sveučilišta u Zagrebu koja potiče objavljivanje rezultata u otvorenim i međunarodno prepoznatim časopisima te u otvorenim repozitorijima (12, 20–22). Razmatrajući povezanost otvorenoga pristupa i citiranosti uočava se da radovi u otvorenome pristupu ostvaruju gotovo polovinu od ukupnoga broja svih citata, što potvrđuje važnost i utjecaj otvorenoga pristupa na vidljivost i citiranost rada. Međutim, u konačnici časopisi/izdavači/nakladnici koji ne naplaćuju objavljivanje radova u otvorenome pristupu imaju manji prosječni broj citata po radu od radova u časopisima koji otvoreni pristup naplaćuju.

Zanimljivo bi bilo istražiti i isplativost trošenja javnoga novca za plaćanje objavljivanja rada u otvorenome pristupu. S obzirom na to da su u razmatranome razdoblju u otvorenome pristupu uz plaćanje objavljena 562 rada, a prosječna cijena APC-a kreće se oko 900 do 1500 eura, ukupni trošak uz najnižu pretpostavljenu cijenu iznosi oko 505 000 eura, odnosno približno 30 000 eura na godišnjoj razini (12, 23). Usporedbe radi, u časopisu *Materials* (MDPI) u kojemu je objavljen najveći broj radova autora sa Stomatološkog fakulteta među časopisima uz naplatu otvorenoga pristupa, trošak objavljivanja iznosi oko 2800 eura po radu, što za ukupno 25 objavljenih radova iznosi 70 000 eura (24). Budući da su stvarne cijene često znatno više, potencijalni trošak javnih sredstava na tim izdatcima mogao bi biti puno veći, što otvara pitanje o racionalnom usmjeravanju sredstava iz znanstvenoga proračuna Stomatološkog fakulteta, ali i općenito u Hrvatskoj. U tom smislu postavlja se i pitanje od općeg značenja za institucije: trebaju li one i dalje plaćati pretplate za tzv. hibridne časopise u kojima se za pojedine radove naplaćuje objavljivanje u otvorenome pristupu, a ostatak radova dostupan je samo pretplatnicima? U krajnjoj liniji, ako model plaćanja autorskih naknada za objavljivanje (APC) postane dominantan, a s obzirom na to da ga prihvaćaju i sami

text, a general question arises for institutions: should they continue to pay subscriptions to so-called hybrid journals, in which open access publication is charged for some papers, while the rest of the content is available only to subscribers? Ultimately, if the APC-based model of payment for publication becomes dominant, and given its acceptance among authors, publishers and open science initiatives, current developments suggest that this might be the case, the question is whether the subscription model will be completely abandoned, making institutional subscriptions obsolete.

Journals published by MDPI, in which papers began to be intensively published only in recent years, have shown a sharp increase in the number of papers, raising the question of the reasons for such sudden popularity despite high publication costs. According to data from WoSCC, by 2025, as many as 49% of papers written by authors from the School of Dental Medicine were published in these journals. Such a trend may suggest that authors prioritize rapid publication to meet formal publication requirements for academic promotion, potentially at the expense of the quality of the peer-review process (25). Additional scepticism is prompted by the fact that these journals have advanced to higher quartiles over a very short period, which fuels suspicion that this may involve strategic positioning in the scientific publishing market.

Based on the bibliometric analysis conducted, it can be concluded that the scientific output of authors from the School of Dental Medicine in the observed period is characterized by a continuous increase in the number of published papers and greater representation in higher-quality foreign scientific journals, stronger international collaboration, increased citation rates and significant adoption of open access publishing. Collectively, these findings indicate a shift from a predominantly locally oriented institution toward a more internationally visible research environment. Nevertheless, it remains apparent that the greatest number of papers are concentrated within a limited number of key journals and originate from a relatively select group of highly prolific authors who constitute the core of the institution's scientific development.

**Conflict of interest:** None declared

**Author's contribution:** Conceptualization, Methodology, Formal analysis, Writing original draft preparation.

autori, izdavači/nakladnici, pa i inicijativa otvorene znanosti, trenutačno sve upućuje na pitanje hoće li se pretplatnički model potpuno ukinuti, čime bi institucijske pretplate postale suvišne?

Časopisi izdavača MDPI-ja u kojima su se radovi počeli intenzivno objavljivati tek unatrag nekoliko godina, ostvarili su velik porast broja radova pa se postavlja pitanje o razlozima takve nagle popularnosti unatoč visokim troškovima objavljivanja. Prema podacima iz baze WoSCC u 2025. godini, u tim je časopisima objavljeno čak 49 % radova autora sa Stomatološkog fakulteta. Ovakav trend može upućivati da je autorima prioritet brzina objavljivanja zbog ispunjavanja propisanih kvota radova za napredovanje, a potencijalno na uštrb kvalitete recenzijskoga postupka (25). Dodatnu dvojbu potiče činjenica da su ti časopisi u tako kratkom vremenu napredovali u više kvartile, pa je pitanje je li riječ o kalkuliranju tržišnim položajem unutar znanstvenoga izdavaštva.

Na temelju provedene bibliometrijske analize može se zaključiti da je znanstvena produkcija autora sa Stomatološkog fakulteta u promatranom razdoblju obilježena kontinuiranim rastom broja objavljenih radova i sve većom zastupljenošću u kvalitetnijim stranim znanstvenim časopisima, jačom međunarodnom suradnjom, povećanom citiranošću i značajnim prihvaćanjem objavljivanja u otvorenome pristupu. Sve to upućuje na prijelaz s pretežno lokalno usmjerene ustanove na međunarodno vidljivije istraživačko okruženje, no i dalje se uočava da se većina radova objavljuje u nekoliko ključnih časopisa te da potječu od razmjerno maloga broja produktivnih autora koji su jezgra znanstvenoga razvoja ustanove.

**Sukob interesa:** Nema sukoba interesa.

**Doprinos autora:** konceptualizacija, metodologija, analiza, pisanje originalnog rada.

## Sažetak

**Cilj:** U ovom radu rezultati su bibliometrijske analize znanstvene produkcije autora sa Stomatološkog fakulteta Sveučilišta u Zagrebu koji su indeksirani u bazi Web of Science Core Collection od 2006. do 2022. godine. **Materijal i metode:** Uzorak čini 1521 rad, a analizirani su, koristeći se alatima WoSCC, InCites, VOSviewer i Excel, prema parametrima kao što su adresa i afilijacija autora, zatim pokazatelji produktivnosti (vrste radova, godine kada su objavljeni, časopisi, jezici, predmetne kategorije WoSCC, otvoreni pristup, autori i suautori) i prema citiranosti (citati, h-indeks, kvartili JCR, ključne teme). **Rezultati:** Najviše radova kategorizirano je kao znanstveni rad (86 %), a ostale vrste čine 14 %. Analiza pokazuje kontinuirani rast znanstvene produkcije u promatranom razdoblju, a objavljivanje radova koncentrirano je u malo časopisa (5 % časopisa objavljuje 53 % radova). Analizirajući zastupljenost pojedinačnih časopisa najviše radova objavljeno je u časopisu Acta stomatologica Croatica (20 %), ali ukupno gledano 59 % radova tiskano je u časopisima stranih izdavača s velikim porastom broja radova u MDPI-ju. Većina radova (65 %) indeksirana je u bazi WoSCC SCI-Expanded. Od 2019. uočava se značajan pomak i sve češće objavljivanje u kvalitetnijim časopisima JCR Q1 i Q2 te porast broja radova u otvorenome pristupu. Znatno veći broj radova u nekoj je vrsti otvorenog pristupa (44 %), pretežno otvoreni pristup uz naplatu (51 %), a citati radova u otvorenome pristupu čine 46 %. Najviše radova u otvorenome pristupu objavljeno je u časopisu Acta stomatologica Croatica (176; 27 %). Na najvećem broju radova (26 %) surađivalo je šest autora po radu, a toliki je i prosječan broj autora po radu. Radovi nastali u međunarodnoj suradnji čine 27 %, a unutar Stomatološkog fakulteta najčešće surađuju dva do četiri autora. Citatna analiza pokazuje da su izdvojeni radovi ukupno imali 19 128 citata, prosječno je 13 citata po radu, a h-indeks je 53. Samo 13 % radova uopće nije citirano, a najveći broj citata raspršen je na velik broj radova. **Zaključak:** Znanstvena produkcija autora sa Stomatološkog fakulteta u promatranom razdoblju obilježena je kontinuiranim rastom broja objavljenih radova i većom zastupljenošću u kvalitetnijim stranim znanstvenim časopisima, jačom međunarodnom suradnjom, porastom broja citata te značajnim prihvaćanjem objavljivanja u otvorenome pristupu.

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