INVESTIGATION OF THE GLOBAL OUTCOMES OF ACUTE RESPIRATORY DISTRESS SYNDROME WITH THE EFFECT OF COVID-19 IN PUBLICATIONS: A BIBLIOMETRIC ANALYSIS BETWEEN 1980 AND 2020

Yayınlarda Covid-19 Etkisiyle Akut Solunum Sıkıntısı Sendromu Küresel Sonuçlarının İncelenmesi: 1980-2020 Arası Bibliyometrik Analiz

Musa ZENGİN[1] , Ramazan BALDEMİR[1]

[1]Health Sciences University Ankara Atatürk Chest Diseases and Thoracic Surgery Training and Research Hospital, Anesthesiology and Reanimation Clinic, ANKARA, TÜRKİYE

ABSTRACT	ÖZ

Objective: Acute respiratory distress syndrome (ARDS) is regarded as a serious complication with high mortality rates and constitutes an important health problem during the COVID-19 pandemic. Therefore, a thorough bibliometric study on ARDS is needed. In this study, it was aimed to holistically summarize the articles published on ARDS between the years 1980 and 2020 using statistical methods and bibliometric analyses.

Material and Methods: The literature was scanned using the Web of Science (WoS) database. Keywords used on WoS included "acute respiratory distress syndrome", "adult respiratory distress syndrome" and "ARDS". The search was carried out on the "titles" of the publications, and the articles obtained were bibliometrically analyzed. Linear and non-linear regression analysis was used in order to estimate the number of future studies.

Results: A total of 11.934 publications were found. Of these publications, 5402 were articles (45.3%) on which the bibliometric analysis was performed. A high increase trend was observed in the number of publications during COVID-19. Most articles were published in the field of Critical Care Medicine (1965, 36.4%). The top four countries contributing to the literature were the USA (1967, 36.4%), Germany (534, 9.9%), France (534, 9.9%), and China (534, 9.9%). The most active 4 institutions were confirmed as theUniversity of Toronto (154), University of California San Francisco (153), University of Washington (153) and University of Harvard (151). The first 2 journals with the most publications were Critical Care Medicine (394) and Intensive Care Medicine (248).

Conclusion: In this comprehensive bibliometric study on ARDS on which the number of research increases day by day with the effect of the COVID-19 pandemic, a summarized information of 5402 articles published between 1980 and 2020 was reported. This study will be a guide for scientists and clinicians regarding the global output of ARDS.

Keywords: *Acute respiratory distress syndrome, adult respiratory distress syndrome, bibliometric analysis*

Amaç: Geçmişte ve COVID-19 pandemi sürecinde ARDS mortalite oranı yüksek olan önemli bir komplikasyon olarak karşımıza çıkmaktadır. Dolayısı ile ARDS konusunda kapsamlı bir bibliyometrik çalışmaya ihtiyaç vardır. Bu çalışmada 1980 ve 2020 yılları arasında ARDS konusunda yayınlanan makalelerin istatistiksel yöntemler ve bibliyometrik analizler kullanılarak bütünsel olarak özetlenmesi amaçlanmıştır.

Gereç ve Yöntemler: Literatür taraması Web of Science (WoS) veritabanı kullanılarak yapıldı. WoS'da arama anahtar kelimesi olarak "acute respiratory distress syndrome", "adult respiratory distress syndrome" ve "ARDS" kullanıldı. Yayınların "title" bölümünde arama yapıldı ve elde edilen makaleler bibliyometrik olarak analiz edildi. Gelecek yıllardaki yayın sayısını tahmin etmek için doğrusal ve doğrusal olmayan regresyon analizi kullanıldı.

Bulgular: Toplam 11934 yayın bulundu. Bu yayınlardan makale olan 5402 (45.3%)'si bibliyometrik olarak analiz edildi. Yayın sayısında COVID-19 sürecinde yüksek bir artış trendi görüldü. En fazla makale Critical Care Medicine (1965, 36.4%) araştırma alanında yayınlanmıştı. Literatüre en fazla katkı yapan ilk 4 ülke ABD (1967, 36.4%), Almanya (534, 9.9%), Fransa (534, 9.9%) ve Çin (534, 9.9%) idi. En aktif ilk 4 kurum Toronto Üniversitesi (154), California San Francisco Üniversitesi (153), Washington Üniversitesi (153) ve Harvard Üniversitesi (151) idi. En fazla yayın yapan ilk 2 dergi Critical Care Medicine (394) ve Intensive Care Medicine (248) idi.

Sonuç: COVID-19'un da etkisiyle her geçen gün araştırma sayısı artan ARDS konusunda yaptığımız bu kapsamlı bibliyometrik çalışmada 1980-2020 yılları arasında yayımlanmış 5402 makalenin bir özet bilgisini paylaştık. Bu makale ARDS global çıktıları hakkında bilim insanları ve klinisyenlere faydalı bir rehber olacaktır.

Anahtar Kelimeler: *Akut solunum sıkıntısı sendromu, bibliyometrik analiz, yetişkin solunum sıkıntısı sendromu*

Correspondence / Yazışma Adresi: **Dr. Musa ZENGİN**
Health Sciences University Ankara Atatürk Chest Diseases and Thoracic Surgery Training and Research Hospital, Anesthesiology and Reanimation Clinic, ANKARA, TÜRKİYE
Phone / Tel: +90 530 7716235   **E-mail /** E-posta: musazengin@gmail.com
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INTRODUCTION

ARDS is a severe form of respiratory failure with significant impact on the morbidity and mortality of critical care patients (1). With high mortality and morbidity rates, acute respiratory distress syndrome (ARDS) is an acute respiratory failure involving both lungs and is characterized by hypoxemia despite oxygen treatment. General mortality rates ranged from 11 to 87% in studies including subjects with ARDS of all etiologies (1). ARDS was defined by the American-European Consensus Conference (AECC) in 1991 and later revised by the Berlin definition as a result of an expert panel in 2011 (an initiative of the European Society of Intensive Care Medicine approved by the American Thoracic Society and the Society of Critical Care Medicine). Three ARDS categories were proposed based on the degree of hypoxemia in the Berlin definition: mild (200 mm Hg < $PaO_2/FIO_2 \leq 300$ mm Hg), moderate (100 mm Hg < $PaO_2/FIO_2 \leq 200$ mm Hg), and severe ($PaO_2/FIO_2 \leq 100$ mm Hg) (2). The Berlin definition of ARDS both improves the predictor validity of the AECC definition regarding mortality and clarifies the conceptual model of ARDS with its diagnostic criteria and severity spectrum (3).

Fundamentally, ARDS is a complication of another disease. With the onset of the coronavirus pandemic in China at the end of 2019, ARDS attracted the clinicians' attention one more time. In a study conducted in China, ARDS has been determined as the most commonly encountered complication (61.1%) in patients followed in intensive care units due to coronavirus pneumonia (4). Nonetheless, ARDS manifests as a result of severe pulmonary infections, aspiration pneumonia, sepsis, severe trauma, severe burns, pancreatitis, drug reactions, and inhalation injuries (5). Mechanical ventilation is a life-saver in the treatment of ARDS. When response to conventional therapies is not achieved, ECMO (extracorporeal membrane oxygenation) can be applied as a treatment option (6).

Bellani et al. (2016) has concluded that ARDS is inadequately recognized, insufficiently treated and related to high mortality rates in a study on epidemiology and mortality in patients with ARDS conducted in 50 countries and 459 intensive care units (7). According to the study findings, 10.4% of ICU admissions and 23.4% of the patients requiring mechanical ventilation have resulted from ARDS. Besides, prevalence has been found as 30.0%, 46.6%, and 23.4% in mild, moderate, and severe ARDS, respectively. Hospital mortality has been detected as 34.9% in mild ARDS, 40.3% in moderate ARDS, and 46.1% in severe ARDS (7).

Although revisions and developments have been made in the diagnosis and treatment of ARDS with a high mortality rate, there is still clinical debate. Consequently, scientists must research ARDS to reach the current data and information on ARDS swiftly, the most read and cited publications, and the centers and authors sharing information the most, which leads to the need for a thorough bibliometric study on ARDS.

Bibliometry is the analysis of scientific publications, notably articles, using statistical methods (8-10). Bibliometric investigations bring out studies with the most citations and impact level, trend topics that are researched the most, active institutions, active authors, contributing countries, and the international cooperation among them on a specific subject or research area (11-14). Thanks to the bibliometric studies presenting a summary of thousands of articles, researchers spare time in literature review and can reach the subject they are looking for much faster (15). In the literature, bibliometric research on medicine's various important topics has been made recently (8-19).

Therefore, a thorough bibliometric study on ARDS is needed. This study aimed to holistically summarize the articles published on ARDS between the years 1980 and 2020 using statistical methods and bibliometric analyses.

MATERIALS AND METHODS

The literature was scanned using the Web of Science (WoS) database. Keywords used on WoS included "acute respiratory distress syndrome," "adult respiratory distress syndrome," and "ARDS." The search was carried out on the "titles" of the publications, and thus all publications between 1980 and 2020 using one of these keywords on their title were reached (access date: 01.01.2021). Codes for the researchers to access similar documents: (*title: ("acute respiratory distress syndrome") or title: ("adult respiratory distress syndrome") or title: ("ARDS") refined by: document types: (article) Timespan: 1980-2020. Indexes: SCI-Expanded, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI).* The articles obtained were analyzed bibliometrically. VOSviewer (Version 1.6.15) package program was used for keyword analyses, citation and co-citation analyses, and bibliometric mapping (20). (http://lert.co.nz/map/) website was used for the drawing of the world map. Statistical analyses were conducted on SPSS (Version 22.0, SPSS Inc., Chicago, IL, the USA) package program. The Kolmogorov-Smirnov test assessed the normal distribution of the data. Linear and non-linear regression analysis was used to estimate the number of further publications. $P<0.05$ was accepted as statistically significant.

RESULTS

A total of 11.934 publications on ARDS were found between the years 1980 and 2020. Of these publications, 5402 (45.3%) were articles, 3129 (26.2%) were meeting abstracts, 1136 (9.5%) were letters, 1011 (8.5%) were editorial materials, 880 (7.4%) were reviews, 402 (3.4%) were Proceedings Papers. The rest were in different publication types (Notes 93, Corrections 80, Early Accesses 57, Book Chapters 51, News Items 13, Correction Additions 11, Book Reviews 5).

In the study, 5402 articles were analyzed bibliometrically. Five thousand ninety-one (94.2%) of the 5402 articles were in English, and the rest were in German (142), French (103), Spanish (43), Turkish (7), Korean (4), Russian (4), Portuguese (3), Swedish (3), Italian (2), Polish (2), Icelandic (1), Japanese (1), and Serbian (1).

The total number of citations received by 5402 articles was 202.128, and the average number of citations per article was 37.42, and the h index was 188.

Active Research Areas

The top 10 research areas with the highest number of studies on ARDS were the following: Critical Care Medicine (1965, 36.4%), Respiratory System (1302, 24.1%), General Internal Medicine (647, 12%), Anesthesiology (417, 7.7%), Surgery (391, 7.2%), Medicine Research Experimental (253, 4.7%), Pediatrics (197, 3.6%), Cardiac Cardiovascular Systems (175, 3.2%), Immunology (134, 2.5%), and Pharmacology Pharmacy (130, 2.4%).

Development of Publications

Figure 1 shows the distributions of the articles by years. The regression analysis results used to estimate the number of further publications between 2021 and 2025 were shown in Figure 1. According to the results of the regression analysis, it was estimated that 477 articles (CI%: 429-524) would be published in 2021 and 503 articles (CI%: 450-556) in 2025 (Fig. 1). On the non-linear regression analysis, 473 articles were estimated to be published in 2021 regarding the cubic model.

Active Countries

Figure 2 shows the distribution of world countries publishing the highest number of articles. The first 20 countries publishing articles the most on ARDS were found as follows: the USA (1967, 36.4%), Germany (534, 9.9%), China (534, 9.9%), France (534, 9.9%), Italy (355, 6.6%), the UK (324, 6%), Canada (301, 5.6%), Japan (227, 4.2%), Spain (210, 3.9%), the

Netherlands (156, 2.9%), Brazil (149, 2.8%), Switzerland (147, 2.7%), Taiwan (128, 2.4%), India (116, 2.1%), Belgium (101, 1.9%), Sweden (101, 1.9%), South Korea (99, 1.8%), Australia (79, 1.5%), Austria (74, 1.4%), and Turkey (68, 1.3%) (Fig. 3a). Out of the 90 countries publishing articles on ARDS, Figure 3 presents the international cooperation density map between 57 countries that co-operate and produce at least 5 articles.

Active Authors

The first ten authors publishing the highest number of articles (more than 50 articles) on ARDS were found respectively as Matthay MA (97 articles), Thompson BT (80 articles), Gattinoni L (64 articles), Brochard L (63 articles), Pesenti A (62 articles), Hudson LD (57 articles), Pelosi P (56 articles), Calfee CS (55 articles), Papazian L (55 articles), and Slutsky AS (55 articles).

Active Institutions

The most active universities publishing more than 50 articles on ARDS were determined respectively as the University of Toronto (154 articles), University of California San Francisco (153 articles), University of Washington (153 articles), Harvard University (151 articles), Massachusetts General Hospital (121 articles), University of Milan (104 articles), Vanderbilt University (98 articles), University of Colorado (96 articles), University of Pennsylvania (93 articles), University of Michigan (84 articles), University of Sao Paulo (81 articles), St Michael's Hospital (69 articles), Johns Hopkins University (66 articles), University of Pittsburgh (64 articles), University of Utah (63 articles), Mayo Clinic (58 articles), University of Texas (55 articles), and University of Maryland (52 articles).

Active Journals

There were 62 journals out of 1098 ARDS-related journals publishing 15 and more than 15 articles on ARDS. Table 1 presents these active journals, the total number of most cited journals citations received by the journals, and the total number of citations per article. Moreover, Figure 4 shows the average citation network visualization map carried out among these 62 journals.

Citation Analysis

Table 2 demonstrates the first most cited 25 articles on ARDS according to the total number of citations. The last column of Table 2 also presents the average number of citations received by the articles per year.

Co-citation Analysis

In the "references" section of the articles analyzed, there were a total of 73.975 published studies that were cited by all of the articles. The most effective first 11 studies that received more than 300 citations were found respectively as Bernard (1994) (Number of co-citations, 1311), Ranieri (2012) (1148), Brower (2000) (982), Murray (1988) (669), Ashbaugh (1967) (663), Ware (2000) (545), Rubenfeld (2005) (460), Bellani (2016) (419), (Amato) (1998) (391), Knaus (1985) (316), and Guerin (2013) (305) (1,2,6,7,21-27).

Keyword Analysis and Trend Topics

Five thousand eight hundred and sixty-four different keywords were used in 5401 articles. Out of these keywords, 81 keywords used in at least 20 separate articles are presented in Table 3. Cluster analysis between these keywords was shown in Figure 5. Trend visualization network map is given in Figure 6a, and citation network map on Figure 6b.

Table 1: Active journals on ARDS

Journals	RC	C	AC	Journals	RC	C	AC
Critical Care Medicine	394	20981	53.3	Internal Medicine	22	181	8.2
American Journal of Respiratory And Critical Care Medicine	214	27097	126.6	Experimental and Therapeutic Medicine	22	113	5.1
Intensive Care Medicine	248	13252	53.4	Lancet	20	2879	144.0
American Review of Respiratory Disease	87	9909	113.9	International Journal of Clinical and Experimental Medicine	22	13	0.6
Chest	221	14134	64.0	Journal of Intensive Care Medicine	21	122	5.8
Critical Care	158	3993	25.3	Lancet Respiratory Medicine	21	3486	166.0
Journal of Critical Care	102	1558	15.3	Anaesthesia and İntensive Care	20	237	11.9
Respiratory Care	75	1295	17.3	Annals of Thoracic Surgery	20	573	28.7
Anesthesiology	68	3321	48.8	Scientific Reports	20	162	8.1
Plos One	66	688	10.4	Asaio Journal	19	151	7.9
Annals of Intensive Care	62	555	9.0	Burns	19	264	13.9
European Respiratory Journal	61	2258	37.0	Revue Des Maladies Respiratoires	19	31	1.6
Journal of Trauma-Injury Infection and Critical Care	48	2418	50.4	Schweizerische Medizinische Wochenschrift	19	54	2.8
ActaAnaesthesiologicaScandinavica	54	1029	19.1	BMC Anesthesiology	18	79	4.4
Clinics in Chest Medicine	54	1913	35.4	Anesthesia and Analgesia	17	454	26.7
Shock	46	1084	23.6	Chinese Medical Journal	17	139	8.2
AnnalesFrancaises D Anesthesie Et De Reanimation	16	42	2.6	Annals of the American Thoracic Society	17	261	15.4
Pediatric Critical Care Medicine	44	1165	26.5	Heart & Lung	17	110	6.5
Anaesthesist	38	336	8.8	Medicine	25	92	3.7
Minerva Anestesiologica	37	714	19.3	Journal of Surgical Research	17	335	19.7
Thorax	37	1604	43.4	Perfusion-UK	17	105	6.2
Journal of Thoracic Disease	32	172	5.4	Respiration	17	215	12.6
New England Journal of Medicine	31	24327	784.7	Southern Medical Journal	17	223	13.1
Bmc Pulmonary Medicine	29	263	9.1	Respirology	16	277	17.3
American Journal of Physiology-Lung Cellular and Molecular Physiology	30	1047	34.9	Journal of Trauma and Acute Care Surgery	25	517	20.7
Jama-Journal of the American Medical Association	29	14419	497.2	Journal of the Formosan Medical Association	16	127	7.9
British Journal of Anaesthesia	27	534	19.8	Radiology	15	802	53.5
Pediatric Pulmonology	29	384	13.2	Surgery	16	631	39.4
American Journal of Respiratory Cell and Molecular Biology	15	444	29.6	International Journal of Artificial Organs	16	139	8.7
Critical Care Clinics	27	544	20.1	Resuscitation	15	317	21.1
Respiratory Research	26	440	16.9	MedicinaIntensiva	15	58	3.9

RC: Record count C: Number of citation, AC: Average citation per document

**Table 2:** Top 25 most cited articles according to total citations on ARDS

No	Author	Journal	PY	TC	AC
1	Brower RG et al.	New England Journal of Medicine	2000	6270	298.6
2	Ranieri VM et al.	JAMA-Journal of the American Medical Association	2012	3555	395
3	Amato MBP et al.	New England Journal of Medicine	1998	2158	93.8
4	Xu Z et al.	Lancet Respiratory Medicine	2020	1756	1756
5	Rossaint R et al.	New England Journal of Medicine	1993	1349	48.2
6	Brower RG et al.	New England Journal of Medicine	2004	1329	78.2
7	Bellani G et al.	JAMA-Journal of the American Medical Association	2016	1328	265.6
8	Guerin C et al.	New England Journal of Medicine	2013	1246	155.8
9	Herridge MS et al.	New England Journal of Medicine	2003	1230	68.3
10	Ranieri VM et al.	JAMA-Journal of the American Medical Association	1999	1199	54.5
11	Wu C et al.	JAMA Internal Medicine	2020	1190	1190
12	Papazian L et al.	New England Journal of Medicine	2010	1190	108.2
13	Herridge MS et al.	New England Journal of Medicine	2011	1175	117.5
14	Davies A et al.	JAMA-Journal of the American Medical Association	2009	965	80.4
15	Amato MBP et al.	New England Journal of Medicine	2015	813	135.5
16	Montgomery AB et al.	American Review of Respiratory Disease	1985	812	22.6
17	Meade MO et al.	JAMA-Journal of the American Medical Association	2008	786	60.5
18	Gattinoni L et al.	New England Journal of Medicine	2006	782	52.1
19	Fouchier RAM et al.	Proceedings of the National Academy of Sciences of the United States of America	2004	781	45.9
20	Briel M et al.	JAMA-Journal of the American Medical Association	2010	746	67.8
21	Steinberg KP et al.	New England Journal of Medicine	2006	732	48.8
22	Mercat A et al.	JAMA-Journal of the American Medical Association	2008	728	56
23	Fowler AA et al.	Annals of Internal Medicine	1983	688	18.1
24	Weiland JE et al.	American Review of Respiratory Disease	1986	636	18.2
25	Hudson LD et al.	American Journal of Respiratory and Critical Care Medicine	1995	634	24.4

PY: Publication year, TC: Total citation, AC: Average citations per year

Table 3: The most frequently used trend keywords on ARDS

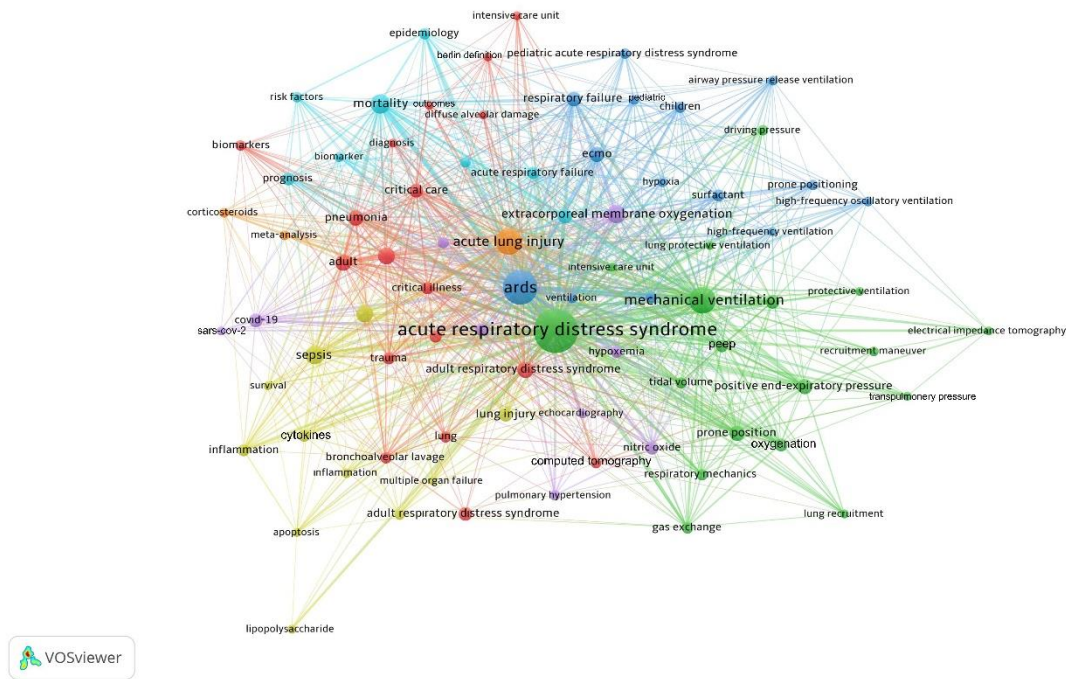| Keyword	O	Keyword	O
acute respiratory distress syndrome	1514	bronchoalveolar lavage	37
ARDS	798	epidemiology	37
mechanical ventilation	386	hypoxemia	37
acute lung injury	371	computed tomography	36
mortality	172	pediatric acute respiratory distress syndrome	35
adult respiratory distress syndrome	165	prone positioning	33
extracorporeal membrane oxygenation	152	intensive care	32
sepsis	150	biomarkers	31
acute respiratory distress syndrome (ARDS)	119	driving pressure	30
respiratory distress syndrome	115	pulmonary hypertension	30
adult	103	risk factors	30
positive end-expiratory pressure	92	hypoxia	28
pneumonia	90	pediatric	28
ECMO	87	septic shock	28
prone position	85	ventilation	28
respiratory failure	81	high-frequency oscillatory ventilation	27
outcome	80	biomarker	26
inflammation	76	echocardiography	26
critical care	71	meta-analysis	26
lung injury	66	airway pressure release ventilation	25
COVID-19	63	corticosteroids	25
ventilator-induced lung injury	62	recruitment maneuver	25
nitric oxide	58	diagnosis	24
respiratory distress syndrome, adult	57	high-frequency ventilation	24
oxygenation	55	intensive care unit	24
prognosis	54	lung protective ventilation	24
pulmonary edema	51	multiple organ failure	24
acute respiratory failure	50	SARS-COV-2	24
critical illness	50	protective ventilation	23
surfactant	49	survival	23
trauma	47	diffuse alveolar damage	22
cytokines	46	electrical impedance tomography	22
peep	46	lipopolysaccharide	22
ALI	44	intensive care unit	21
gas exchange	44	lung recruitment	21
tidal volume	44	apoptosis	20
lung	42	berlin definition	20
children	41	outcomes	20
pediatrics	39	transpulmonary pressure	20
respiratory mechanics	38		

O: Number of occurrences
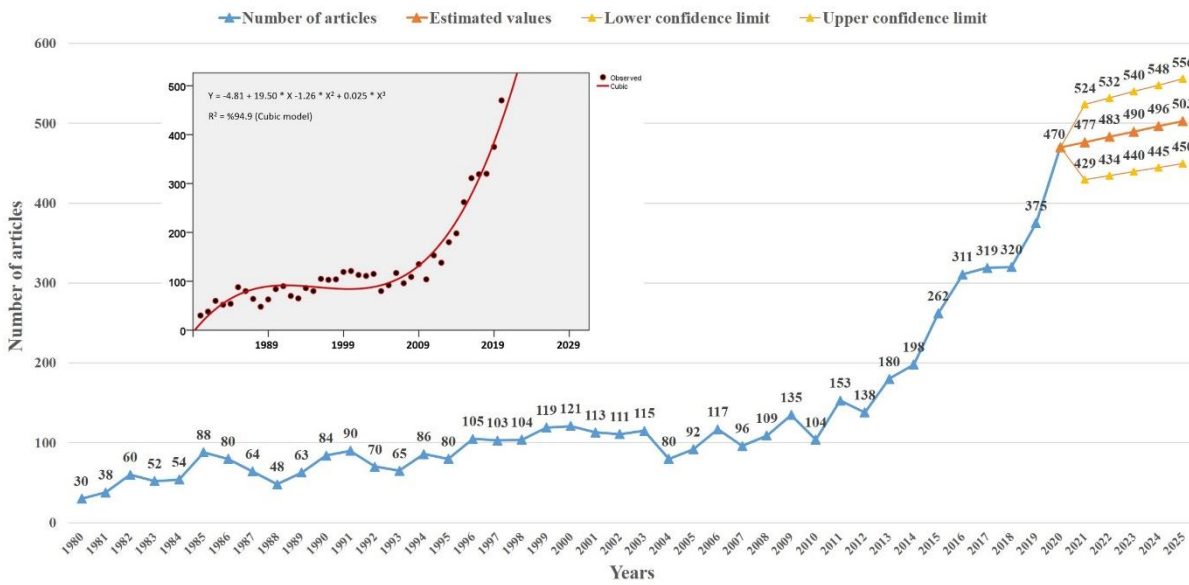
Figure 1: The distribution of ARDS articles by years and the regression line for the estimation of the number of publications in the following years
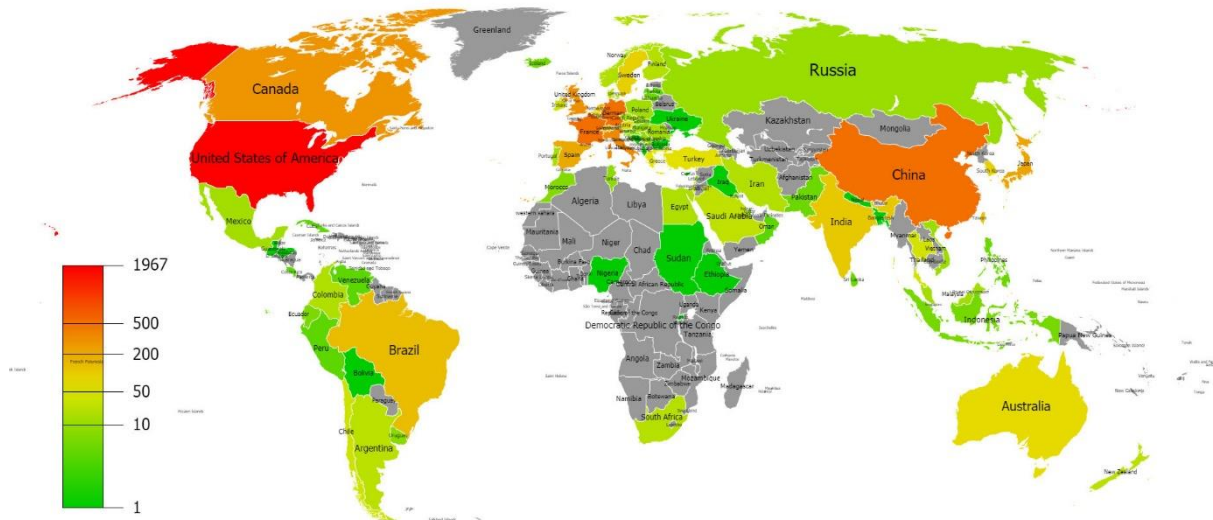

Figure 2: World map showing the distribution of articles on ARDS by Country Footnote: The number of articles for countries increases from green to red in the indicator at the bottom left of the figure

Figure 3: (a) Bar chart for the top 20 countries producing the most articles on ARDS (b) Density visualization map for international cooperation of worldwide countries on ARDS

Figure 4: Network visualization map for citation analysis of journals that produce publications on ARDS Footnote: The number of citations from blue to red (blue-green-yellow-red) increases, the size of the circle area indicates that the number of articles produced is greater

Figure 5: Network visualization map for cluster analysis based on keyword analysis on ARDS Footnote: The colors indicate the clusters, the size of the circle area suggests that the number of articles produced is greater, and the thickness of the lines indicates the strength of a relationship
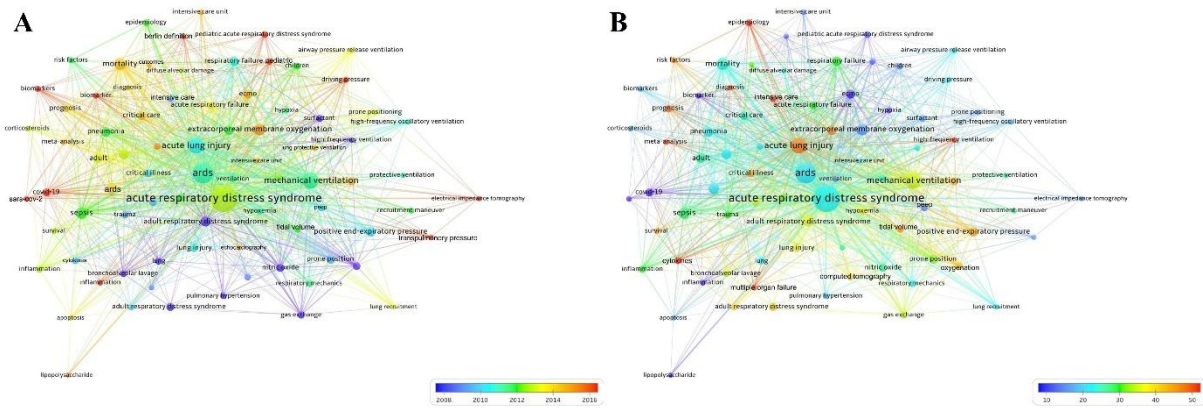
Figure 6: (a) Network visualization map for trends based on keyword analysis on ARDS Footnote: Indicator shows current articles from blue to red, the size of the circle area indicates that the number of articles produced is greater (b) Network visualization map for citations based on keyword analysis on ARDS Footnote: The number of citations from blue to red (blue-green-yellow-red) increases, the size of the circle area indicates that the number of articles produced is greater

DISCUSSION

Our findings indicated that the number of articles published on ARDS increased with every passing day. Less than 100 articles per year had been published until 1996. Articles between the range of 100-200 had been published every year between 1996 and 2013. The number of articles, which was limited initially, increased significantly and reached 470 in 2020. According to the regression analysis results, this increasing trend is believed to continue in the upcoming years. It is considered that the increase in 1996 resulted from the ARDS definition following the American-European Consensus, and the increase in 2013 resulted from the revised definition of Berlin ARDS. The remarkable rise in the number of articles, particularly in the last two years, maybe related to ARDS development due to COVID-19. ARDS is the most common complication among the reasons for admission to the intensive care unit due to COVID-19 (4). The pandemic is found to be instrumental in publication productivity on ARDS. The number of articles on ARDS during the pandemic has increased due to the rise in the prevalence of ARDS in patients followed for COVID-19 pneumonia and concordantly in the requirement of intensive care in these patients. While the risk factors and clinical manifestations of ARDS that develop due to COVID-19 are not yet fully identified, it is considered that it has a more different process and clinical course than the conventional ARDS (28,29).

A significant correlation has been established between the economic potential of a country and its publication productivity in several bibliometric research in the literature (12,13). Our study also detected that the countries publishing the highest number of articles on ARDS are developed countries or have a strong economy, which made us consider that the most important factor in publication productivity is the level of development.

The journals with the most publications were found respectively as the Critical Care Medicine, Intensive Care Medicine, Chest, American Journal of Respiratory and Critical Care Medicine, Critical Care, Journal of Critical Care, American Review of Respiratory Disease, Respiratory Care, and Anesthesiology. We suggest these journals to authors wishing to do research and publish articles on ARDS. When the journals generating at least 15 articles were evaluated in regard to the number of citations per articles, the journals receiving an average of 50 and over 50 citations were respectively found to be the New England Journal of Medicine, Jama-Journal of the American Medical Association, Lancet Respiratory Medicine, Lancet, American Journal of Respiratory and Critical Care Medicine, American Review of Respiratory Disease, Chest, Radiology, Intensive Care Medicine, Critical Care Medicine, Journal of Trauma-Injury Infection and Critical Care, and Anesthesiology. These journals stand out as high-impact journals. We suggest these journals to authors who wish to reach a higher impact with their articles.

When the articles analyzed were reviewed according to the total number of citations, the first most cited article was determined as the study by Brower et al. (2000) (AcuteRespiratoryDistressSyndrome Network) titled "Ventilation with lower tidal volumes as compared with traditional tidal volumes for acute lung injury and the acute respiratory distress syndrome" and published in the New England Journal of Medicine (6). The following most influential study was that of Ranieri et al. (2012) (ARDS Definition Task Force) that constituted the Berlin definition of ARDS and was published in JAMA (2). The third most cited article was the study by Amatove et al. (1998) titled "Effect of a protective-ventilation strategy on mortality in the acute respiratory distress syndrome" and published in the New England Journal of Medicine (25). The fourth most cited article was the study by Xu, Z. et al. titled "Pathological findings of COVID-19 associated with acute respiratory distress syndrome" and published in Lancet Respiratory

Medicine's journal in 2020 (28). When the articles were assessed according to the number of citations per year, the most useful article was that of Xu, Z. et al. (2020) (28). The second most effective article was by Wu et al. (2020), titled "Risk factors associated with acute respiratory distress syndrome and death in patients with coronavirus disease 2019 pneumonia in Wuhan, China" and published in JAMA Internal Medicine (29). The most influential studies after the ones mentioned above were found respectively as those by Ranieri et al., Brower et al., Bellani et al., Ranucci et al., Guerin et al., and Cavalli et al. (2,6,7,27,30,31). The first 11 articles receiving the highest number of co-citations were confirmed respectively as follows: Bernard (1994), Ranieri (2012), Brower (2000), Murray (1988), Ashbaugh (1967), Ware (2000), Rubenfeld (2005), Bellani (2016), Amato (1998), Knaus (1985), and Guerin (2013) (1,2,6,7,21-27). It can be recommended for the researchers and clinicians interested in this subject to read these articles.

When the keyword analysis findings were evaluated, it was seen that there emerged 6 clusters as a result of cluster analysis. When studies conducted until today were evaluated in the literature, the subjects could be said to have clustered around mechanical ventilation-prone position, sepsis, pneumonia, pediatric-ECMO, mortality-epidemiology, and COVID-19.

According to the result of trend keyword analysis, the most studied keywords in recent years were determined as SARS-COV-2, COVID-19, electrical impedance tomography, Berlin definition, transpulmonary pressure, driving pressure, pediatric biomarkers, and inflammation. The most cited keywords were cytokines, epidemiology, high-frequency ventilation, intensive care, meta-analysis, diagnosis, prognosis, and multiple organ failure.

Scanning of the literature revealed only two different bibliometric studies on the treatment of ARDS and the topic of ALI/ARDS. Wang et al. (2020) focused on only studies regarding the treatment of ARDS (32). Wang et al. (2020) analyzed a 10-year process (2009-2019) on ALI and ARDS (33). This study that we conducted is more comprehensive in terms of the publishing process and statistical analyses than the studies in the literature. The study analyzed the period between 1980 and 2020 and evaluated the citations, co-citations, keyword analyses, and world countries cooperation analyses thoroughly.

A limitation of the study is that we only used the WoS index. PubMed was not preferred since citation and co-citation analyses cannot be performed on the PubMed database. Scopus database indexes low-impact journals. WoS database is preferred more for bibliometric analysis since it indexes articles published in high-impact journals (15,17). WoS database has been used in most of the studies conducted recently in the literature (8-19).

In this comprehensive study we conducted on ARDS, a topic that seems to be studied with many articles day by day, a summarized information of 5402 articles published between 1980 and 2020 was presented. A marked increase could be observed in the number of studies in the last two years with the effect of COVID-19. We think that the number of studies has increased due to other systemic involvement of COVID-19 and these studies should be examined bibliometrically. In this context, we think that the relationship between COVID-19 and diseases such as cerebrovascular disease, coronary artery disease can be investigated bibliometrically. Countries with the most significant contribution to ARDS were the USA, Germany, France, and China. Critical Care Medicine published the highest number of articles. The journal receiving the most citations per article was the New England Journal of Medicine. We believe that this present article will be a useful guide to clinicians and researchers on the subject regarding the global output of ARDS.

Conflict of Interest: The authors declare that there is no conflict of interest regarding the publication of this article.

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