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Scientometric analysis of methanol intoxication literature: Global publication output between 1980 and 2019

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Abstract
Aim: Scientometrics refers to the analysis of scientific literature related to a certain field. Even though the number of publications on methyl alcohol poisoning has recently increased, there has been no bibliometric or scientometric analysis conducted to date. In 2020 in particular, cases of methyl alcohol poisoning have increased due to the COVID-19 pandemic, which is expected to draw greater attention to this field.
Material and Methods: All data used in this study were collected from four databases accessed via the Web of Science. All studies published between 1980 and 2019 identified by searching for the keywords "methanol" and "poisoning" were included in the study. The relationship between the number of publications and productivity and characteristics of countries was analyzed with Spearman's correlation test, while GunnMap and VOSviewer were used to create infographics and infomaps. This study was conducted in accordance with the Declaration of Helsinki
Results: A total of 744 articles, most of which were original (79.70%), were identified from the four databases accessed via the Web of Science. An analysis of the number of publications by country ranked the United States in the first place, with 174 articles (23.387 %), while the Czech Republic was found to have the most productive researchers. The most popular area was toxicology (20.565%), and Charles University was the most productive institution. It was found that the number of publications and citations did not increase over the years
Discussion: The developed countries dominated the literature on methyl alcohol poisoning. It was further observed that articles on methyl alcohol abuse started to appear in 2020 in developing countries, which can be attributed to the COVID-19 pandemic, and the mistaken belief that it has anti-viral properties. Since the diagnosis and treatment of methyl alcohol poisoning are gaining significance, we recommend that researchers be encouraged to make further studies in this area.

Keywords
Bibliometrics, Citation Analysis, Methanol, Intoxication, Scientometrics

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Introduction

Methanol, also known as methyl alcohol, is a toxic alcohol widely used in various range of products such as fuels, solvents and clothing [1] . Cluster poisoning and outbreaks of intoxication were reported in the literature due to consumption of the products containing a high concentration of methanol [2-5]. At the end of 2019, a cluster of patients with pneumonia was reported from the city of Wuhan in Hubei Province of China [6]. First, the cause of this disease was unknown. Later, the cause of the pneumonia was identified as a novel coronavirus, and the outbreak evolved to a pandemic affecting all the world in months (World Health Organization; 2020. Available at: http://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/news/news/2020/3/who-announces-covid-19-outbreak-a-pandemic.2020). As of today, according to the official figures announced, the total number of SARS-CoV-19 cases worldwide has reached 60 million with over 1 million deaths (Available at: https://www.worldometers.info/coronavirus/. Published March 2020. Accessed November 24, 2020). In the SARS-CoV-19 pandemic, outbreaks of methanol intoxication due to the false belief that consumption of alcohol prevents virus infection were reported in different regions of the world [7,8,9,10,11].

Scientometrics, also known as the "science of science", is a novel academic field investigating publication trends, patterns and providing information on the productivity of authors, institutions, journals and countries [12]. To the best of our knowledge, academic literature lacks a scientometric study evaluating methanol intoxication literature. In this study, as the first trial in academic literature, we aimed to perform a holistic scientometric analysis of methanol intoxication literature.

Material and Methods

The Web of Science (WoS, Clarivate Analytics, USA) Core Collection was the major database for our scientometric analysis. WoS has been reported to be the most reliable database in the academic world, and therefore we chose WoS as the search source for our scientometric evaluation [13]. All documents produced between 1980 and 2019 were included in the study by using a search string containing the keywords ("methanol" AND "intoxication"). WoS GunnMap 2 was our tool to generate infomap revealing the global distribution of the academic productivity of methanol intoxication literature (GunnMap, 2020. Available at : http://lert.co.nz/map/. Accessed January 10, 2020). VOSviewer version 1.6.15 (Centre for Science and Technology Studies, Leiden University, The Netherlands) was a freeware for creating scientometric networks in our study (Vosviewer, 2020. Available at : https://www.vosviewer.com/. Accessed January 10, 2020). This study was conducted in accordance with the Declaration of Helsinki.

Results

General Features of the Literature

Between 1980 and 2019, a total of 744 articles were published in the literature on methanol intoxication, and only 183 documents were open access. The peak year of the production was 2013 with 43 documents, and the most indexed document type was original article, followed by letter and review (79.704,

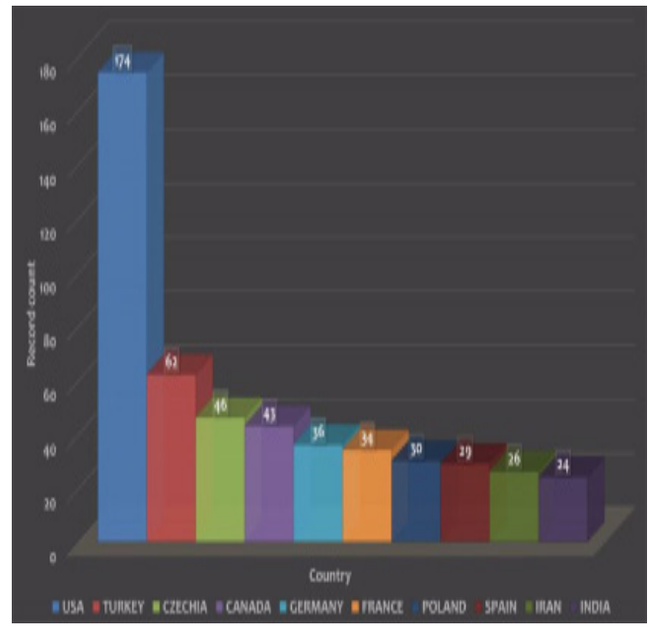


Figure 1. Countries by record count

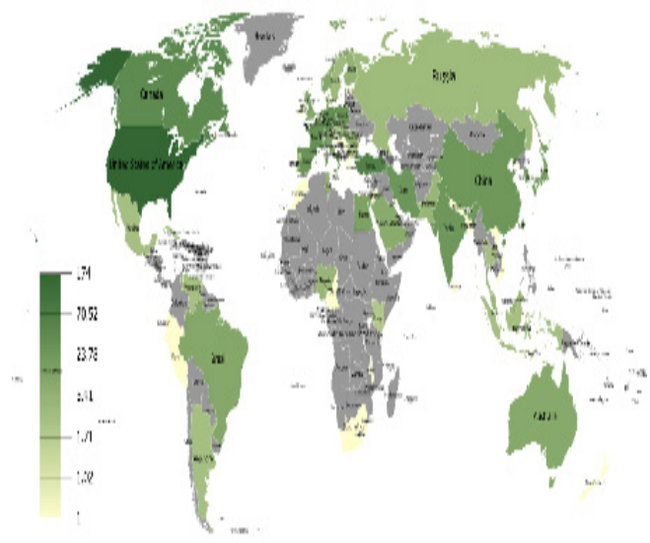


Figure 2. Global productivity

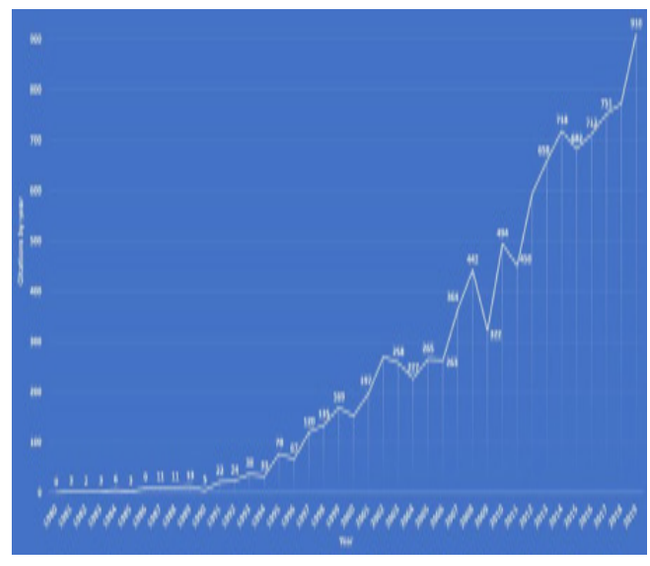


Figure 3. Citations by year

Table 1. Topmost indexed document types, research areas, source titles, authors and organizations in methanol intoxication literature between 1980 and 2019[a]

			Record count	% a
Document Type				
Original Article			593	79.704
Letter			43	5.780
Review			40	5.376
Proceeding Paper			39	5.242
Meeting Abstract			31	4.167
Editorial Material			19	2.554
Note			11	1.478
Book Chapter			3	0.403
Research Area				
Toxicology			153	20.565
Internal Medicine			111	14.919
Pharmacology			93	12.500
Neurosciences			86	11.559
Chemistry			65	8.737
Molecular Biology			48	6.452
Emergency Medicine			46	6.183
Urology			36	4.839
Radiology			28	3.763
Ophthalmology			23	3.091
Journal Name				
Clinical Toxicology			22	2.957
Journal of Toxicology			19	2.554
Forensic Science International			17	2.285
Human & Experimental Toxicology			12	1.613
American Journal of Kidney Diseases			10	1.344
Toxicology Letters			10	1.344
Journal of Analytical Toxicology			8	1.075
American Journal of Emergency Medicine			7	0.941
Journal of Forensic Sciences			7	0.941
Neurotoxicology			7	0.941
Author	Institution	Country		
Zakharov S	Charles University	Czechia	31	4.167
Pelclova D	Charles University	Czechia	26	3.495
Navratil T	General University Hospital	Czechia	22	2.957
Skrzydlewska E	Medical Academy of Białystok	Poland	19	2.554
Vaneckova M	Charles University	Czechia	18	2.419
Eells JT	University of Wisconsin-Milwaukee	USA	17	2.285
Diblik P	Charles University	Czechia	15	2.016
Seidl Z	Charles University	Czechia	15	2.016
Hantson P	Université Catholique de Louvain	Belgium	13	1.747
Kotikova K	Charles University	Czechia	12	1.613
Organizations		Country		
Charles University		Czechia	36	4.839
General University Hospital in Prague		Czechia	31	4.167
Czech Academy of Sciences		Czechia	24	3.226
J. Heyrovský Institute of Physical Chemistry		Czechia	21	2.823
Medical College of Wisconsin		USA	16	2.151
Université Catholique de Louvain		Belgium	15	2.016
Medical University of Białystok		Poland	13	1.747
Cliniques Universitaires Saint-Luc		Belgium	12	1.613
University of Oslo		Norway	11	1.478
Assistance Publique – Hôpitaux de Paris		France	10	1.344
Total			744	100

5.78 and 5.376%, respectively; Table 1). The most studied areas were Toxicology, Internal Medicine and Pharmacology (20.565, 14.919 and 12.5%, respectively; Table 1).

Productivity of the Countries, Source Titles, Authors and Institutions

The USA was ranked as the top productivity country with 174 articles (23.387%), followed by Turkey, Czechia, Canada and Germany (n=62, 46, 43 and 36 items, respectively; Figure 1). Global production of the publications was distributed irregularly, and nearly no documents were published from African countries, except for Egypt, Tunisia, Nigeria and Kenya (Figure 2). The journals contributing the most to the literature were Clinical Toxicology, Journal of Toxicology and Forensic Science International (2.957, 2.554 and 2.285%, respectively; Table 1). Interestingly, seven of topmost productive researchers were from Czechia, and the most prolific author in the literature was Zakharov S from Charles University in Czechia with 31 papers (4.167% of all production in the literature; Table 1). Charles University was also the most contributor institution of the literature with 36 documents, and the first four places were occupied by Czechian institutions (Table 1). The USA had only one organization in the list of top ten institutions, Medical College of Wisconsin, although it ranked first in the list of the most productive countries list (Table 1).

Citation analysis and Scientometric Network Analyses

H-index of the methanol intoxication literature was calculated as 48, and the average citation per item was 14.84. The total number of citations was 11,041 (8,239 without self-citations). The peak year for citations was 2019 with 910 records (Figure 3). The most cited document in methanol intoxication literature was the original article titled "Therapeutic photobiomodulation for methanol-induced retinal toxicity" published in Proceedings of the National Academy of Sciences of the United States of America in 2003. The most used keywords were noted as "methanol", "poisoning", "ethanol", "hemodialysis" and "intoxication" (Table 2).

Articles related to the treatment of retinal damage and the most cited publications were analyzed (Table 3).

Evaluation of the Period of Pandemic (2020)

Since it is a specific and uncompleted period, we decided to assess publications produced in the COVID-19 pandemic. Our search on WoS retrieved 18 articles indexed in 2020, and there were 14 original articles in the literature with two reviews and two letters. Czechia ranked first with 4 articles as in our general analysis, including the period 1980-2019, followed by Iran, Turkey and the USA (n=2, 2, 2 documents, respectively). The most productive institutions in this period were Charles University, General University Hospital in Prague and Czech Academy of Sciences (n=3, 3, 2 items, respectively). This ranking of the institutions was the same as in the general analysis, and all three institutions were from Czechia. The most prolific authors were Diblik P, Kotikova K, Vaneckova M, Zakharov S. All authors had the same number of publications (3 documents) and all were from Czechia.

Table 2. Most used 20 keywords in methanol intoxication literature between 1980 and 2019

Keyword (Total link strength)			
1.	Methanol (295)	11.	Magnetic resonance imaging (32)
2.	Poisoning (125)	12.	Osmolal gap (31)
3.	Ethanol (105)	13.	Mortality (27)
4.	Hemodialysis (86)	14.	Liver (22)
5.	Intoxication (80)	15.	Basal ganglia (21)
6.	Ethylene glycol (79)	16.	Rat (21)
7.	Fomepizole (78)	17.	Putamen (19)
8.	Metabolic acidosis (61)	18.	Antidote (16)
9.	Anion gap (40)	19.	Brain (16)
10.	Formic acid/Formate (33)	20.	Outbreak (15)

Discussion

The terms "scientometrics" and "bibliometrics", referring to the statistical analysis of academic literature investigating the scientific characteristics of a field, including such factors as

Table 3. Top ten most cited documents in methanol intoxication literature between 1980 and 2019

Article	Author	Journal Name/Published in	Total Citation	Average Citations per Year
Therapeutic photobiomodulation for methanol-induced retinal toxicity	Eells, JT; Henry, MM; Summerfelt, P; et al.	Proceedings of The National Academy of Sciences of The United States of America	258	14.33
Methanol and Formic-Acid Toxicity - Biochemical-Mechanisms	Liesivuori, J; Savolainen, H	Pharmacology & Toxicology	217	7.23
Fomepizole for the treatment of ethylene glycol poisoning	Brent, J; McMartin, K; Phillips, S; et al.	New England Journal of Medicine	203	9.23
Toxic alcohol ingestions: Clinical features, diagnosis, and management	Krautt, Jeffrey A.; Kurtztt, Ira	Clinical Journal of The American Society of Nephrology	194	14.92
Focal Application of Alcohols Elevates Extracellular Dopamine in Rat-Brain - A Microdialysis Study	Wozniak, KM; Pert, A; Mele, A; et al.	Brain Research	144	4.80
Antidotes for methanol and ethylene glycol poisoning	Jacobsen, D; McMartin, KE	Journal of Toxicology-Clinical Toxicology	136	5.67
Alcohol Action on A Neuronal Membrane-Receptor - Evidence for A Direct Interaction with The Receptor Protein	Li, CY; Peoples, RW; Weight, FF	Proceedings of The National Academy of Sciences of The United States of America	106	3.93
Current recommendations for treatment of severe toxic alcohol poisonings	Megarbane, B; Borron, SW; Baud, FJ	Intensive Care Medicine	101	6.31
Methanol Poisoning	Kruse, JA	Intensive Care Medicine	101	3.48
Surrogate alcohol: What do we know and where do we go?	Lachenmeier, Dirk W.; Rehm, Juergen; Gmel, Gerhard	Alcoholism-Clinical and Experimental Research	93	6.64

authors, countries, keywords and publication trends, are almost identical and interchangeable. Bibliometric analyses are used to assess global scientific productivity in biomedical fields. A literature review of methanol poisoning produces limited results, and so can be considered insufficient for the assessment of global scientific productivity. To the best of our knowledge, the present study is the first to analyze global research efficiency in the field of methanol poisoning, covering the years between 1980 and 2019. On the condition that an adequate number of standardized indicators are used, such studies may support an analysis of diagnosis and treatment success in methanol poisoning, and provide information on historical changes of poisoning. It should be noted, however, that bibliometric studies have certain limitations, since they do not take into account the quality of publications [14]

In the 1980–2019 period, scientists published 744 articles on methanol poisoning, peaking in 2013 when 43 articles were published. An analysis of each country's contribution to literature places the United States in first place in terms of output over the last 39 years, with 174 articles, while Turkey, the Czech Republic, Canada and Germany have steadily increased their share. While the United States ranked first as the most productive country in terms of the number of articles, the country's contribution to literature was lower than that of the Czech Republic, where Charles University made the greatest institutional contribution to literature with 36 articles on four institutions from the same country made it into the top ten. In comparison, only one institution from the United States – the Medical College of Wisconsin – was listed in the top ten. Zakharov S., a researcher at Charles University in the Czech Republic was found to be the most prolific author, with 31 articles, mainly on toxicology, internal diseases and pharmacology.

The categorization mapping presented in Table 1 is the results of an analysis of the relationship between these topics and the years of publication.

An analysis of the top 10 journals containing articles on methanol poisoning found that six (60 percent) were listed as "toxicology journals", while the remaining four were in the "forensic science" (20 percent), "kidney disease" (10 percent) and "emergency medicine" (10 percent) categories. ''Clinical Toxicology'', the ''Journal of Toxicology'', and ''Forensic Science International'' made the greatest contributions to the literature. In the literature review, toxicology was the most searched field, with the most popular keywords being methanol, poisoning, ethanol and hemodialysis, with most searches made to identify antidotes and effective treatment methods for poisoning.

The h-index of methanol poisoning literature was calculated as 48. The total number of citations was 11,041, and 2019 was the busiest year, with 910 citations. The article cited most in methanol poisoning literature was "Therapeutic Photobiomodulation for Methanol-induced Retinal Toxicity", published in the Proceedings of the National Academy of Sciences of the United States of America in 2003. The article investigates the treatment of retinal damage secondary to poisoning, and presents treatment options for poisoning, like the other most-cited publications (Table 3).The COVID-19 pandemic introduced a novel methyl alcohol poisoning risk to the field. Shortly after the initial outbreak, rumors began to circulate in social media that the consumption of alcohol or mouthwash could prevent or treat COVID-19, which led to an increase in poisoning rates involving the consumption of industrial ethanol, as well as in the number of deaths from alcohol poisoning. At the time of writing in 2020, a total of 18 articles have been published, 14 of which are original research articles, investigating cases of methanol poisoning related to COVID-19 [7,9,10], and it is thought that the number of methanol poisoning cases may increase if the pandemic continues.

Limitations

On the condition that standardized indicators are used, such studies may be very useful for the analysis of innovative approaches to the diagnosis and treatment of methanol poisoning, and may provide information on developments in the field of poisoning management.

It should be noted, however, that bibliometric studies have certain limitations, since they do not take into account the quality of the reviewed publications [14].

Conclusion

The present study details the general diagnosis and treatment trends related to methanol poisoning researches. Despite the limitations of bibliometric studies, the present study can be argued to present a comprehensive picture of scientific studies of methanol poisoning.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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