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Research Article

Mapping of Medical and Health Studies in Bosnia and Herzegovina using Scopus

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ABSTRACT:
This study analyses the research activities of Bosnia and Herzegovina in Medical and Health studies during 2012 – 2021, based on the total publication output, its growth rate, quality of papers published, and rank of Bosnia and Herzegovina in the global context. Patterns of international collaborative research output and major partner countries of Bosnia and Herzegovina are also discussed. This study also evaluates the research performance of different institutions and characteristics of published literature in Bosnia and Herzegovina and foreign journals. The Medical and Health published literature data has been retrieved by using the Scopus database. Bosnia and Herzegovina hold 93rd rank among the productive countries in medical and health research.

Keywords: Medical and Health Studies, Mapping, Bosnia and Herzegovina, Scopus, Scientometric Study.

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INTRODUCTION

This paper looks at the examination usefulness of medical and health studies in Bosnia and Herzegovina. Bosnia and Herzegovina have changed a great deal since the 1990s. The country provinces attempt to improve numerous parts of life for its residents, yet sadly, there are as yet critical issues. [1] Before the Bosnia battle in 1992, Bosnia and Herzegovina were a port Yugoslavia. Yugoslavia had a decent clinical and medical services framework that gave most individuals inclusion. It additionally connected Medicine and medical services to the state, so practically the whole populace got health care coverage. Yugoslavia even had one of the most minimal new-born child death rates at fewer than 15 births for every 1,000 live births in the country.[2] Today, inside urban communities, most residents have sufficient medical services inclusion, yet in country rural regions, clinics are rare. Albeit the framework has improved inside the most recent twenty years, Medical and Healthcare in Bosnia Herzegovina actually needs further gatherings. In the latter stages of the war, inspired by Family Medicine programs in countries such as Canada, plans to rebuild a new system founded on a strong primary care model emerged. Over the next fifteen years, the Queen's University Family Medicine Development Program in Bosnia and Herzegovina played an instrumental role in rebuilding the primary care system through educational initiatives at the undergraduate, residency, Masters, PhD, and continuing professional development levels with the academic outcome.[3] The academic community of Bosnia and Herzegovina (B&H) is represented by four Academies, which include eminent personalities in the field of medical sciences (Academy of Sciences and Arts of Bosnia and Herzegovina, Department for Medical Sciences (ANUBiH), Academy of Sciences and Arts of the Republika Srpska (ANURS), Croatian Academy of Sciences and Arts in BiH (HAZU B&H), and the Academy of Medical Sciences of Bosnia and Herzegovina (AMNuBiH)).[4] During the last two decades, there was a strong shift in the assessment of the research performance at the different scales, starting from the country level and moving to institutions, journals and researchers. As a consequence, a rich recent literature has developed to propose different methodologies, tools and quantitative and qualitative indicators for ranking

the universities and research institutions and establishing criteria for assessing the assessment of researchers.[5]

RELATED LITERATURE

Few Scientometric studies have been carried in the past analysing the medical and health studies.

Evaluated the preclinical and clinical papers from the medical journals Bosnia and Herzegovina using the PubMed database with randomly selected publications. Study found that showed that only a small number of pre-experimental clinical trials fully implemented the basic principles of design (7%), and the performance ratio of some aspects of the relevant experimental design ranged from 12% to 77%. Only one clinical study found no error (2%) and specific error rates ranged from 10% to 89%. The average impact factor of the studies was about one, and the average publication date was less than 5 years.[6]

Scientometric study analyses India's medical activities during the period 1999-2008, publication growth rate, quality of papers, India's ranking in the global context, International collaboration and Indian collaboration are studied. This study evaluates the research results for different types of Indian medical colleges, hospitals, research institutes, universities and research foundations and the characteristics of literature published in Indian and foreign journals. It analyses the publication of clinical research on disease and organs using the SCOPUS database.[7]

Study highlighted and analysed patterns of knowledge, cognition and change in health research worldwide. A total of 14,692 papers collected from the Web of Science database from 1996 to 2019. This is a comprehensive study of global health research from collaborative research findings on research outcomes, collaboration, keywords, and highly cited papers. The publications showed that scientists' interest in global health research increased especially after the impact of SARS. The United States, United Kingdom, Canada, Australia, and China have contributed majorly to global health research.[8,9]

Bibliometric and Scientometric analysis ware performed on all original health studies with PubMed indexing, which was directed to Bihar. The publication trend, authorship, subject and source of funding were analysed. A total of 982 scientific papers were published, of which 40% were basic or clinical research and approximately 60% were public health research. The last decade has seen an exceptional increase in research growth as well as received major funds from international agencies. The most common subjects were clinical subjects (25%) and leishmaniasis (23%).[10,11]

The publication trends of the Faculty of Medicine, Mansoura University was conducted using the PubMed database from the establishment of the university to 2012. Of the 2798 articles on Mansoura, 1756 were included in the analysis and 1042 were excluded (false positives). Most publications were in 2011 (10.6%, 187/1756), followed by 2012 (10.2%, 179/1756). The most contributed department was urology and nephrology with 35.9% (631), followed by Pediatrics and Parasitology. Most publications were intervention / clinical research (38.4%, 662/1756. In order to increase the number and quality of publications and academic staff participating in high-quality international research.[12-14]

OBJECTIVES

The main objective of this study is to analyse the research performance of Bosnia and Herzegovina in Medicine in the national and global context, as reflected in its publication output during 2012 – 2021. In particular, the study focuses on the following objectives: (i) the Bosnia and Herzegovina medical and health research output, its growth, rank and global publications share and impact, (ii) to examine the growth trend of publications, (iii) to identify the top 20 most productive sources (iv) Organisations and to 20 most productive authors, (v) to identify the highly cited publications, (vi) to examine the most significant keywords in literature on Bosnia and Herzegovina medical and health,

MATERIALS AND METHODS

This study is based on the Bosnia and Herzegovina publication data in Medical and health, retrieved from the Scopus Citation database for 10 years (2012 – 2021). The Scopus database provides comprehensive, multidisciplinary citation data and considered one of the primary data sources for bibliometric analysis. In addition, Scopus data can be easily exported to Microsoft Excel or third – party software such as Biblioshney, for further analysis and mapping.

The search took place in June 2021 and all publications published before 24 June 2021 was evaluated. The finalised search starting with All fields (medical AND health studies) AND AFFILCOUNTRY (Bosnia AND Herzegovina) timespan 2012 -2021.

The bibliometric parameters used to analysis the publication related to Medical and health studies from Bosnia and Herzegovina, were type of documents, publications output, journals, countries and institutions, publications parameters, country share and collaborations. The most commonly used terms and collaboration between countries were recognised by using Biblioshny and VOS Viewer software.

ANALYSIS AND RESULTS

Summarizes the Medicine and Health research in Bosnia and Herzegovina

This study is based on the Bosnia and Herzegovina publication data in Medical and Health study, retrieved from the Scopus citation database for 10 years (2012 – 2021). The Scopus database yielded 1990 publications (2012 – 2021) on the theme "medical AND health studies. The study present an evaluation of research based on Bosnia and Herzegovina publications indexed in Scopus database, using quantitative and qualitative indicators.

Table 1 summarizes the search results. This shows that the all types of documents and sources are considered for the study. Also provides the total authors, authors of single papers, multi-authored papers, total keywords, total authors keywords, author collaborations.

Table 1: Summarizes the search results.

Description	Results
Main Information about Data	
Timespan	2012:2021
Sources (Journals, Books, etc)	778
Documents	1990
Average years from publication	3.66
Average citations per documents	20.32
Average citations per year per doc	4.45
References	80015
Document Types	
article	1638
book	3
book chapter	31
conference paper	114
editorial	14
erratum	2
letter	8
note	9
review	170
short survey	1
Document Contents	
Keywords Plus (ID)	12815
Author's Keywords (DE)	5441
AUTHORS	
Authors	26612
Author Appearances	47939
Authors of single-authored documents	53
Authors of multi-authored documents	26559
Authors Collaboration	
Single-authored documents	70
Documents per Author	0.0748
Authors per Document	13.4
Co-Authors per Documents	24.1
Collaboration Index	13.8

World research output in medical and health studies, its publication share and rank in global context

The Table 2 shows that the global publication share of top 20 most productive countries in medical and health studies varies from 2.325 to 32.855% during 2012 – 2021. United States secured the 1st rank with a global publication share of 32.855 % (1171977 papers) during 2012 – 2021 followed by the United Kingdom (10.111 % share 360650 papers), China (9.438% share 336659 papers), Australia 6.035% share 215278 papers), Canada (5.988% share 213607 papers), Germany (5.231 % share 186597 papers) at 2nd, 3rd, 4th, 5th and 6th positions respectively. Italy, India, Netherlands, Japan, Spain, France, Iran, Brazil and South Korea ranked 7th to 15th positions with their global publication share ranging from 4.606% to 2.325%.

Bosnia and Herzegovina medical and health research annual growth and citation count

Table 3 provided the year wise chronological distribution of articles of the study span. Out of 1990 publications published during the period 2012 – 2021, the maximum number of 350 (17.58%) papers were published in the year of 2020, followed by 281(14.12%) papers published in the year of 2019, 249 papers (12.51%) published in the year of 2017 and 242 papers (12.16%) published in the year of 2018 respectively (Figure 1).

Analysis of most preferred Sources and Citations

Table 4 listed the top 20 journals of the Bosnia and Herzegovina researchers who preferred to publish their findings. Theses journals and their corresponding ranking are based on previous studies on the contributions of disciplines, h index, g index and m index. The wide range of subject areas in Medicine and Health research publications were highly concentrated in these top journals. Therefore, the rate of highly cited articles varies from journal to journal. The topmost preferred journal was *Medicinski Glasnik* (TP=154; TC=368; h index=9) followed by *Psychiatria Danubina* (TP=107; TC=401; *h*-index=8), *Medical Archives* (Sarajevo, Bosnia And Herzegovina) (TP=92; TC=438; *h*-index=10), *ACTA Informatica Medica* (TP=63; TC=412; *h*-index=10) and remaining all are produced below 30 under publications listed.

Most prolific Authors

Table 5 shows, the list of top 20 most influential with 16 or more highly cited articles surprisingly most of the authors produced more than 100 citations. The most prodactive author was Masic I. (NP=42; TC=285), followed by Begic E. (NP=28; TC=95), Badnjevic A (NP=25; TC=140), Vranic S. (NP+19; TC=169), Gurbeta L. (NP=20; TC=260) (Figure 2).

Table 2: World output and ranking of productive countries in medical and health studies, 2012 – 2021.

Countries	Number of papers			Share of Papers			Rank		
	2012 - 2021	2012 - 2016	2017 - 2021	2012 - 2021	2012 - 2016	2017 - 2021	2012 - 2021	2012 - 2016	2017 - 2021
USA	1171977	533361	638616	32.855	35.705	30.804	1	1	1
UK	360650	157683	202967	10.111	10.556	9.790	2	2	3
China	336659	107120	229539	9.438	7.171	11.072	3	3	2
Australia	215278	89610	125668	6.035	5.999	6.062	4	5	4
Canada	213607	93300	120307	5.988	6.246	5.803	5	4	5
Germany	186597	77610	108944	5.231	5.196	5.255	6	6	6
Italy	164310	64432	99878	4.606	4.313	4.818	7	7	7
India	139237	53728	85509	3.903	3.597	4.125	8	9	8
Netherland	138890	61727	77103	3.894	4.132	3.719	9	8	9
Japan	127925	53735	74190	3.586	3.597	3.579	10	10	10
Spain	114003	44998	69005	3.196	3.012	3.328	11	12	11
France	112284	47497	64789	3.148	3.180	3.125	12	11	12
Iran	104916	37762	67154	2.941	2.528	3.239	13	13	13
Brazil	97817	39111	58706	2.742	2.618	2.832	14	12	14
South Korea	82926	32118	50808	2.325	2.150	2.451	15	14	15
	3567076	1493792	2073183	100.000	100.000	100.000			

Table 3: Year-wise publications distribution.

Year	TP	% of TP	TC	ACP
2012	119	5.980	47	0.395
2013	123	6.181	226	1.837
2014	126	6.332	553	4.389
2015	138	6.935	916	6.638
2016	177	8.894	2159	12.198
2017	249	12.513	3721	14.944
2018	242	12.161	5723	23.649
2019	281	14.121	7781	27.690
2020	350	17.588	11595	33.129
2021	185	9.296	7718	41.719
	1990	100		

TP=Total papers, TC=Total citations, ACP=Average citations per papers

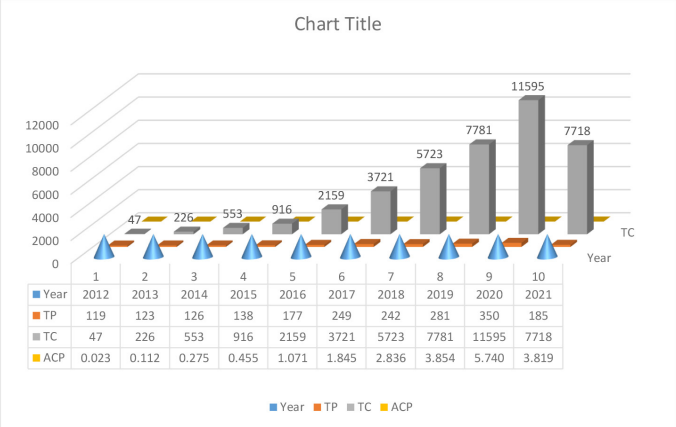

Figure 1: Year wise publications growth.

Table 4: Most preferred sources.

Source	NP	TC	*h*_ index	*g*_ index	*m*_ index
Medicinski Glasnik	154	368	9	12	0.900
Psychiatria Danubina	107	401	8	18	0.800
Medical Archives (Sarajevo, Bosnia And Herzegovina)	92	438	10	16	1.111
ACTA Informatica Medica	63	412	10	18	1.000
PLOS One	21	621	12	21	1.200
Frontiers In Pharmacology	14	332	9	14	1.000
European Heart Journal	12	13249	12	12	1.333
Eurosurveillance	7	311	6	7	0.750
Annals of the Rheumatic Diseases	6	934	5	6	0.556
Atherosclerosis	6	313	4	6	0.571
European Journal of Preventive Cardiology	5	921	5	5	0.833
The Lancet	4	6042	4	4	0.667
Forensic Science International: Genetics	4	343	4	4	0.400
European Journal of Heart Failure	3	671	2	3	0.222
Nature Genetics	3	446	2	3	0.333
New England Journal of Medicine	1	924	1	1	0.250
The Lancet Neurology	1	576	1	1	0.200
Journal of the National Cancer Institute	1	345	1	1	0.167
Rhinology	1	326	1	1	0.500
Annals of Surgery	1	294	1	1	0.100

Table: 5 Top 20 prolific authors.

Rank	Author	NP	TC
1	Masic I.	42	285
2	Begic E.	28	95
3	Badnjevic A	25	140
4	Vranic S.	19	169
5	Gurbeta L.	20	260
6	Badnjevic A.	17	225
7	Godman, B.	19	174
8	Račić, M.	19	42
9	Valjevac A.	17	62
10	Begovac, J.	18	95
11	Fras, Z.	18	151
12	Gaita, D.	18	194
13	Puljak L.	16	209
14	Sekulic D.	15	194
15	Vasilj I.	16	27
16	Zenic N.	17	151
17	Badimon, L.	16	221
18	Dilic, M.	16	140
19	Martinac M.	16	83
20	Mocroft, A.	16	95

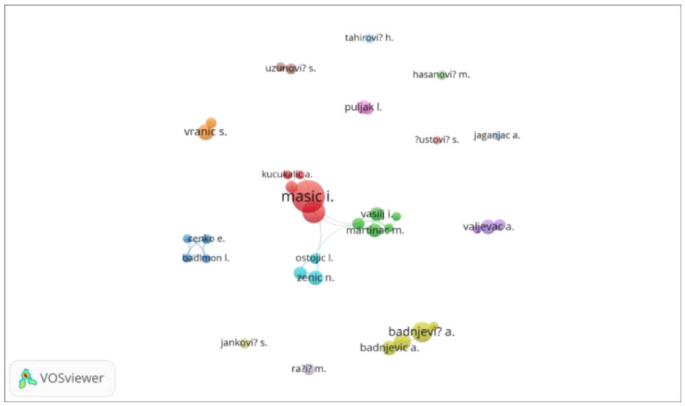

Figure 2: Most prolific author's collaboration network.

Institutions co-citation Analysis

Table 6 shows that contribution of top 20 institutions varied from 61 to 614 papers and together they contributed share of publications. On further analysis, it was observed that only 9 institutions are produced more than 100 publications. University of Sarajevo, Bosnia and Herzegovina 614 papers followed by University of Zagreb School of Medicine (Croatia) and University of Belgrade (Serbia) 231 publications, University of Banja Luka (Bosnia and Herzegovina) 204 publications, University of Mostar (Bosnia and Herzegovina) 178 publications, University of Tuzla (Bosnia and Herzegovina) 162 publications, University of Zagreb (Croatia) 157 publications (Figure 3).

Table 6: Profile of top 20 Organisations.

Sl.No	AFFILIATION	Country	NP
1	University of Sarajevo	Bosnia and Herzegovina	614
2	University of Zagreb School of Medicine	Croatia	231
3	University of Belgrade	Serbia	231
4	University of Banja Luka	Bosnia and Herzegovina	204
5	University of Mostar	Bosnia and Herzegovina	178
6	University of Tuzla	Bosnia and Herzegovina	162
7	University of Zagreb	Croatia	157
8	University of East Sarajevo	Bosnia and Herzegovina	126
9	Belgrade University School of Medicine	Serbia	107
10	International Burch University	Bosnia and Herzegovina	99
11	University of Ljubljana	Slovenia	83
12	Clinical Centre of Serbia	Serbia	78
13	University of Novi Sad	Serbia	74
14	Charles University	Czechia	68
15	University Medical Center Ljubljana	Slovenia	68
16	Inserm	France	66
17	Medical University of Vienna	Austria	64
18	SS Cyril and Methodius University	North Macedonia	62
19	Medical Faculty Split	Croatia	62
20	Sarajevo School of Science and Technology	Bosnia and Herzegovina	61

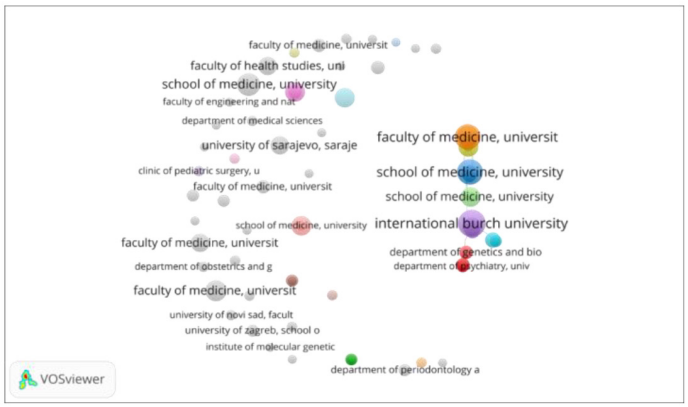

Figure 3: Top 20 Organisations.

Highly cited papers

Highly cited papers are important to the reputation of the university. Table 7 shows that top 20 highly cited papers were shown in Table 6. Interestingly, all the highly cited papers are published in journals and these papers were received a total 22779 citations. All these citations were collected from the Scopus database. European Heart Journal (United Kingdom) published majority of highly cited papers and received citations12741, followed by Lancet Journal, United Kingdom.

Table 7: **Highly cited publications.**

Paper	DOI	TC	TCpY
IBANEZ B, 2018, EUR HEART J	10.1093/eurheartj/ehx393	3130	782.500
GALI N, 2016, EUR HEART J	10.1093/eurheartj/ehv317	2749	458.167
DI CESARE M, 2016, LANCET	10.1016/S0140-6736(16)30054-X	2236	372.667
BENTHAM J, 2017, LANCET	10.1016/S0140-6736(17)32129-3	2201	440.200
PRIORI SG, 2015, EUR HEART J	10.1093/eurheartj/ehv316	1767	252.429
CATAPANO AL, 2016, EUR HEART J	10.1093/eurheartj/ehw272	1636	272.667
MACH F, 2020, EUR HEART J	10.1093/eurheartj/ehz455	1225	612.500
NEUMANN FJ, 2020, EUR HEART J	10.1093/eurheartj/ehz425	955	477.500
SCHWARTZ GG, 2018, NEW ENGL J MED	10.1056/NEJMoa1801174	924	231.000
ZHOU B, 2017, LANCET	10.1016/S0140-6736(16)31919-5	850	170.000
COSENTINO F, 2020, EUR HEART J	10.1093/eurheartj/ehz486	805	402.500
ZHOU B, 2016, LANCET	10.1016/S0140-6736(16)00618-8	755	125.833
KOTSEVA K, 2016, EUR J PREV CARDIOL	10.1177/2047487315569401	580	96.667
MAAS AIR, 2017, LANCET NEUROL	10.1016/S1474-4422(17)30371-X	576	115.200
YOO DH, 2013, ANN RHEUM DIS	10.1136/annrheumdis-2012-203090	482	53.556
THE INTERNATIONAL SOCIETY OF GENDER MEDICINE (IGM), 2018, EUR HEART J	10.1093/eurheartj/ehy340	474	118.500
MAGGIONI AP, 2013, EUR J HEART FAIL	10.1093/eurjhf/hft134	409	45.444
STAHL EA, 2019, NAT GENET	10.1038/s41588-019-0397-8	354	118.000
CASTELLSAGU X, 2016, J NATL CANCER INST	10.1093/jnci/djv403	345	57.500
FOKKENS WJ, 2020, RHINOLOGY	10.4193/Rhin20.600	326	163.000

Significant keywords

Table 8 shows that the 20 significant keywords (with frequency of appearance varying from 179 to 1394) have been identified from the literature, which throw light on the trends of research on his them. The largest frequency of occurrence (556) of keywords to the main topic 'Major Clinical Study', "Human (1394) and "Bosnia and Herzegovina" (393), etc. The visualization map of co – occurrence of keywords are presented in Figure 4, were keywords have been presented in different clusters represented by various colours. Related keywords are found in the same cluster.

Table 8: **Significant keywords.**

Sl.No	Name of the keywords	Frequency
1	Human	1394
2	Article	1040
3	Female	974
4	Humans	944
5	Male	891
6	Adult	779
7	Major Clinical Study	556
8	Controlled Study	469
9	Middle Aged	468
10	Bosnia And Herzegovina	393
11	Aged	389
12	Priority Journal	303
13	Questionnaire	236
14	Risk Factor	232
15	Cross-sectional Study	230
16	Prevalence	208
17	Adolescent	205
18	Prospective Study	199
19	Young Adult	189
20	Child	179

RESULTS AND SUMMARY

Bosnia and Herzegovina secured 93rd position among the productive countries of the world in medical and health research during 2012 – 2021, publishing 1990 papers. The maximum Bosnia and Herzegovina medical and health research output (1990) papers come from medicine 1528, followed by Biochemistry, Genetics and Molecular Biology 202 papers, highest publications published in journal articles 1638 (82.312%), highly preformed journal is *Medicinski Glasnik* were produced 154 papers. University of Sarajevo is the most productive institution with 613 (21.956%) papers.

In order to increase the research output, improve the quality and undertake more focused research, there is an urgent need to formulate a national health research plane. There

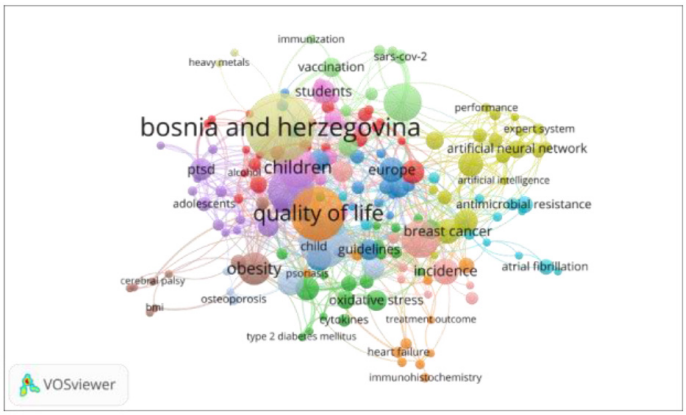

Figure 4: Network visualisation map of co-occurrence of keywords.

is a need to create a research culture and climate that foster health research. In addition, capacity development for human resource development and infrastructure should be taken as a priority. There is also need to improve the existing medical education system, which should foster research culture. A clear research career structure and productive related incentive are required for people involved in research. The efforts of the government should be to make available the tolls of modern information technology and biotechnology to health professionals and researchers which are present not accessible to majority of researchers. Highly-quality research in Bosnia and Herzegovina is grossly inadequate and requires strategic planning, investment and resource support.

The scientometric analysis presented above provides information about the quality and quality of research in this area based on published publications. It provides important clues to decision-makers and practicing scholars about current research trends, present status and upcoming research topic for future research.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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