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Supplementary Material



Analysis of Publication Activity and Research Trends in the Field of Lichen Planus: Pubmed Review

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PRISMA 2009 Checklist.

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Systematic review	1
ABSTRACT			
Structured summary	2	<p>Background: Currently, there is only one bibliometric study of lichen planus (LP) and oral lichen planus (OLP) in the literature, which examined the most cited articles in the Scopus database. Our study covered all published articles for 140 years since 1880 to 2021 in the PubMed database. In addition to the classical bibliometric analysis, we conducted a lexical analysis of key terms in order to build research trends in the field of oral lichen planus.</p> <p>Aims: Analysis of publication activity in the field of lichen planus by countries, their economic status and population, as well as identification of concomitant diseases by lexical analysis of key terms extracted from headings and abstracts over the past 20 years.</p> <p>Methods: Information from the PubMed database was retrieved automatically based on a query for the period from 1880 to 2021 including the fields: title, abstract, authors, and year of publication. A total of 8173 articles were retrieved. The selection of keywords and the identification of trends in related terminology were carried out using a combination of expert and automatic methods.</p> <p>An analysis of publication activity by country and by socio-economic indicators was carried out. With the help of neural network analysis the most characteristic terms related to LP were identified. Common terms were ranked by occurrence in titles and abstracts.</p> <p>Results: Publication activity in the field of LP and OLP has especially increased in the 21st century. The United States is the most productive country. China is a leader among countries with economies in transition. India is a leader among emerging economies. LP research is distributed worldwide. Finland ranks first in the number of publications per capita. The temporal dynamics of terminology is noted including an increase in the number of terms used in any field of science (hereinafter referred to as general scientific terms).</p> <p>Conclusion: Publication activity in the field of LP and OLP has increased significantly in the 21st century. The highest publication activity was observed among authors from India, the USA and China. The leaders among economically developed countries are Italy, among the countries with economies in transition - China, and among the emerging economies - India. Based on lexical analysis of key terms the following concomitant diseases were identified: carcinoma, leukoplakia, hepatitis, lupus.</p>	1
INTRODUCTION			
Rationale	3	<p>This study presents the analysis of the researchers' performance in the field of lichen planus (LP). The data were extracted from the PubMed database with the search by parameters: relative growth rate, country-wise distribution, and prevailing vocabulary.</p> <p>Lichen planus is a chronic inflammatory, immune-dependent disease of the skin and mucous membranes. In general structure of dermatological morbidity, LP is 1.5-2.4%, among all diseases of the oral mucosa — 30-35%. Despite the prevalence, only one bibliometric analysis related to LP in the academic literature has been carried out.</p>	3
Objectives	4	Usually, bibliometrics studies focused on a single combination of words. Our approach is based on the study of terms with the use of contextual analysis.	3
METHODS			

Section/topic	# Checklist item	Reported on page #
Protocol and registration	5 Not applicable	-
Eligibility criteria	6 Scientific papers published from 1880 to 2021, English. PubMed Library on-line	4
Information sources	7 Scientific papers published from 1880 to 2021.	4
Search	8 Advanced Search Builder from PubMed. Special program for extracting articles with certain keywords/terms in titles and abstracts from PubMed.	4
Study selection	9 Selection of articles with the term “lichen planus”, breaking them down over the years.	5
Data collection process	10 The process includes two steps. The first step uses semantic selection of appropriate terms with a short context size (with the 3 words window). Next, a semantic information is used to select the prevalent terms by year.	5
Data items	11 We proceeded from the assumption that the joint use of terms indicates their joint study.	
Risk of bias in individual studies	12 Not applicable	-
Summary measures	13 Not applicable	-
Synthesis of results	14 Not applicable.	-
Section/topic	# Checklist item	Reported on page #
Risk of bias across studies	15 Not applicable	-
Additional analyses	16 Lexico-semantic analysis of key words. Trend analysis by key terms	12, 13

RESULTS

Study selection	17	<pre> graph TD PubMed[PubMed] -- key terms --> C1[Collection 1 using MeSH Terms related to lichen planus] C1 --> P1[Process 1 Analysis of publication activity] C1 --> P2[Process 2 Analysis by countries] C1 --> D[Differentiation by economic status of countries] C2[Collection 2 titles and abstracts by each year] --> P3[Process 3 Analysis by population] C3[Collection 3 titles and abstracts by 20-year periods] --> P5[Process 5 Lexical analysis] D --> P4[Process 4 Analysis by GDP per capita] P5 --> P6[Process 6 Analysis of concomitant diseases] </pre>	6
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Study characteristics	18 The data for our study were extracted from the PubMed database. The following search keywords were used (search query fragment): “lichen planus” OR “lichen planus pigmentosus” OR “hypertrophic lichen planus” OR “mucosal lichen planus” OR “annular lichen planus” OR “hypertrophic lichen planus” OR “atrophic lichen planus” OR “ulcerative lichen planus” OR “bullous lichen planus” OR “lichen planus pemphigoides” OR “inverse lichen planus” OR “actinic lichen planus”. We analyzed articles published from 1880 to 2021. A total of 8173 records for LP and 4775 records for OLP were extracted from PubMed database for this study (15.01.2021). The papers from different countries were identified by using the Advanced Search Builder. The number of publications by country was determined by inserting the name/s of the countries in the «affiliation» field in the «advanced» section of the PubMed search engine, for example, (“lichen planus”[MeSH Terms] OR to (“lichen”[All Fields] AND “planus”[All Fields]) OR “lichen planus”[All Fields] AND Andorra[Affiliation]), (“lichen planus”[MeSH Terms] OR (“lichen”[All Fields] AND “planus”[All Fields]) OR “lichen planus”[All Fields]) AND (USA[Affiliation] OR United States[Affiliation]). The search query for the oral lichen planus was the following: (“lichen planus, oral”[MeSH Terms] OR (“lichen”[All Fields] AND “planus”[All Fields] AND “oral”[All Fields]) OR “oral lichen planus”[All Fields] OR (“oral”[All Fields] AND “lichen”[All Fields] AND “planus”[All Fields])) AND (“0001/01/01”[PubDate]: “2020/12/31”[PubDate]). To calculate the number of publications per country, we searched for publications by affiliation of authors. Then we summarized the number of publications with known affiliation and expressed the number of publications by country as a percentage of the total number of extracted publications. To find the number of publications per million persons or gross domestic product (GDP), we divided the number of publications per country's population (or per GDP). A special search strategy was developed for the present study. To extract keywords from the titles and abstracts, we used MEDLINE/PubMed database for all years. A set of programs in the python language was developed. The programs extract articles with certain keywords/terms in titles and abstracts and perform statistical terms' analysis of the MEDLINE/PubMed database records (titles, abstracts, authors, etc.). Based on the terminology statistics of thematic collections, we determined the words and collocations more often found together with the studied terms (the key terms of collection, for example, “lichen planus”) in titles and abstracts by periods. When researching the trends of concomitant diseases, the search was built according to the scheme: (“lichen planus”[MeSH Terms] OR (“lichen”[All Fields] AND “planus”[All Fields]) OR “lichen planus”[All Fields]) AND (“leukoplakia”[MeSH Terms] OR “leukoplakia”[All Fields]). Example of the Search query: (LICHEN PLANUS) AND LUPUS included to (“lichen planus”[MeSH Terms] OR (“lichen”[All Fields] AND “planus”[All Fields]) OR “lichen planus”[All Fields]) AND (“lupus vulgaris”[MeSH Terms] OR (“lupus”[All Fields] AND “vulgaris”[All Fields]) OR “lupus vulgaris”[All Fields] OR “lupus”[All Fields] OR “lupus erythematosus, systemic”[MeSH Terms] OR (“lupus”[All Fields] AND “erythematosus”[All Fields] AND “systemic”[All Fields]) OR “systemic lupus erythematosus”[All Fields]).	4-6, 8
Risk of bias within studies	19 Not applicable	-
Results of individual studies	20 Not applicable	-
Synthesis of results	21 Not applicable	-
Risk of bias across studies	22 Not applicable	-
Additional analysis	23 Not applicable	-
DISCUSSION		
Summary of evidence	24 A comparative analysis of publication activity over the decades showed that more than 62% of the total number of publications was published in less than 20 years of the 21st century. In the most productive 20 countries in LP research, India stands out in the first place with 17,11% of the total number of publications. LP has a worldwide distribution with no overt racial predisposition. We investigated whether the Gross Domestic Product (GDP) influences LP research productivity in all countries by economic groups according to the classification of the International Monetary Fund. The leaders among the economically developed countries are Italy, USA, UK, Spain, Japan. Among the countries with economies in transition, China is the undisputed leader. Among the emerging economies, the leaders are India, Iran and Brazil. Countries with economies in transition and countries of the former USSR either do not have publications at all or have very few. A statistical analysis of the headings and abstracts of articles related to LP made it possible to distinguish the following lexical and semantic groups. The total number of words selected in 1960-1979 was 664, in 1980-1999 - 4413, 2000-2020 - 11168. In each reviewed period, the titles were dominated by specific medical terms (related to the disease). In each period, general scientific terms were in the second place in use, and general medical terms were in the third place. However, the dynamics of the correlation of terms is noted.	17, 18, 19.
Limitations	25 The study was limited to English-language publications	

Section/topic	#	Checklist item	Reported on page #
Conclusions	26	The bibliometric analysis of publications in the field of lichen planus was performed for the period 1880–2020. It is shown that publication activity has increased significantly in the 21st century. At the same time, the growth of publications related to OLP is faster. We have identified the most active 20 countries by the number of publications per 1 million people. The analysis of the dependence of publication scientific activity on the GDP of countries was carried out. The article contains lexical analysis of key terms, statistical processing of a variety of terms, and the definition of thematic groups of terms. Based on the analysis of publication activity, terminological trends were calculated for the period from 1960-2020, and the correlation between the most popular areas of research in the field of lichen planus was determined. Recently, special attention has been paid to the problem associated with lichen planus and other diseases such as carcinoma and leukoplakia, which may be a topic for further deeper studies. The growth is noted for publications related to carcinoma and LP, and notably for carcinoma and OLP.	19-20
FUNDING			
Funding	27	The reported study was funded by RFBR, project number 20-04-60185. The reported study was funded by RFBR and NSFC, project number 21-57-53018.	20

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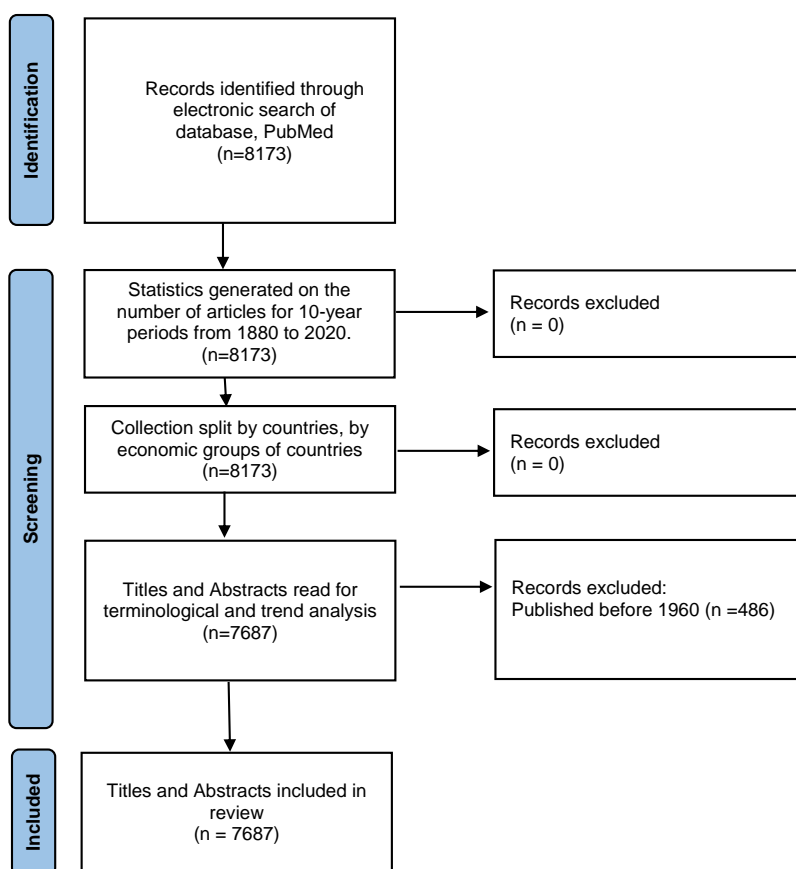


Fig. (1). PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers only.