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Mostafavi, Ismael and Bigdeloo, Ismael, "Bibliometrics analysis of scientific outputs of Covid-19 disease in Scopus database" (2020). *Library Philosophy and Practice (e-journal)*. 4716.
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Bibliometrics analysis of scientific outputs of Covid-19 disease in Scopus database

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Abstract

Aim: The aim of the present study was to analyze the descriptive and content structure of scientific documents produced by Covid-19 in the Scopus database using scientometrics method.

Materials and Methods: The present study was conducted using a scientometrics method. The population of this study consists of 1353 documents in the field of Covid-19 in Scopus Database. The collected data were analyzed using Excel software and the subject maps of this area were mapped using RavarPremap, UCINET, NetDraw and SPSS software.

Results: The findings of the study show that a total of 46901 documents are indexed by Covid-19 on the Scopus database. Extracted documents were 8 formats. The results showed the most productive authors of Covid-19 disease show that the three researchers Wang Y, Xia J and Li X had the most scientific output respectively. The results showed authors with high social network centrality.

Conclusions: Also clustering analysis of the concepts and words of this new viral disease shows that research by world researchers have included 8 study clusters. These 10 study clusters include: Diagnostic Imaging and Isolation; Symptoms of Coronavirus; Virus Genome and Phylogeny; Pathogenicity; Public health and Outbreak Novel and Coronavirus; Epidemic Coronavirus; Coronavirus Infection and Covid-19; Virus Pneumonia and SARS-cov-2.

Keywords: Bibliometrics analysis, Scientific Outputs, Covid-19, Scopus Database

Introduction

Nowadays, science assessment studies use different methods and techniques such as citation, co-lexicography, and co-authorship with the aim of examining the structure of knowledge in scientific fields. One of the most widely used methods for drawing and analyzing the structure of knowledge in different fields is the co-occurrence of words, or in other words, the relationship between the words used in different parts of the document; This method, which was introduced in the 1980s, is based on the assumption that the use of common keywords in the sections of title, abstract, keywords and text of scientific products indicates the closeness of the concepts of those texts to each other, which is due to It can determine the structure, concepts, and components of a scientific field. In this analysis, indicators are used for the co-occurrence of two items - such as the proximity and similarity index, which is used to measure the relationship between items (1).

Evaluation of scientific outputs along with the advancement of knowledge and the increasing production of science and increasing competition has become one of the most challenging and indispensable issues in measuring of science. Scientometrics analysis has received much attention in recent decades and is used to evaluate the research performance of researchers and the growth of various disciplines. One of the most common methods for evaluating scientific products is the use of scientific methods. Scientometrics analysis of scientific publications is one of the important aspects of scientific research effort in recent years. In fact, scientometrics studies are used to identify patterns of publications, authorship, citations, and so on. These factors can contribute to the dynamics of scientific fields and thus lead to better access and management of information. Scientific data can also be used to identify emerging research areas and to evaluate the research performance of researchers, research groups, and countries.

Scientific development and the achievement of important research results and achievements in any subject area require the collaboration of scientists, researchers and experts in the field. Scientific collaborations of researchers to achieve the common goal of producing science have become one of the key indicators of community development and a key issue in scientific policymaking.

One of the most important topics in the discussion of science production is the activity and participation of researchers at universities and science centers as one of the major producers of practical resources for each country in advancing science at national, regional and international levels. In this regard, evaluation of the scientific output of this group at national and international level is very important (2).

Currently, the number of products stored in credible information databases such as Scopus database is one of the important criteria for scientific evaluation and ranking of countries, researchers, institutions and universities in the world. In fact, universities can evaluate, measure and evaluate their performance using standard assessment tools. This way they can improve on their weaknesses and gain higher rankings.

One of the branches of science that is very important nowadays and which has a great impact on human life is Covid-19 disease. Covid-19 viruses are a large group of viruses that can infect animals and humans and cause respiratory distress; they can be as mild as cold or as severe as pneumonia. In rare cases, animal Covid-19 viruses infect humans and then spread between them. You may recall the SARS (acute respiratory syndrome) virus from 2002 to 2003; it was an example of a Covid-19 virus transmitted from animals to humans. Another important and newer breed is the Covid-19 virus MERS (Middle East Respiratory Syndrome), which was discovered in 2012 in the Middle East, and scientists say the virus first spread to humans (3).

Research Literature

Hussein (4) The main topics identified included genetics, epidemiology, animal and human diseases, and other biological issues related to Covid-19. In the study of Boetto (5) related to coronavirus, most of the scientific productions were related to SARS and Mers. However, research by Colavizza et al. (6) shows that the issues of prevalence, infection and countermeasures on social media have been more significant. Jafari et al. (7) found that from the result of cluster analysis of Covid-19 works at the international level, the most important research trends and topics considered by Covid-19 researchers, the keywords SARS, contagious, transmission, MERS, Wuhan, disease, incidence Infection, Respiratory Syndrome, Epidemic, Sun, Energy, Plasma, Solar Corona, Evolution, Solar Flame, Density, Solar Wind, Flare, Identification, Receptor, Pneumonia, Bat, and Risk Management.

A review of the research background shows that comprehensive research is conducted by examining the scientific fields related to this disease in a comprehensive database of the same as Scopus database. Therefore, the present study was conducted for this purpose.

The main purpose of the present study is to analyze the descriptive and content structure of scientific documents produced by Covid-19 disease researchers in Scopus database using scientific methods to introduce important and influential authors and concepts and topics studied in. In this regard, this research aims to answer the following questions:

1. What is the format of the scientific outputs of Covid-19 disease in the Scopus database?
2. Which countries have contributed the most to scientific outputs of Covid-19 disease in the Scopus database?
3. What are the core Journals of Covid-19 disease researches in the Scopus Database?
4. Who are the top researchers in Covid-19 disease in terms of social network centrality indicators?
5. How is Covid-19 disease concepts and words clustering in the Scopus Database?

Materials and Methods

This research is a descriptive and scientometric. In order to study the scientific productions of Covid-19, homogeneous analysis, co-authorship and network analysis have been used.

The research population consists of 46901 scientific outputs in the form of Article, Letter, Note, Editorial, Review, etc. in the field of Covid-9 indexed at Scopus database (6.6.2020). search strategy follows:

(TITLE-ABS-KEY ("2019-nCoV infection") OR TITLE-ABS-KEY ("coronavirus disease 2019") OR TITLE-ABS-KEY ("COVID-19 pandemic") OR TITLE-ABS-KEY ("2019-nCoV disease") OR TITLE-ABS-KEY ("2019 novel coronavirus disease") OR TITLE-ABS-KEY ("COVID19") OR TITLE-ABS-KEY ("2019 novel coronavirus infection") OR TITLE-ABS-KEY ("coronavirus disease-19") OR TITLE-ABS-KEY ("COVID-19") OR TITLE-ABS-KEY ("2019 novel coronavirus (SARS-CoV-2)") OR TITLE-ABS-KEY ("novel coronavirus (COVID-19)") OR TITLE-ABS-KEY ("Coronavirus disease (COVID-19)") OR TITLE-ABS-KEY ("COVID-19 Pneumonia") OR TITLE-ABS-KEY ("severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)"))).

After extracting articles from Scopus database in RIS format, to unify articles keywords in terms of converting one or more modes to one state, removing terms such as gender and age, etc. For co-occurrence analysis of keywords between 3979 keywords 69 keywords with a minimum frequency of 25 were selected; also for co-authorship by 67 authors with at least 8 academic productions by using Ravarpremap software. Ravarpremp software is one of the data analysis software. Then, to co-authoring map, in terms of centrality indices, which include Degree centrality, Closeness centrality, Betweenness centrality, and EigenVector centrality (8). The 68-author matrix was converted to a UCINET software format using the software Netdraw plugin, the centerpieces were drawn. To cluster the themes of the 69 core keyword matrices, SPSS software was applied to the Ward hierarchical clustering method, which resulted in the formation of eight thematic clusters. centrality indices are as follows (9):

Degree centrality: The simplest type of centrality is that the value of each node is obtained by counting the number of its neighbors. The number of neighbors is obtained based on the interfaces to which the node is connected. This measure is defined by the number of direct links in an operator in a network.

Betweenness Centrality: The index of a node indicates the number of times that node is in the shortest path between the two other nodes in the network. High-visibility nodes play an important role in network connectivity, which are central to the network and play an important role in the flow of information across the network.

Closeness Centrality: The Closeness index of a node represents the average length of the shortest paths between those nodes in the network. Nodes with a high Closeness index are more powerful in the network and play a more central role in the network and are more accessible to other nodes.

Eigenvector Centrality: The Eigenvector represents the degree of communication of one node with other powerful and central nodes in a network, and it is built on the principle that not all graph edges have the same values, but edges that are associated with effective nodes

of the network relative to other edges. Higher value therefore nodes with higher eigenvalues are linked to the effective nodes.

Findings

The format type of the scientific outputs of Covid-19 disease in the Scopus database:

The findings showed total of 46901 documents in the field of Covid-19 disease were indexed in Scopus database during 2019 to 2020. These 46901 documents are presented in 10 different format types; the Article format (23484 records) had most frequency in Scopus database in this field. In other words, most of the scientific output in this field was in the form of an article. The results show that research papers, abstracts, and review articles are ranked first to third in the list of document format, respectively (Table 1).

Table 1. Distribution Frequency of Publishing Type in Covid-19 Scopus database

Rank	Type	Frequency
1	Article	23484
2	Letter	9193
3	Review	5051
4	Note	4145
5	Editorial	3934
6	Short Survey	522
7	Erratum	279
8	Conference paper	213
9	Data Paper	56
10	Book Chapter	24

Countries with the highest participation in the scientific outputs of Covid-19 disease at the Scopus database

Given the emergence of this viral epidemic in about 239 countries around the world. The results of the global rankings of countries show that the China, United States, United Kingdom and Italy are among the top countries in the study of Covid-19 in the two years, respectively. These countries are at a very large disparity with other countries. Given their extensive research facilities and the onset of the outbreak in China, the two countries were among the leading countries in the covid-19 study, and were ranked at the top of the ranking in this area.

the United States ranked first with 11811, China with 6110, and United Kingdom with 5228, respectively. The countries' rankings in terms of production of science in Covid-19 disease are shown in Table 2.

Table 2. Distribution Frequency of Countries Productions in Covid-19 Scopus database

Rank	country	Frequency	Rank	country	Frequency
1	United States	11811	11	Brazil	1303
2	China	6110	12	Iran	1135
3	United Kingdom	5228	13	Switzerland	1007
4	Italy	4946	14	Netherland	914
5	India	2946	15	Turkey	827
6	France	9009	16	Singapore	750
7	Canada	1943	17	Japan	664
8	Spain	1894	18	Belgium	648
9	Germany	1817	19	Hong Kong	553
10	Australia	1739	20	South Korea	548

Core periodicals of Covid-19 scientific outputs in Scopus database

The results show that most scientific outputs and studies have been published in the Journal Of Medical Virology, BMJ, BMJ Clinical Research Ed., International Journal Of Environmental Research And Public Health, Lancet, and journals. At all covid-19 outputs published in 211 journals in scopus database.

Table 3. Distribution Frequency of Core periodicals of Covid-19 scientific outputs in database

Rank	Journal	frequency	Rank	Journal	frequency
1	Journal Of Medical Virology	505	11	Dermatologic Therapy	231
2	BMJ	475	12	Science Of The Total Environment	219
3	BMJ Clinical Research Ed	457	13	Critical Care	210
4	International Journal Of Environmental Research And Public Health	355	14	Science	199
5	Lancet	347	15	British Journal Of Surgery	195
6	Medical Hypotheses	272	16	Lancet Infectious Diseases	188
7	International Journal Of Infectious Diseases	274	17	Asian Journal Of Psychiatry	168
8	Journal Of Infection	246	18	Nature	167
9	New England Journal Of Medicine	245	19	Psychiatry Research	161
10	JAMA Journal Of The American Medical Association	244	20	Show preview for (161)	161

Centrality measures of Covid-19 researchers

Number of 25401 researchers studied in present study. Centrality measures of Covid-19 researchers showed in Table 4. Researchers in this field were evaluated in terms of social

network centrality indicators. The results show that in degree centrality index LI, X. (85), WANG, Y. (83) and LI, Y. (71) are ranked, respectively. In the betweenness centrality the WANG, Y. (70.904), LI, X. (57.954) and ZHANG, Y. (50.601) are ranked, respectively. The closeness index XIA, J. (493), HU, Y. (493) and ZHAO, Y. (492) are ranked, respectively. In the Eigenvector Centrality LI, X. (0.331), WANG, Y. (0.325) and LI, Y. (0.274) are ranked, respectively.

Table 4: Centrality indicators of Covid-19 disease researchers in Scopus database based on Social Networks Analysis

No.	Author	Degree Centrality	Author	Closeness Centrality	Author	Betweenness Centrality	Author	Eigenvector Centrality
1	LI, X.	85	XIA, J.	493	WANG, Y.	70.904	LI, X.	0.331
2	WANG, Y.	83	HU, Y.	493	LI, X.	57.954	WANG, Y.	0.325
3	LI, Y.	71	ZHAO, Y.	492	ZHANG, Y.	50.601	LI, Y.	0.274
4	LI, J.	69	ZHANG, X.	492	LIU, J.	46.332	LIU, Y.	0.233
5	LIU, Y.	65	LI, L.	492	WANG, J.	45.843	LI, J.	0.233
6	ZHANG, Y.	64	ZHOU, Y.	491	LI, Y.	42.346	LIU, J.	0.212
7	WANG, J.	64	WANG, Z.	490	CHEN, J.	33.429	WANG, J.	0.212
8	LIU, J.	61	WANG, X.	490	LI, J.	31.947	ZHANG, Y.	0.211
9	ZHANG, J.	57	YANG, Y.	489	YANG, Y.	29.326	YANG, Y.	0.189
10	YANG, Y.	56	ZHANG, L.	488	YANG, Z.	26.758	ZHANG, L.	0.18
11	ZHANG, L.	56	ZHANG, J.	487	ZHANG, L.	25.496	ZHANG, J.	0.18
12	WANG, Z.	55	LIU, Y.	486	LI, L.	25.056	WANG, Z.	0.17
13	CHEN, L.	52	CHEN, J.	486	ZHANG, X.	24.824	CHEN, L.	0.155
14	ZHANG, Z.	47	WANG, J.	484	ZHANG, J.	24.43	ZHANG, Z.	0.148
15	WANG, X.	46	LI, J.	483	ZHOU, Y.	23.68	WANG, X.	0.146
16	LIU, L.	43	ZHANG, Y.	481	WANG, H.	22.53	LIU, L.	0.127
17	CHEN, J.	42	LIU, J.	481	LIU, Y.	22.432	XU, J.	0.115
18	ZHANG, S.	40	LI, Y.	480	WANG, C.	20.34	XIA, J.	0.109
19	XU, J.	40	LI, X.	477	HU, Y.	18.439	ZHANG, S.	0.106
20	ZHAO, Y.	39	WANG, Y.	476	CHEN, H.	18.119	CHEN, J.	0.106

Normalized social network analysis indicators provide more accurate information about the status of researchers in dense scientific networks. Normalized Centrality measures of Covid-19 researchers showed in Table 5. Researchers in this field were evaluated in terms of normalized social network centrality indicators. The results show that in normalized degree centrality index LI, X. (1.288), WANG, Y (1.258) and LI, Y. (1.076) are ranked, respectively. In the normalized Betweenness centrality the WANG, Y. (3.306), LI, X. (2.702) and ZHANG, Y. (2.359) are ranked, respectively. The normalized closeness index WANG, Y. (13.866),

LI, X. (13.836) and LI, Y (13.75) are ranked, respectively. In the normalized eigenvector Centrality LI, X. (46.87), WANG, Y. (45.94) and LI, Y. (38.716) are ranked, respectively.

Table 5: Normalized Centrality indicators of Covid-19 disease researchers in Scopus database based on Social Networks Analysis

No .	Author	Degree Centrality (Normalized)	Author	Closeness Centrality (Normalized)	Author	Betweenness Centrality (Normalized)	Author	Eigenvector Centrality (Normalized)
1	LI, X.	1.288	WANG, Y.	13.866	WANG, Y.	3.306	LI, X.	46.87
2	WANG, Y.	1.258	LI, X.	13.836	LI, X.	2.702	WANG, Y.	45.94
3	LI, Y.	1.076	LI, Y.	13.75	ZHANG, Y.	2.359	LI, Y.	38.716
4	LI, J.	1.045	ZHANG, Y.	13.721	LIU, J.	2.16	LIU, Y.	33.016
5	LIU, Y.	0.985	LIU, J.	13.721	WANG, J.	2.137	LI, J.	32.891
6	ZHANG, Y.	0.97	LI, J.	13.665	LI, Y.	1.974	LIU, J.	30.025
7	WANG, J.	0.97	WANG, J.	13.636	CHEN, J.	1.558	WANG, J.	29.973
8	LIU, J.	0.924	LIU, Y.	13.58	LI, J.	1.489	ZHANG, Y.	29.832
9	ZHANG, J.	0.864	CHEN, J.	13.58	YANG, Y.	1.367	YANG, Y.	26.73
10	YANG, Y.	0.848	ZHANG, J.	13.552	YANG, Z.	1.247	ZHANG, L.	25.479
11	ZHANG, L.	0.848	ZHANG, L.	13.525	ZHANG, L.	1.189	ZHANG, J.	25.437
12	WANG, Z.	0.833	YANG, Y.	13.497	LI, L.	1.168	WANG, Z.	24.075
13	CHEN, L.	0.788	WANG, Z.	13.469	ZHANG, X.	1.157	CHEN, L.	21.899
14	ZHANG, Z.	0.712	WANG, X.	13.469	ZHANG, J.	1.139	ZHANG, Z.	20.908
15	WANG, X.	0.697	ZHOU, Y.	13.442	ZHOU, Y.	1.104	WANG, X.	20.587
16	LIU, L.	0.652	ZHAO, Y.	13.415	WANG, H.	1.05	LIU, L.	17.983
17	CHEN, J.	0.636	ZHANG, X.	13.415	LIU, Y.	1.046	XU, J.	16.265
18	ZHANG, S.	0.606	LI, L.	13.415	WANG, C.	0.948	XIA, J.	15.472
19	XU, J.	0.606	XIA, J.	13.387	HU, Y.	0.86	ZHANG, S.	15.026
20	ZHAO, Y.	0.591	HU, Y.	13.387	CHEN, H.	0.845	CHEN, J.	15.022

Mapping of authors in social networks by centrality measures

Fig 1 showed LI, X. (85), WANG, Y. (83) and LI, Y. (71) had highest value of degree centrality among the social network of authors. The degree centrality showed the number of neighbors obtained a node, based on the interactions to which the author is connected others. This researcher had direct links to other operator in a network.

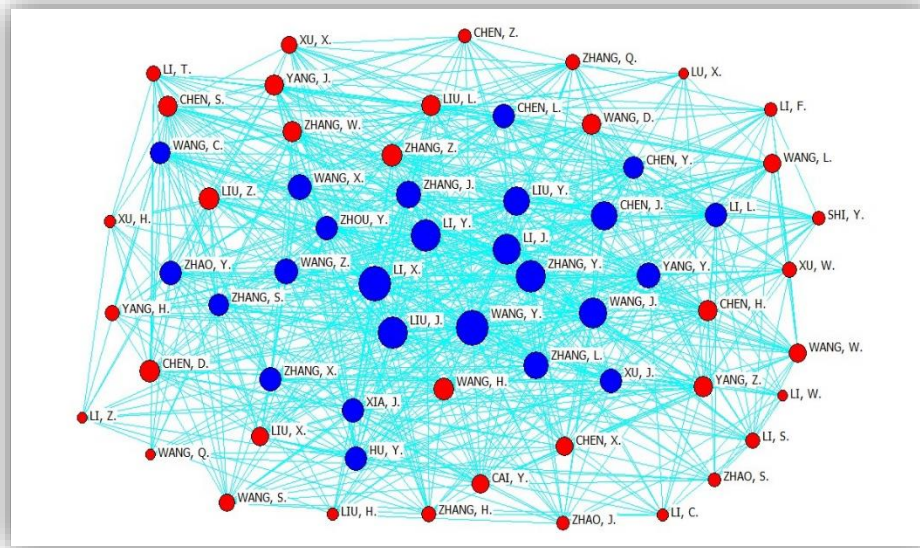


Fig 1: Degree Centrality map of resrchers in Covid-19 outputs in Scopus database

Fig 2 showed WANG, Y. (70.904), LI, X. (57.954) and ZHANG, Y. (50.601) had highest value of Betweenness centrality among the social network of authors. The author that is in the shortest path between the two other authors in the network. High-visibility authors play an important role in authors network connectivity, which are central to the network and play an important role in the flow of information across the authors network.

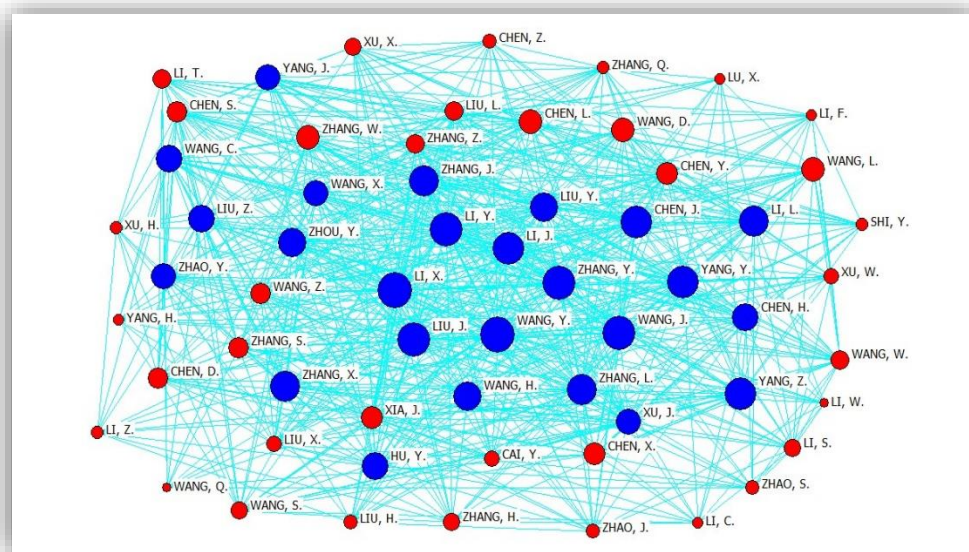


Fig 2: Betweenness Centrality map of resrchers in Covid-19 outputs in Scopus database

Fig 3 showed XIA, J. (493), HU, Y. (493) and ZHAO, Y. (492) had highest value of closeness centrality among the social network of authors. this measure represents the average length of the shortest paths between other authors in the authors network. authors with high Closeness index are more powerful in the network and play a more central role in the network and are more accessible to other authors.

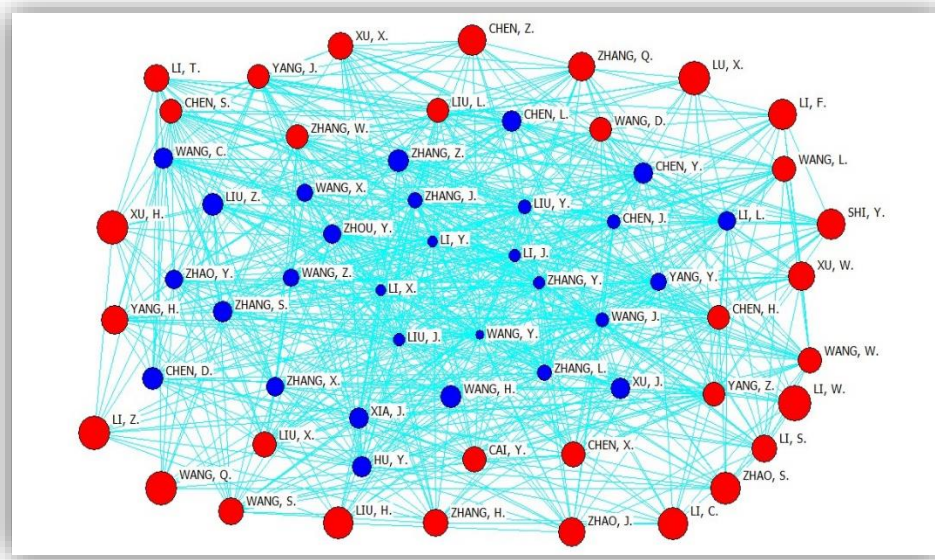


Fig 3: Closeness Centrality measure of resrchers in Covid-19 outputs in Scopus database

Fig 4 showed LI, X. (0.331), WANG, Y. (0.325) and LI, Y. (0.274) had highest value of eigenvector centrality among the social network of authors. this measure represents the degree of communication of one authors with other powerful and central authors in a network, and it is built on the principle that not all graph authors have the same values, but authors that are associated with effective authors of the network relative to other authors. Therefore, higher value authors with higher eigenvalues are linked to the effective authors.

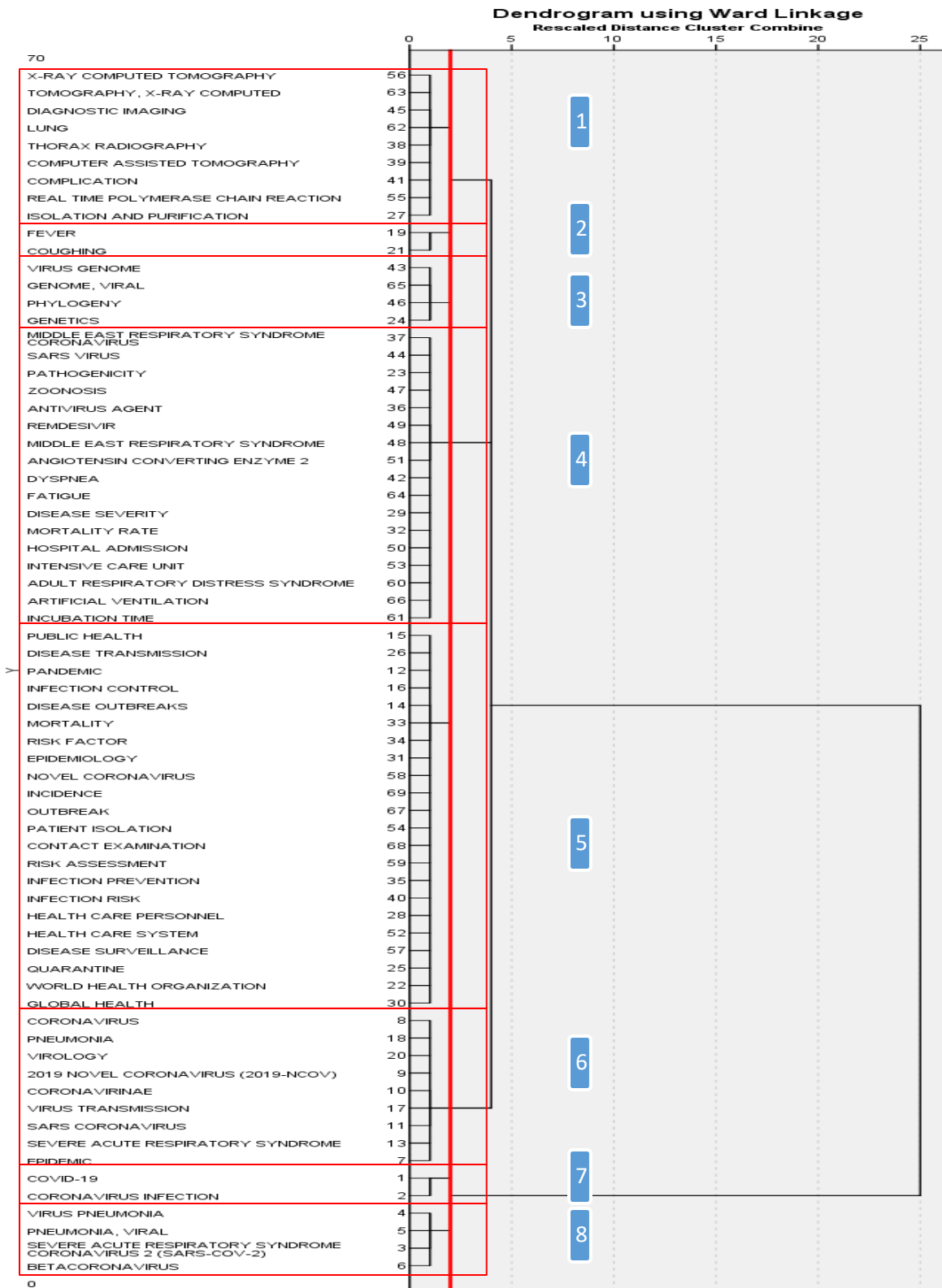


Fig 5: Cluster of concepts and words of Covid-19 disease in Scopus scientific database

. The results of the study indicate that studies centered around the Covid-19 disease includes 8 subject clusters that are presented in Table 6.

Table 6: Cluster of concepts and words of Covid-19 disease in Scopus scientific database

Clusters	N. Keyword	Keywords
DIAGNOSTIC IMAGING AND ISOLATION	9	COMPLICATION; COMPUTER ASSISTED TOMOGRAPHY; DIAGNOSTIC IMAGING; ISOLATION AND PURIFICATION; LUNG; REAL TIME POLYMERASE CHAIN REACTION; THORAX RADIOGRAPHY; TOMOGRAPHY, X-RAY COMPUTED; X-RAY COMPUTED TOMOGRAPHY
Symptoms of Coronavirus	2	COUGHING; FEVER
VIRUS GENOME AND PHYLOGENY	4	VIRUS GENOME; PHYLOGENY; GENETICS; GENOME, VIRAL
PATHOGENICITY	17	ANTIVIRUS AGENT; ANGIOTENSIN CONVERTING ENZYME 2; ADULT RESPIRATORY DISTRESS SYNDROME; ARTIFICIAL VENTILATION; DYSPNEA; FATIGUE; MIDDLE EAST RESPIRATORY SYNDROME; MIDDLE EAST RESPIRATORY SYNDROME CORONAVIRUS; MORTALITY RATE; INCUBATION TIME; PATHOGENICITY; REMDESIVIR; SARS VIRUS; ZOONOSIS; DISEASE SEVERITY; HOSPITAL ADMISSION; INTENSIVE CARE UNIT
PUBLIC HEALTH AND OUTBREAK NOVEL AND CORONAVIRUS	22	PUBLIC HEALTH; PANDEMIC; PATIENT ISOLATION; DISEASE TRANSMISSION; DISEASE OUTBREAKS; DISEASE SURVEILLANCE; INFECTION CONTROL; INCIDENCE; INFECTION PREVENTION; INFECTION RISK; MORTALITY; RISK FACTOR; RISK ASSESSMENT; EPIDEMIOLOGY; NOVEL CORONAVIRUS; OUTBREAK; CONTACT EXAMINATION; HEALTH CARE PERSONNEL; HEALTH CARE SYSTEM; QUARANTINE; WORLD HEALTH ORGANIZATION; GLOBAL HEALTH
EPIDEMIC CORONAVIRUS	9	CORONAVIRUS; CORONAVIRINAE; PNEUMONIA; VIROLOGY; VIRUS TRANSMISSION; 2019 NOVEL CORONAVIRUS (2019-NCOV); EPIDEMIC; SARS CORONAVIRUS; SEVERE ACUTE RESPIRATORY SYNDROME
CORONAVIRUS INFECTION AND COVID-19	2	CORONAVIRUS INFECTION; COVID-19
VIRUS PNEUMONIA AND SARS-COV-2	4	VIRUS PNEUMONIA; BETACORONAVIRUS; PNEUMONIA, VIRAL; SEVERE ACUTE RESPIRATORY SYNDROME CORONAVIRUS 2 (SARS-COV-2)

Conclusion

After the identification of a new type of covid-19 (the newest and, of course, the most dangerous type of coronavirus) in Wuhan, China, and its rapid spread around the world, many studies were conducted and published on various aspects of the disease; Coronavirus is one of the viruses that is transmitted first to animals and then to humans. Most people with covid-19 experience mild to moderate respiratory illness and recover without special treatment. Older people and people with major medical problems such as cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illness (3). After identifying the first patients with Covid 19, identifying the symptoms of this

emerging disease and its treatment methods, as well as its prevention, became one of the important fields of study of researchers around the world.

Also clustering analysis of the concepts and words of this new viral disease shows that research by world researchers have included 8 study clusters. These 10 study clusters include: DIAGNOSTIC IMAGING AND ISOLATION; Symptoms of Coronavirus; VIRUS GENOME AND PHYLOGENY; PATHOGENICITY; PUBLIC HEALTH AND OUTBREAK NOVEL AND CORONAVIRUS; EPIDEMIC CORONAVIRUS; CORONA VIRUS INFECTION AND COVID-19; VIRUS PNEUMONIA AND SARS-COV-2. The results of the present study confirm the results of some researches (4, 5, 6, and 7). Knowing the process of doing research around the world can be expected to be a major step in the process of scientific research. In order to use experiences, scientific exchange between universities lead to increase scientific output. We identify the factors and definitive treatment of the Covid-19 virus by studying them. Researchers will be provided with appropriate facilities and funds by the health authorities of the countries.

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