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ORIGINAL ARTICLE

Discovered Trends and Research Novelties on Iron Deficiency Anemia through Bibliometric Analysis

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Abstract

Aims: This study aimed to determine the trend of the number of publications and visualization of the linkages on the topic of iron deficiency anemia through bibliometric analysis.

Methods: The research method used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart. Scientific publication data related to iron deficiency anemia were retrieved via https://app.dimensions.ai/ from 2000 to 2022 and further analyzed using VOSviewer.

Results: There were 143 items, 5 clusters, 4021 links, and a link strength of 47211 on the topic of iron deficiency anemia. Research trends related to iron deficiency anemia focus on genetics, knowledge, hemoglobin, and pregnant women. Suggested research topics related to iron deficiency anemia include hepatitis, disease activity, and nutrition status.

Conclusion: The findings of this study can help researchers to recognize trends and novelties of research on the topic of iron deficiency anemia and recommend directions for further research.

Keywords: Iron deficiency anemia, bibliometrics analysis, novelty, trend.

INTRODUCTION

Quality of life is an important aspect of increasing the productivity of people. Quality of life is greatly affected by health conditions that are free from physical and spiritual ailments. Physical ailments that affect a person's quality of life include iron deficiency anemia [1].

Iron deficiency anemia is a condition of blood deficiency which is characterized by decreased hemoglobin levels [2,3], hematocrit levels [4], erythrocyte count [5], and erythrocyte index [6]. Iron deficiency anemia affected symptoms of weakness and

fatigue [7], headaches [8], easy drowsiness [9], icteric [10], irregular heartbeat [11], shortness of breath [12], chest pain [13], concentration difficulty [14], and decreased intelligence [15]. Therefore, the topic of iron deficiency anemia is an interesting topic to be studied.

This interesting data can be researched through Google Trends by typing the keyword: iron deficiency anemia, search from January 2004 to April 2023, the data presented in Figure 1. This data was retrieved on May 29 2023. Figure 1 shows that interest in the topic of iron deficiency anemia has fluctuated with a steady trend increase.

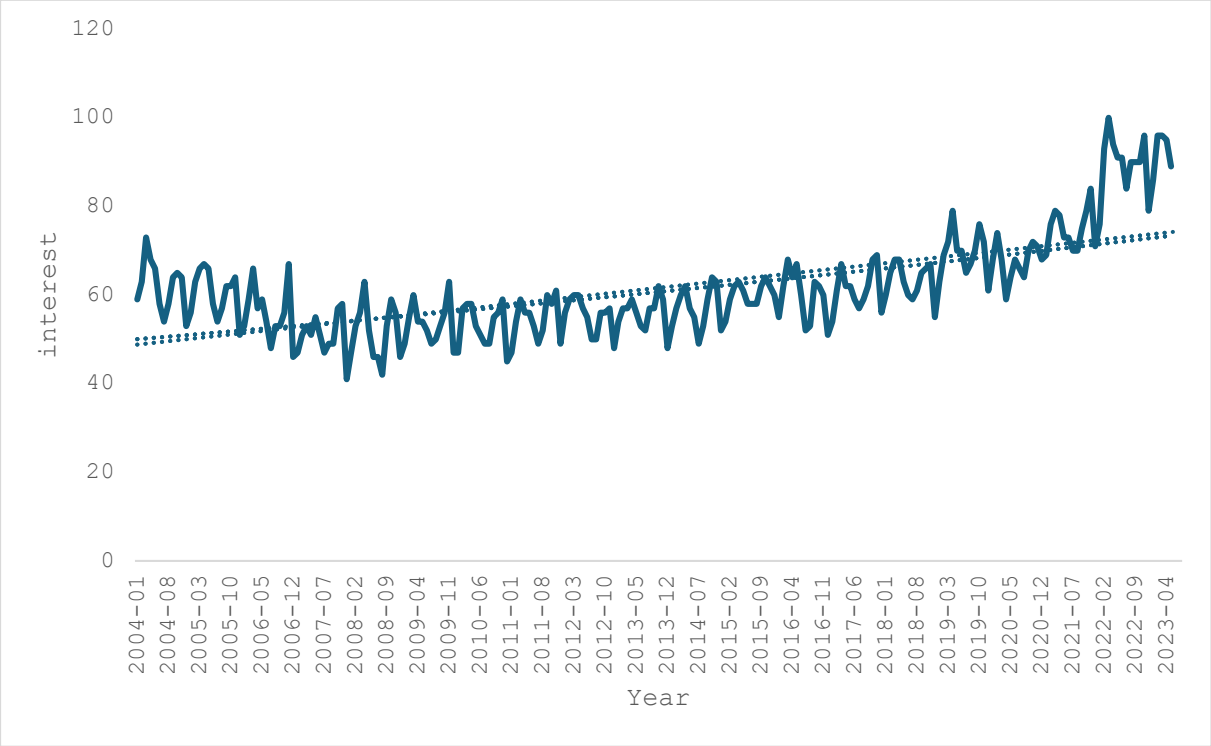

Figure 1: Interest over time in the topic of iron deficiency anemia (Data source: Google Trends)

Interest in the topic of iron deficiency anemia can be reviewed by country. Interest in the topic of iron deficiency anemia by country is presented in Figure 2. Peru is a country with high interest in the topic of iron deficiency anemia followed by Angola.

Figures 1 and 2 illustrate interest in the general topic of iron deficiency anemia. Meanwhile, researchers who wish to study the topic of iron deficiency anemia require more specific information for scientific publications in the form of scientific articles and scientific seminar proceedings.

In research related to iron deficiency anemia, researchers need information about trends and novelties for the topic in the future. This problem arises amongst researchers, especially novice researchers. Bibliometrics analysis is a statistics-based approach to research that visualizes the contribution of academic institutions and changes in research hotspots [16]. Bibliometric analysis is a scientific and quantitative method for assessing published

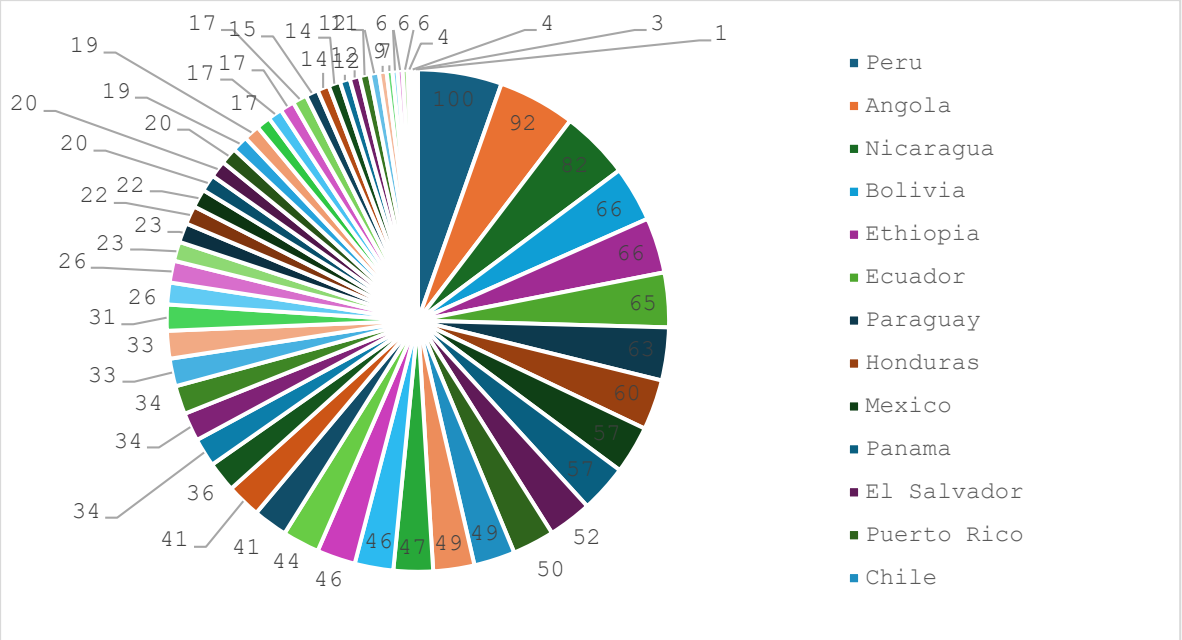

Figure 2: Histogram of interest by country on the topic of iron deficiency anemia (Data Source: Google Trends)

articles, which can help researchers find development trends and research hotspots of a particular research field, providing future research development [17]. Bibliometric analysis helps the researcher to identify emerging areas and future directions of the research domain with the help of visualization tools [18]. Bibliometric analysis has been used by various authors to evaluate information theory listed in the Scopus database [18], to evaluate immigration and environmental degradation [19], and to investigate trends in glioma radiotherapy studies since 2011 [20].

There is no bibliometric analysis of iron deficiency anemia publications to determine trends and novelty. This study was conducted to answer the following questions:

Q1. What is the trend in the number of publications on the topic of iron deficiency anemia?

Q2. What is the trend in the number of citations on the topic of iron deficiency anemia?

Q3. What is the state of network visualization on the topic of iron deficiency anemia?

Q4. What is the overlay visualization on the topic of iron deficiency anemia?

Q5. What is the density visualization on the topic of iron deficiency anemia?

This study aimed to determine the trends in the number of publications, the trend of the number of citations, network visualization, overlay visualization, and density visualization on the topic of iron deficiency anemia through bibliometric analysis.

MATERIALS AND METHODS

The research method employs Bibliometrics, one of five forms of metric studies for proper data analysis [21]. Bibliometrics analysis is better suited to statistically assess the distribution of research articles, phrases, and keywords to determine research trends [22]. Furthermore, bibliometric analysis is a study technique used in library and information science to

assess research performance [23]. Bibliometric analysis is critical in determining the impact of research because papers are rated depending on the number of citations received [24].

This study's data were based on online searches through https://app.dimensions.ai/. The data were gathered on May 30, 2023. The research method was a systematic review (Systematic Review) with steps following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart [25]. PRISMA steps include identification, screening, and inclusion, as seen in Figure 3. Stage 1 (Identification) found 199,203 records from dimensions.ai by searching for the keyword iron deficiency anemia between 2000 and 2022 and selecting the title and abstract. In stage 2 (Screening), the 'article' option was chosen, resulting in the exclusion of 10,895 records. The final sample from Stage 3 (Inclusion) provided 188,308 articles, both open and non-open access.

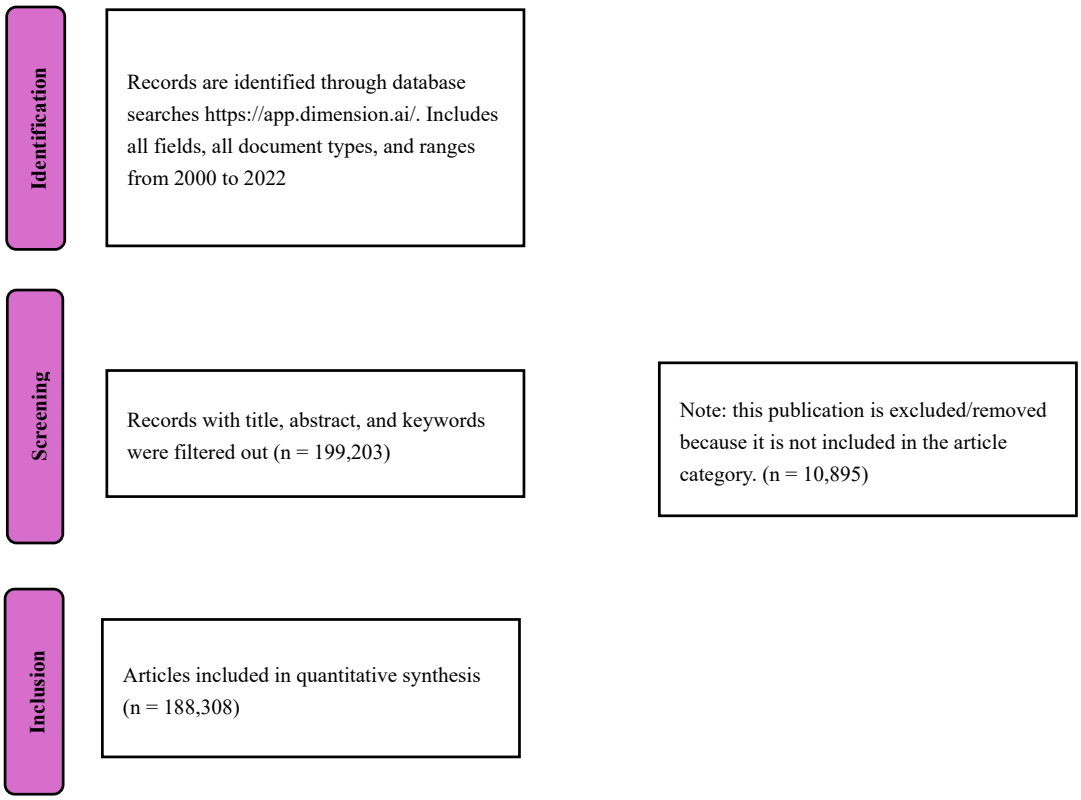

Figure 3: PRISMA flowchart (Page et al., 2021)

Data were analyzed using VOSviewer. VOSviewer is a computer program for creating and viewing bibliometric maps [26]. Type of data is selected to create a map based on text data. In this research, the analysis was reviewed for co-occurrence.

RESULTS

Searches from 2000 to 2022 yielded 173,306 scientific article publications. The number of publications on the topic of iron deficiency anemia per year from 2010 to 2022 is presented in Figure 4. The highest increase occurred in 2021 with 15,144 publications. The lowest increase occurred in 2000 with the number of publications of 3510.

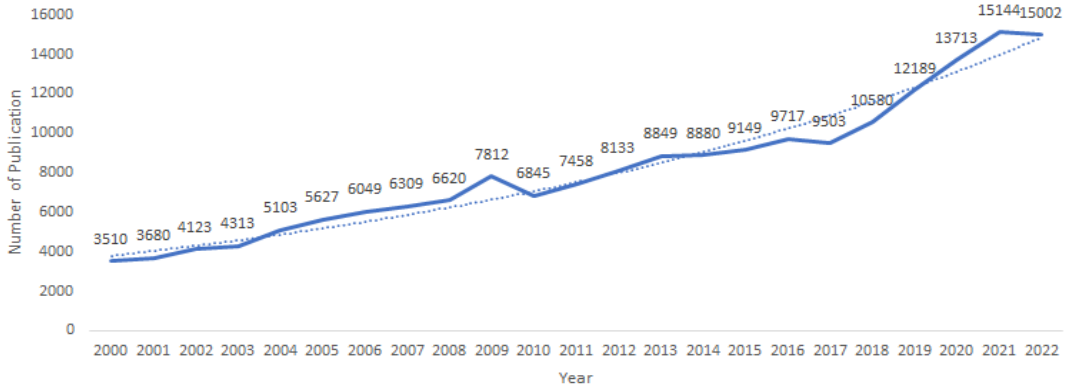

Figure 4: Number of linear regression publications from 2010 to 2022
(source: https://app.dimensions.ai/**)**

The number of citations related to the topic of iron deficiency anemia per year from 2000 to 2022 is presented in Figure 5. The highest increase occurred in 2022 with 377,158 citations. The lowest number of citations occurred in 2000 with a total of 1306 publications. The number of citations increased linearly from year to year as shown in Figure 7 on the dotted line.

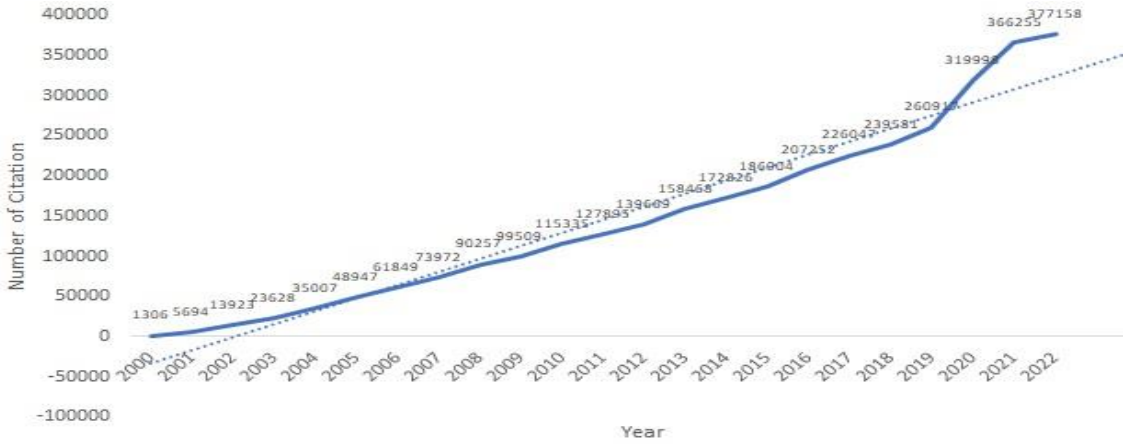

Figure 5: Number of citations for the topic of iron deficiency anemia from 2010 to 2022
(source: https://app.dimensions.ai/)

Based on data analyzed with VOSviewer from 2000 to 2022, the selected data type generated a map based on text data, and the selected data source was read from a reference management file, and title and abstract fields were chosen. The computation method used full counting, while the threshold employed minimal terms, with 10 of the 7,374 terms and 238 terms meeting the threshold. A relevancy score was calculated for each of the 238 terms. The most relevant phrases were chosen based on the score. The default option was to select 60% most relevant terms, with a total of 143 terms to choose from. Network visualization of these 143 terms is presented in Figure 6.

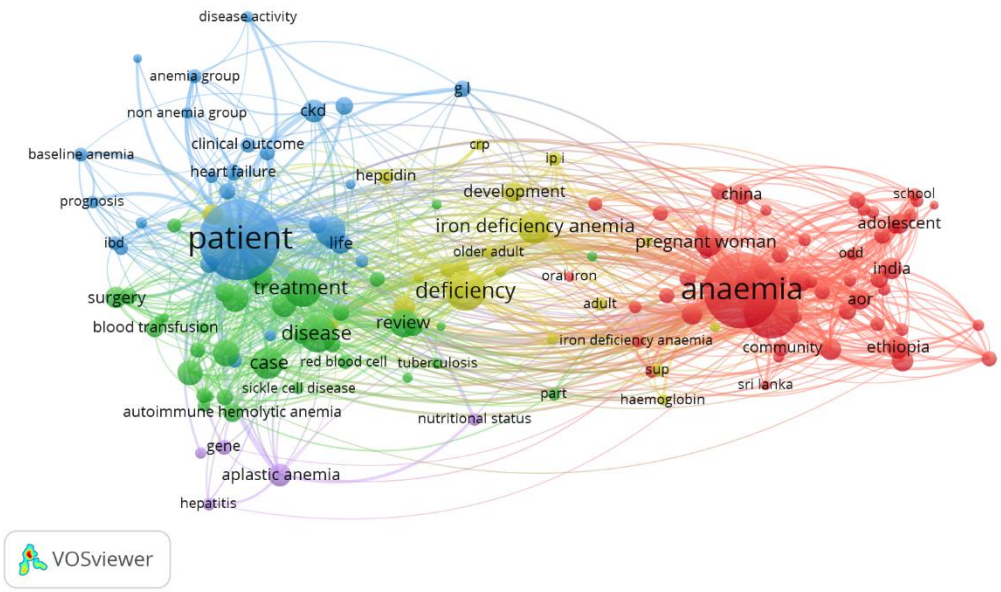

Figure 6: Network visualization

(source: VOSviewer)

VOSviewer also provides an overlay visualization map. Overlay visualization of these 143 terms is presented in Figure 7. Overlay visualization provides analysis based on the keyword iron deficiency anemia from 2010 to 2022 to observe trends in research titles related to iron deficiency anemia. Based on the visualization of the map overlay in Figure 7, the yellow nodes imply that the keywords are of current research interest. For example, current research trends in iron deficiency anemia focus, among others, on the third trimester, determinants, and knowledge.

The density visualization of these 143 terms is presented in Figure 8.

Figure 8 shows a visualization of density with the number of items that are found in several items, one of which is the patient. Some items with yellow knots mean that they have been widely used as topics in previous journal publications. Thus, research topics related to iron deficiency anemia are suggested to be topics that have a visualization of density in the low category including nutritional status, hemoglobin, and iron deficiency.

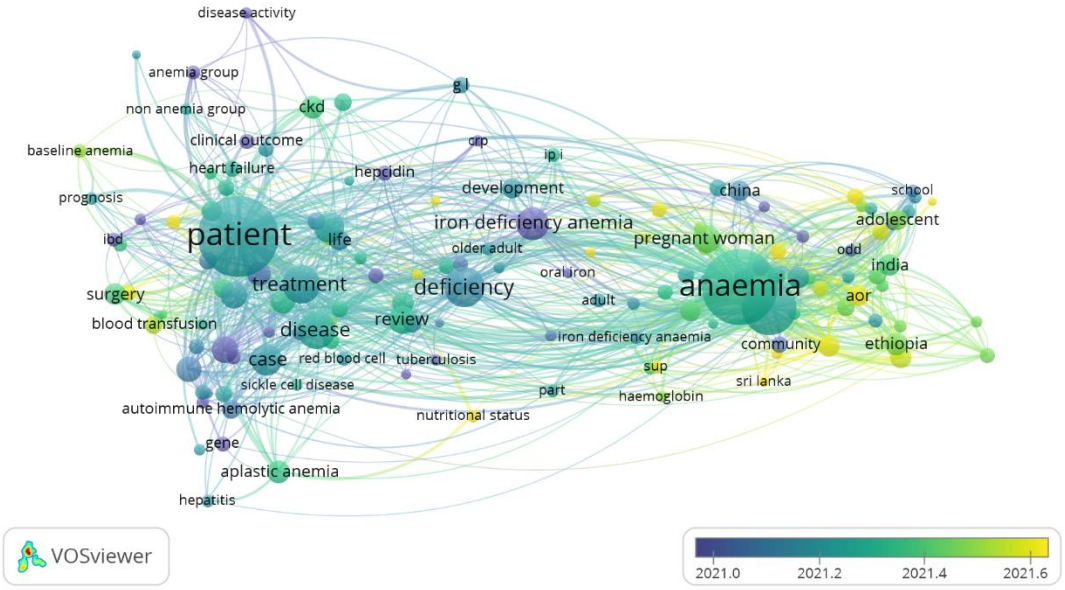

Figure 7: Overlay visualization

(source: VOSviewer)

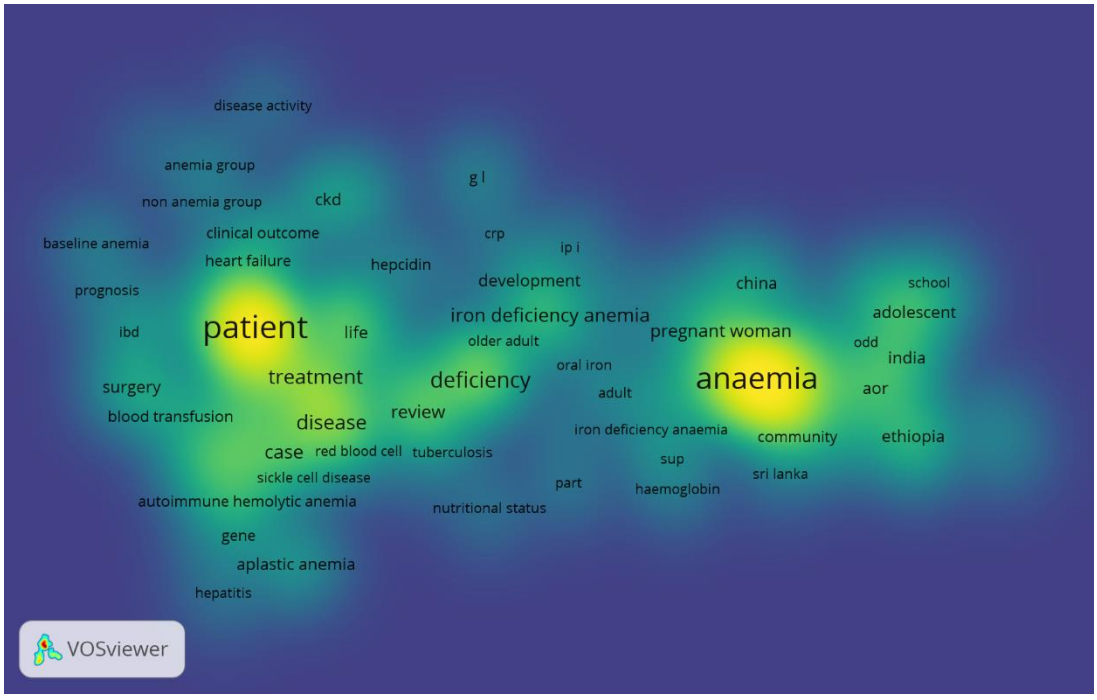

Figure 8: Density visualization

(source: VOSviewer)

DISCUSSION

Referring to Figure 4, bibliometric analysis was used in studies on the topic of iron deficiency anemia in the statistical field. This bibliometric approach can also be applied to themes in engineering [22], health [17] and education [27]. This study shows that from 2000 to 2022, the lowest number of iron deficiency anemia articles occurred in 2000 and the maximum in 2021, with an average of 8187.3 (Figure 9). The number of publications increased exponentially from year to year.

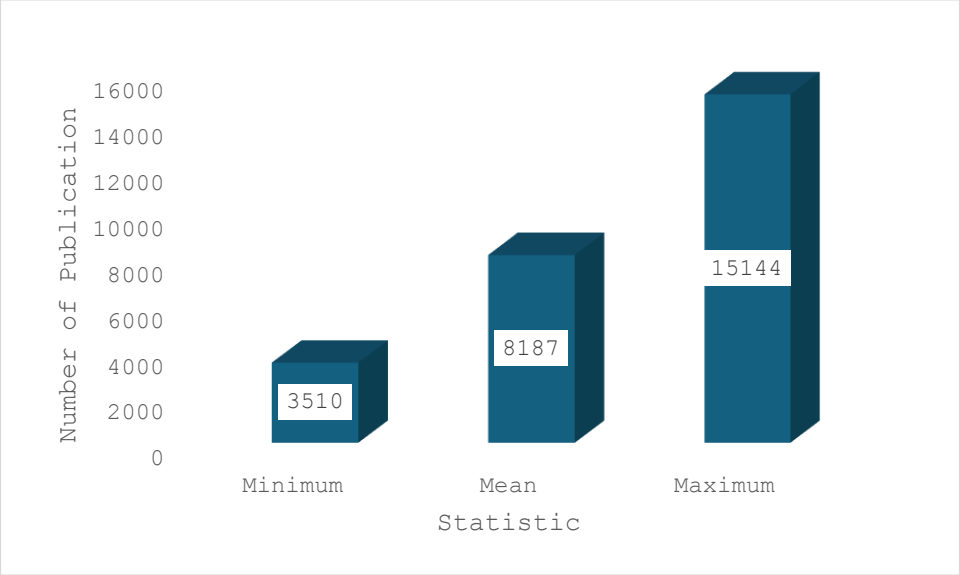

Figure 9: Histogram of the increase in the number of smallest, average, and highest publications for the topic of linear regression

With 370 publications, Hagop M. Kantarjian from The University of Texas MD Anderson Cancer Center in the United States was the author who has contributed the most to this iron deficiency anemia topic. With a total of 1,590 citations, the article titled 'A Double-Blind Placebo-Controlled Trial of Ruxolitinib for Myelofibrosis' was the most widely cited of the 370 publications [28]. In that study, ruxolitinib administration provided a significant clinical benefit in patients with myelofibrosis by reducing spleen size, improving debilitating myelofibrosis-associated symptoms, and increasing overall survival when compared to placebo, but side effects were more frequent iron deficiency anemia and thrombocytopenia in the early part of the treatment period. This study was very relevant to aspects of the diagnosis of myelofibrosis sufferers [29]. The Blood Journal, with 236 articles, was the journal with the most iron deficiency anemia. The article titled 'International Working Group (IWG) consensus criteria for treatment response in myelofibrosis with myeloid metaplasia, for the IWG for Myelofibrosis Research and Treatment (IWG-MRT)' received the most citations, totalling 280 [30]. The article was consistent with the scope of the journal Blood, which, according to VIOSviewer's analysis of the 5 cluster terms, largely discusses blood and iron deficiency anemia. Biomedical and Clinical Sciences, with 236 publications, was the field of science that discusses iron deficiency

anemia the most. Based on the number of articles in this field of science, it is advised that researchers investigating iron deficiency anemia publish and refer to studies published in Biomedical and Clinical Sciences journals.

According to Figure 5, the year 2000 had the fewest iron deficiency anemia citations, while 2022 had the most, with an average of 145756.4 (Figure 10). The high number of citations in 2022 indicates that iron deficiency anemia was still a topic of discussion at the end of the year, and its incidence increased in various regions [31]. The number of citations also increased from year to year linearly. The paper entitled '2016 ESC Guidelines for the Diagnosis and Treatment of Acute and Chronic Heart Failure' had the most citations. The European Society of Cardiology (ESC) Task Force for the Diagnosis and Treatment of Acute and Chronic Heart Failure Developed with Special Contribution of the ESC Heart Failure Association (HFA) [32] had 10,159 citations. This article does not go into detail on iron deficiency anemia. Even though it is still related to the research of iron deficiency anemia, the article's highest number of citations may be impacted by the number of authors, namely 112. The second most cited article, with 7,566 citations, is 'Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries in 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017 [33]. These studies showed that a large proportion of the world's population experiences non-fatal health loss with considerable heterogeneity among different causes, locations, ages, and sexes. Non-fatal loss of health is associated with iron deficiency anemia studies. Iron deficiency anemia is a condition characterized by reduced hemoglobin in the body [34–36]. Hemoglobin is a metalloprotein, namely a protein containing iron in red blood cells that functions as a carrier of oxygen from the lungs throughout the body [37, 38]. Iron deficiency anemia can reduce the quality of life, especially at 60 years and over [39].

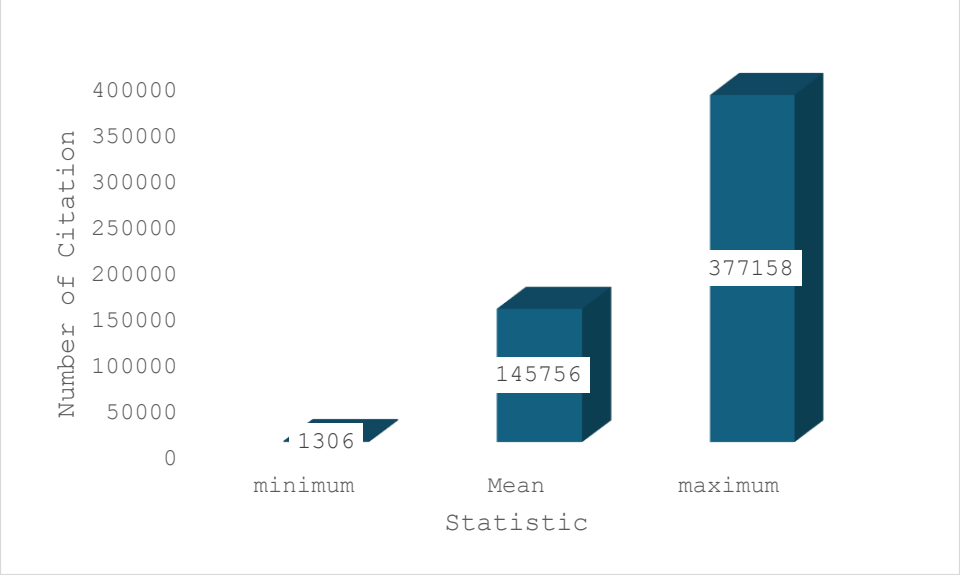

Figure 10: Histogram of the increase in the number of smallest, average, and highest citations for the topic of iron deficiency anemia

Referring to Figure 6-8 of the VOSviewer analysis results, two items connected by a line indicate that the two items appear together in a title and abstract. Conversely, two items not connected by a line indicate that the two items do not appear together in the title and abstract. VOSviewer analysis yielded 143 items, 5 clusters, 4021 links, and a total link strength of 47211. In more detail, these clusters are presented in Table 1.

Table 1: Clusters for the topic of iron deficiency anemia (Source: VOSviewer)

Cluster	Number of items	Cluster member items
1	54	An adolescent, adolescent girl, iron deficiency anemia, iron deficiency anemia prevalence, aor, area, associated factor, benefit, boy, childhood iron deficiency anemia, childhood iron deficiency anemia, china, cluster, community, cross-sectional study, delivery, determinant, district, education, Ethiopia, first trimester, food, ghana, girl, health survey, HIV, ifa, inda, iron deficiency anemia, knowledge, magnitude, malaria, maternal iron deficiency anemia, mother, nigeria, obesity, odd, odds ratio, oral iron, predictor, pregnant woman, the present study, prevention, region, reproductive age, rural area, school, severe iron deficiency anemia, third trimester, women.
2	37	Aiha, anemium, autoimmune hemolytic, blood transfusion, cancer patient, case. Case report, chronic disease, complication, day, diagnosis, differential diagnosis, disease, drug, erythropoiesis, iron deficiency anemia, perioperative iron deficiency anemia, red blood cell, review, sickle cell disease, thalassemia, transfusion, treatment, tuberculosis, zinc deficiency.
3	27	Acs, admission, iron deficiency anemia group, baseline iron deficiency anemia, chronic kidney disease, CKD, clinical outcome, covid, disease activity, heart failure, higher risk, hospitalization, inflammatory bowed, life, ibd, mortality, non-iron deficiency anemia group, patient, prognosis, quality, report, survival, thrombocytopenia.
4	20	Adult, cancer, crp, deficiency, development, etiology, fetal iron deficiency anemia, haemoglobin, hepcidin, iron deficiency anemia, micronutrient deficiency, nutritional deficiency, older adult, pathogenesis, pernicious iron deficiency anemia, role, sub, vitamin.
5	5	Aplastic iron deficiency anemia, Fanconi iron deficiency anemia, gene, hepatitis, nutritional station.

According to VOSviewer's analysis, there were many studies and publications on iron deficiency anemia associated with genetics, knowledge, hemoglobin, pregnant women, third trimester, adolescent girls, India, childhood iron deficiency anemia, iron deficiency anemia, and vitamins. Currently, the publication trend in Overlay visualization is towards iron deficiency anemia, which is associated with knowledge, aor (adjusted odds ratio), adolescent girls, third trimester, and pregnant women. It is yet not saturated for studies on iron deficiency anemia related to hepatitis, disease activity, and nutrition status based on density visualization.

Although this research has provided insight into the development of iron deficiency anemia papers from 2000 to 2022 via https://app.dimensions.ai/, it has limitations. New publications are added to the https://app.dimensions.ai/ database regularly. As a result, the iron deficiency

anemia bibliometric analysis may be reassessed in the coming years. Furthermore, this bibliometric study solely extracts data from scientific articles from the https://app.dimensions.ai/ database. Further research should be added to other databases for a broader and more complete picture of iron deficiency anemia.

CONCLUSION

This study used https://app.dimensions.ai/ to undertake a bibliometric analysis of iron deficiency anemia papers from 2000 to 2022. This study yielded some findings. The number of citations on the issue of iron deficiency anemia has increased linearly with the many publications on the topic of iron deficiency anemia, which has an exponentially expanding trend. The relationship between iron deficiency anemia and various other issues may be evaluated using VOSviewer, particularly on density visualization, and it is discovered that there are still many opportunities to investigate iron deficiency anemia associated with hepatitis, disease activity, and nutrition status.

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الاتجاهات المكتشفة والمستجدات البحثية حول فقر الدم الناجم عن نقص الحديد من خلال التحليل الببليومتري

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الملخص

الخلفية والاهداف: تهدف هذه الدراسة إلى تحديد اتجاه عدد المنشورات وتصور الروابط حول موضوع فقر الدم بسبب نقص الحديد من خلال التحليل الببليومتري.

منهجية الدراسة: تستخدم طريقة البحث المخطط الانسيابي لعناصر إعداد التقارير المفضلة للمراجعات المنهجية والتحليلات الوصفية (PRISMA). تم استرجاع بيانات المنشورات العلمية المتعلقة بفقر الدم الناجم عن نقص الحديد عبر https://app.dimensions.ai/من عام 2000 إلى عام 2022 وتم تحليلها بشكل أكبر باستخدام VOSviewer.

النتائج: هناك 143 فقرة و5 مجموعات و4021 رابط وقوة رابط 47211 في موضوع فقر الدم بعوز الحديد. تركز اتجاهات البحث المتعلقة بفقر الدم الناجم عن نقص الحديد على علم الوراثة والمعرفة والهيموجلوبين والنساء الحوامل. تشمل موضوعات البحث المقترحة المتعلقة بفقر الدم الناجم عن نقص الحديد التهاب الكبد ونشاط المرض والحالة التغذوية.

الاستنتاج: يمكن لنتائج هذه الدراسة أن تساعد الباحثين على التعرف على اتجاهات ومستجدات الأبحاث حول موضوع فقر الدم بسبب نقص الحديد والتوصية بتوجيهات لمزيد من البحث.

الكلمات الدالة: فقر الدم بسبب نقص الحديد، التحليل الببليومتري، الجدة، الاتجاه.