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Review Article

Chronic Respiratory Diseases: A Mediterranean View

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ABSTRACT

Background: Understanding Chronic Respiratory Diseases (CRDs) in the Mediterranean region is important for developing effective interventions and policies. **Methodology:** To achieve this, we mapped and quantified CRD research output using a bibliometric study. Utilizing SCOPUS and PubMed databases, we selected a total of 6,686 publications over a 25-year period across 22 countries in the Mediterranean region. We refined our search across databases by using terms such as "Chronic Respiratory Diseases", "Risk Factors", and "Management". VOSviewer aided our analysis in highlighting research collaborations, identifying key content areas, and analyzing the research output distribution by country and institution. **Results:** This analysis showed that, remarkably, the Mediterranean region accounted for a significant 34.7% of global CRD research, indicating its substantial contribution to the field. This substantial contribution has been achieved by key authors such as Miravitlles, Roche, and Soriano. However, our analysis revealed a noteworthy trend, with terms like 'smoker' dominating the discourse, while topics such as allergies and pollutants received comparatively less significance. **Conclusion:** This bibliometric analysis provides valuable insights into the research landscape of CRDs in the Mediterranean area. By identifying research gaps and highlighting areas of focus, we can better direct future efforts towards addressing these pressing health concerns. Moreover, the significant contribution of the Mediterranean region to CRD research emphasizes the importance of encouraging international cooperation. By collaborating across various organizations and nations, we can develop practical strategies for managing and preventing chronic respiratory illnesses, ultimately improving the health outcomes of populations in the Mediterranean region and beyond.

Keywords: Chronic Respiratory Disease, Bibliometric Analysis, Mediterranean, Asthma, Risk Factors, Management.

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INTRODUCTION

Chronic Respiratory Diseases (CRDs) encompass various lung-related illnesses primarily triggered by exposure to environmental inhalants, impacting individuals globally (James *et al.*, 2018). CRDs pose a significant health burden in the Mediterranean region due to their high prevalence, severity, and financial burden, necessitating effective interventions and policies (Aït-Khaled *et al.*, 2001). Despite their significant public health burden, CRDs receive less research funding and attention compared to other diseases like Alzheimer's, cancer, and heart disease (Fallahzadeh *et al.*, 2022). Globally, CRDs have seen a significant rise in prevalence, particularly in high-income regions, with bronchial asthma and Chronic Obstructive Pulmonary Disease (COPD) being the most prevalent types (Soriano *et al.*, 2020).

This increase emphasizes the need for intensified research and preventive measures, including vaccination campaigns and smoking cessation programs (Hellings *et al.*, 2017). Moreover, lifestyle modifications, early diagnosis, and addressing environmental factors play a crucial role in managing these complex diseases, which often manifest from childhood and worsen with age.

The Mediterranean region, despite its diverse cultures and climates, suffers significantly from CRDs, making it a unique area for research. However, there's a lack of information on CRD prevalence, incidence, and burden in the Eastern Mediterranean region (Masjedi *et al.*, 2018). Given the region's unique characteristics, a comprehensive review of the literature is necessary to identify research gaps. Thus, a bibliometric study is needed to assess the volume of research on CRDs, identify management trends, and pinpoint risk factors contributing to their rising prevalence.

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Researchers in the Mediterranean region can collaborate through research networks identified via bibliometric analysis, fostering collaboration and joint research projects. Understanding these networks helps locate key scholars and institutions leading in the field, offering future cooperation opportunities. A bibliometric analysis of studies on CRDs in the Mediterranean region is urgently needed based on these points.

This work aims to assess research on CRDs in the Mediterranean region through a bibliometric analysis, revealing publication trends and key issues. The main goal is to map the current state of research on CRDs in the Mediterranean by offering an in-depth analysis of focus areas and collaboration patterns.

METHODOLOGY

This study focused on CRDs as the primary research field, utilizing SCOPUS and PubMed databases. Explicit criteria were set for search precision.

Keyword combinations like "Chronic Respiratory Diseases", "Risk Factors", and "Management", along with Mediterranean countries, were used. Boolean operators like AND, OR, and NOT were applied to align curated studies with research objectives, excluding irrelevant ones.

A systematic search was conducted using PubMed and SCOPUS, focusing on original studies on risk factors and management strategies for CRDs, limited to clinical and epidemiological studies on human adults in Mediterranean countries. Reviews, systemic reviews, meta-analyses, studies on infectious diseases, pediatrics, trauma, cell cultures, *in vitro* experiments, and animal models were excluded.

Three reviewers examined publications from 1997 to 2023 to identify the country of origin and publication type. Data was confirmed by at least one other reviewer.

The ratio of CRD research in the Mediterranean region to global CRD research was calculated by dividing the number of Mediterranean references by the global references on CRDs.

VOSviewer software was used for bibliometric analysis to visualize bibliometric networks by creating clusters of related nodes (Van Eck and Waltman, 2014). In the authorship network, the top 30 authors contributing to Mediterranean CRD research were identified. The size of each node represented the number of articles published by an author, with larger nodes indicating higher publication counts. Additionally, two co-occurrence networks were created to reflect associations between keywords found in titles and abstracts. In these networks, nodes represented keyword frequency, while lines between nodes illustrated connections between keywords (Arruda *et al.*, 2022).

RESULTS

Many authors published papers on chronic respiratory diseases across 22 Mediterranean countries. The top 30 authors, selected for having at least eight publications, are listed in Table 1 by the number of papers they've written. These authors are primarily from Spain, Italy, France, and Greece. The mean H-index among them is 60 (range: 19-119). The top five are Miravitlles, M; Roche, N; Soriano, JB; Garcia-Aymerich, H; and Gourgoulianis, KI. Professor Miravitlles leads with 33 papers, an H-index of 98, and a total link strength of 133. Garcia-Aymerich follows with 16 papers, an *H*-index of 67, and a link strength of 103. Despite having one of the highest H-indexes (119), Torres has only 11 papers and a link strength of 53. At the list's end, Plaza V has eight papers, an H-index of 40, and a link strength of 8. Figure 2 also highlights low collaboration levels among authors from different countries.

To enhance visualization, 73 keywords appearing more than five times were selected using VOSviewer. The analysis focused on the total occurrences, with the visualization map shown in Figure 2. Tables 2a and 2b present the top 20 terms by occurrence and relevance. A keyword's relevance indicates its ability to provide valuable insights, while its occurrence shows its frequency. The five most frequent keywords are quality (46), life (43), diagnosis (27), smoker (24), and adult and COPD exacerbation (23). However, no clear pattern links occurrence to relevance, as some low-occurrence terms like COPD prevalence, stable COPD, air pollution, and idiopathic pulmonary fibrosis still hold high relevance in chronic respiratory disease research.

Title content

For better visualization of the search, title content with more than 5 appearances was selected via VOSviewer title and 73 keywords met this requirement. The visualization was based on the total number of occurrences, and the visualization map is presented in (Figure 3). In addition, Tables 2a and 2b were shown to analyze the occurrence and relevance of the 1st 20 terms. The relevance of a keyword depends on its ability to convey valuable information or insights within a given context, while its occurrence indicates how frequently it appears within that context.

The five most frequently used keywords were determined as quality (occurrences=46), life (occurrences=43), diagnosis (occurrences=27), smoker (occurrences=24), and adult and COPD exacerbation (occurrences=23). However, the pattern between occurrence and relevance is random, suggesting no discernible relationship as they appear to happen independently of each other. For example, COPD prevalence has an occurrence of 5 but it has the 2nd highest relevance (2.5431) similarly to the keywords stable COPD, air pollution, and idiopathic pulmonary fibrosis that have low occurrence but are significant in relation to the research about chronic respiratory diseases.

In Figure 3, 73 keywords appearing over five times were grouped into seven clusters, with node size indicating frequency. Keywords in titles and abstracts reveal a paper's main ideas. From 352 keywords appearing over ten times, five clusters were identified (Figure 4). The blue and purple clusters mainly include chronic respiratory disease names like asthma and interstitial lung disease. The green cluster includes smoker, nitric oxide, and air pollution. The red and yellow clusters focus on CRD management, with terms like improvement and hospital admission, while depression appears in the red cluster, highlighting the importance of managing psychological symptoms.

Tables 3a and 3b analyze the top 20 title and abstract keywords. The most frequent keywords are asthma (207 occurrences), mortality (180), quality (157), smoking (104), and hospitalization (98). However, the highest relevance scores are for HADS (4.2139), C-PAP (4.074), depression scale (3.8585), hospital anxiety (3.7507), and continuous positive airway pressure (3.4395), indicating that the most relevant research focuses on CRD management, including asthma, COPD, and idiopathic pulmonary disorder.

DISCUSSION

This bibliometric analysis of chronic respiratory disease research over 25 years in Scopus and PubMed offers valuable insights into the field's progress, challenges, and the Mediterranean region's significant contribution, driven by high disease prevalence.

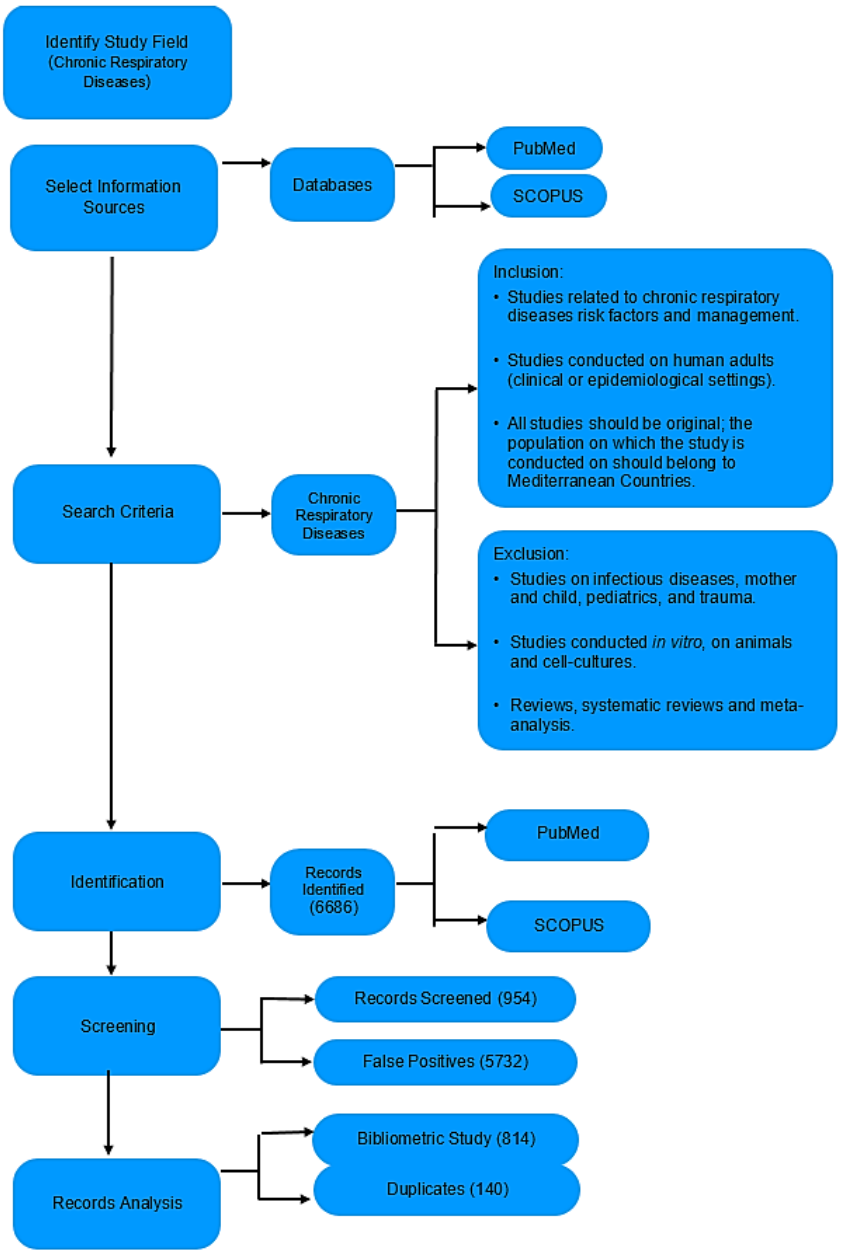

Figure 1: Abstracts flowchart of publications related to chronic respiratory diseases in the Mediterranean countries.

Table 1: Top 30 authors with the highest number of published documents.

Authors	Documents	Total link strength	Major institution	Countries	*h*-index
Miravitlles, M.	33	133	Hospital universitari Vall d'herbon institut de recerca (VHIR)	Spain	98
Roche, N	20	89	Aix-marseille university CNRS - CEREGE UMR 7330	France	32
Soriano, J. B.	18	71	Facultad de Medicina de la Universidad Autónoma de Madrid	Spain	99
Garcia-Aymerich, J.	16	103	Instituto de Salud Global de Barcelona	Spain	67
Gourgoulianis, K.I	13	11	University of Thessaly	Greece	51
Almagro, P.	12	31	Mutua de Terrassa	Spain	28
Casanova, C.	12	68	Hospital Universitario Nuestra Senora de Candelaria	Spain	46
Santus, P.	12	48	Università degli Studi di Milano	Italy	37
Scichilone, N.	11	57	Università degli Studi di Palermo	Italy	44
Torres, A.	11	53	Institut d'Investigacions Biomèdiques August Pi i Sunyer - IDIBAPS	Spain	119
Antó,J. M.	10	64	Instituto de Salud Global de Barcelona	Spain	101
Braido, F.	10	41	IRCCS San Martino Polyclinic Hospital	Italy	40
Canonica, G. W.	10	36	Humanitas Research Hospital	Italy	108
Celli, B.R.	10	51	Harvard Medical School	Spain	119
Fabbri, L.M.	10	19	University of Ferrara	Italy	108
Pelaia, G.	10	48	Pulmonary Medicine Unit, Department of Health Sciences, "Magna Graecia" University, Catanzaro, Italy.	Italy	20
Soler-Cataluña, J. J.	10	52	Centro de Investigación Biomédica en Red de Enfermedades Respiratorias (CIBERES), Instituto de Salud Carlos III, Madrid, España; Servicio de Neumología, Hospital Arnau de Vilanova, Valencia, España.	Spain	55
Ambrosino, N.	9	26	Istituti Clinici Scientifici Maugeri IRCCS, Istituto Scientifico di Montescano IRCCS, Italy.	Italy	73
Annesi-Maesano, I.	9	33	Sorbonne Université and INSERM, Epidemiology of Allergic and Respiratory Diseases Dept, Institut Pierre Louis of Epidemiology and Public Health, Paris, France.	France	86
Barreiro, E.	9	37	Pulmonology Department, Muscle Wasting and Cachexia in Chronic Respiratory Diseases and Lung Cancer Research Group, IMIM-Hospital del Mar, Parc de Salut Mar, Barcelona, Spain.Health and Experimental Sciences Department (CEXS), Universitat Pompeu Fabra (UPF), Barcelona Biomedical Research Park (PRBB), Barcelona, Spain.Centro de Investigación en Red de Enfermedades Respiratorias (CIBERES), Instituto de Salud Carlos III (ISCIII), Madrid, Spain.	Spain	60
Esteban, C.	9	36	From Institut Universitaire de Cardiologie et de Pneumologie de Québec-Université Laval, Quebec, QC (Y.L., F.S., S.B., F.M.), Centre Hospitalier Affilié Universitaire de Trois-Rivières, Trois-Rivières, QC (F.C.), Mount Sinai Hospital, McGill University (M.B.), and Montreal Chest Institute, Research Institute of the McGill University Health Centre and McGill University (J.B.), Montreal, Centre Intégré de Santé et de Services Sociaux de Laval, Laval, QC (B.P.), and the Ottawa Hospital Research Institute, University of Ottawa, Ottawa (S.D.A.) - all in Canada; Hospital Pedro Hispano-Unidade Local de Saúde de Matosinhos, Matosinhos (P.S.), and Centro Hospitalar Vila Nova de Gaia-Espinho, Vila Nova de Gaia (M.G.) - both in Portugal; and Hospital Universitario de Getafe, Getafe (A.A.F.), and Hospital Galdakao, Servicio Vasco de Salud-Osakidetza, Bizkaia (C.E.) - both in Spain.	Spain	40
Gea, J.	9	41	Servicio de Neumología, Hospital del Mar - IMIM, Barcelona, Spain; Dpt. MELIS, Universitat Pompeu Fabra, Barcelona, Spain; CIBERES, ISCIII, Barcelona, Spain.	Spain	66
Pelaia, C.	9	40	Respiratory Medicine Unit, University "Magna Græcia" of Catanzaro, Catanzaro, Italy.	Italy	27
Perez, T.	9	48	Service de Pneumologie, CHU Lille, Institut Pasteur de Lille, U1019-UMR9017-CIIL-Centre d'Infection et d'Immunité de Lille, Lille, France.	France	36
De Marco, R.	8	55	Unit of Epidemiology and Medical Statistics, Department of Diagnostics and Public Health, University of Verona, Verona, Italy.	Italy	19

Authors	Documents	Total link strength	Major institution	Countries	*h*-index
De Miguel-Díez, J.	8	19	Servicio de Neumología, Hospital General Universitario Gregorio Marañón, Facultad de Medicina. Universidad Complutense de Madrid (UCM), Instituto de Investigación Sanitaria Gregorio Marañón (IiSGM), Madrid, España.	Spain	32
Jouneau, S.	8	28	Department of Respiratory Medicine, Competence Centre for Rare Pulmonary Diseases, CHU Rennes, Univ Rennes, Rennes, France. and IRSET UMR108, Univ Rennes, Rennes, France.	France	44
Pedone, C.	8	25	Unit of Geriatrics, Campus Bio-Medico di Roma University, Via Alvaro del Portillo 200, 00128, Rome, Italy.	Italy	58
Pirina, P.	8	41	Department of Respiratory Diseases, University Hospital Sassari (AOU), Sassari, Italy.	Italy	35
Plaza, V.	8	8	Servicio de Neumología, Hospital de la Santa Creu i Sant Pau, Institut d'Investigació Biomédica Sant Pau (IIB Sant Pau), Universitat Autònoma de Barcelona, Departament de Medicina, Barcelona, España.	Spain	40

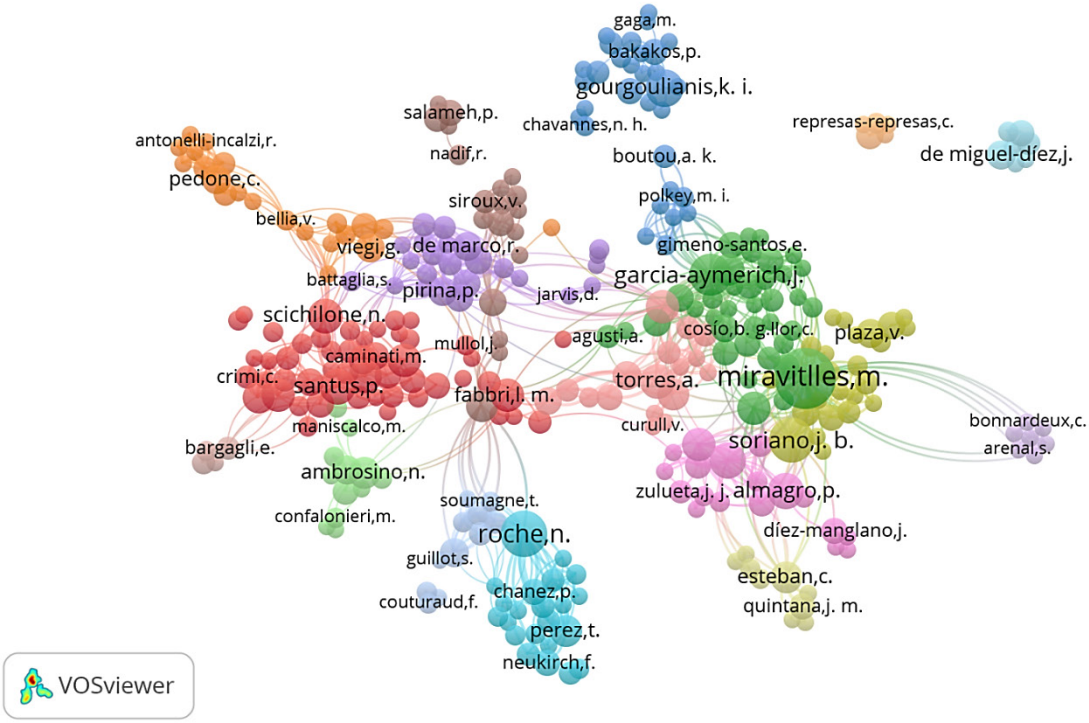

Figure 2: A VOS viewer map showing the top published authors in the field of CRD in the Mediterranean region.

However, eight Arab nations within the region contribute far less than European countries like Spain, France, Italy, and Greece. Factors like wars, displacement of scholars, poor infrastructure, brain drain, and limited funding due to poverty and a lack of research culture have hindered Arab research output. The absence of high-income economies further exacerbates these challenges (Elsayed and Sabtan, 2019; World Bank, 2024).

The prominence of European authors in COPD research may be linked to higher COPD prevalence in Europe (12.4%) (Han *et al.*, 2020) compared to the Middle East (3.6%) (Tageldin *et al.*, 2012) influenced by lifestyle, smoking rates, and research infrastructure (Blanco *et al.*, 2019). Low collaboration between Western European researchers highlights the need for more international partnerships, which could enhance global citations and scientific knowledge. Such collaborations also foster cultural maturity and inclusion, benefiting the global scientific community. Institutions, particularly in the MENA region, should seek cross-border collaborations to boost research impact and resource sharing (Alamah *et al.*, 2023).

Keywords analysis reveals that terms like "quality," "smoking," "life," and "death" are research hotspots, reflecting the significant global impact of chronic respiratory diseases, which accounted for 7% of global deaths in 2017. Smoking and pollution are major risk factors, with tobacco smoke's toxins causing extensive

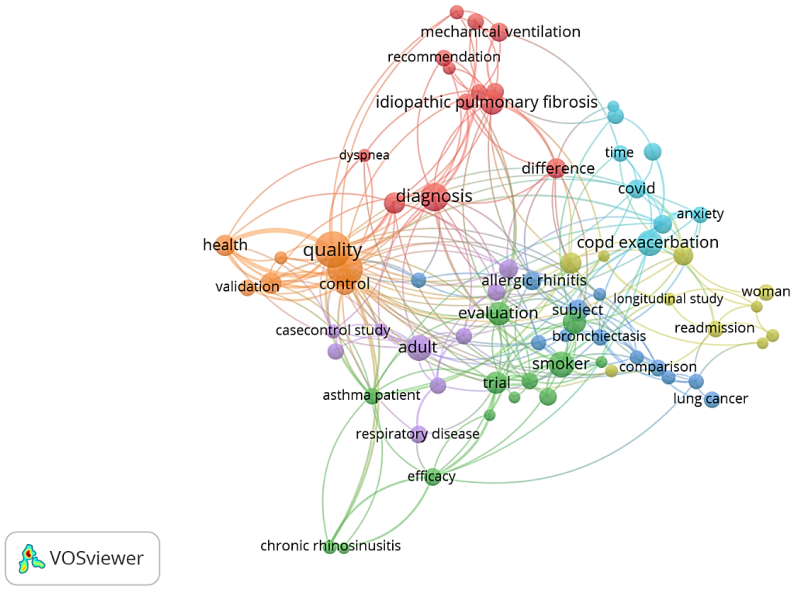

Figure 3: The keyword mapping of titles in the research of chronic respiratory diseases.

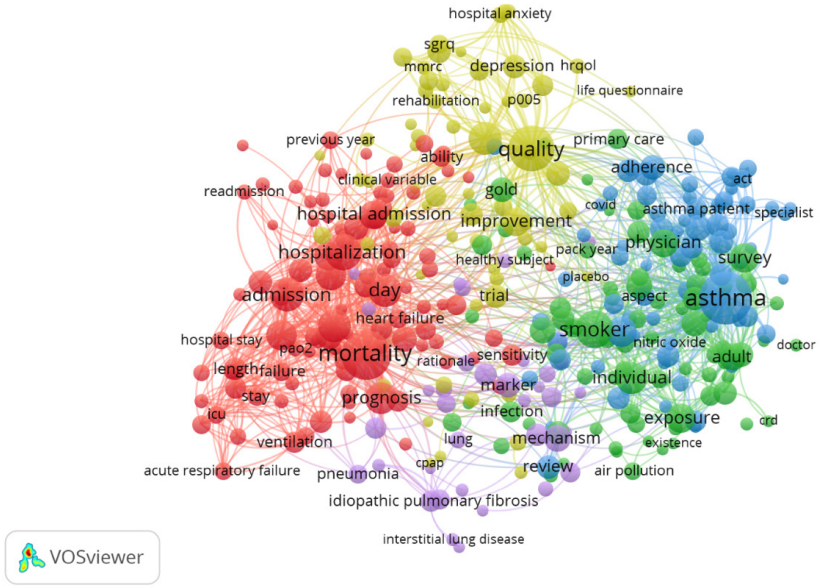

Figure 4: Visualization analysis of research in chronic respiratory diseases, risk factors, and management. A total of 352 keywords for Titles and Abstract content appearing over 10 times fell into five clusters based on colors.

damage throughout the respiratory system, leading to diseases like COPD. Prioritizing tobacco control and improving air quality are crucial to reducing CRD-related mortality (Gan *et al.*, 2022; Laniado-Laborín, 2009).

The keyword "asthma" has the highest occurrence in the Title and Abstract (207 times), highlighting its significance as a common chronic respiratory disease in the Mediterranean region. According to the 2017 Global Burden of Disease Study, asthma's prevalence in the Middle East and North Africa was 4.95%, higher than COPD (3.13%) and interstitial lung disease (0.03%). Despite their low occurrence, terms like HADS, depression scale, and hospital anxiety have high relevance, reflecting the psychological distress often seen in chronic respiratory disease patients (Nowak *et al.*, 2014). Up to 40% of these patients suffer from mood and anxiety disorders (Maurer *et al.*, 2008), which are often underdiagnosed, impacting their daily lives and disease severity (Cafarella *et al.*, 2012).

Preventable risk factors for CRDs, such as tobacco smoking, indoor pollution, and allergens, can be managed, but research on these topics is lacking (Bousquet *et al.*, 2007). Notably, smoking,

Table (2a): Table listing the top 20 terms with highest occurrence.

Term	Occurrences
Quality	46
Life	43
Diagnosis	27
Smoker	24
Adult	23
COPD exacerbation	23
Evaluation	20
Idiopathic pulmonary fibrosis	20
Phenotype	20
Trial	18
Control	16
Health	16
Subject	16
Chronic obstructive pulmonary disease patient	15
Patients	15
Questionnaire	15
Difference	14
Severe Asthma	14
Allergic Rhinitis	13
Depression	13

Table (2b): Table listing the top 20 terms with highest relevance score.

Term	Relevance Score
Severe exacerbation	2.7013
COPD prevalence	2.5431
Death	2.2059
Distribution	2.0599
Woman	2.0582
Predictive factor	2.034
Longitudinal study	2.0189
Mechanical ventilation	1.7374
Hospital admission	1.7289
Readmission	1.7047
Acute respiratory failure	1.6532
Prognostic value	1.609
Lung cancer	1.5912
Stable COPD	1.5788
Recommendation	1.5299
Importance	1.4697
Guideline	1.29
Chronic respiratory disease	1.2812
Development	1.1957
Nasal polyp	1.1719

Table (3a): Table listing the top 20 terms with highest occurrence.

Term	Occurrences
Asthma	207
Mortality	180
Quality	157
Smoker	104
Hospitalization	98
Admission	88
Death	83
Day	82
Scale	81
Individual	78
Prognosis	74
Predictor	73
Acute exacerbation	71
Response	69
Exposure	67
Survey	66
COPD Exacerbation	63
Hospital admission	63
Improvement	63
Physician	61

Table (3b): Table listing the top 20 terms with highest relevance score.

Term	Relevance Score
HADS	4.2139
CPAP	4.074
Depression Scale	3.8585
Hospital anxiety	3.7507
Continuous Positive Airway Pressure	3.4395
Mechanical Ventilation	3.1441
Acute Respiratory Failure	3.0219
ACT Score	3.0022
Intubation	2.9245
ICU	2.9167
ACT	2.7832
Invasive Mechanical Ventilation	2.7464
Asthma Control Test	2.732
IPF Patient	2.478
Obstructive Sleep Apnea	2.4121
Intensive Care Unit	2.3395
ILD	2.2894
Interstitial Lung Disease	2.1898
Hospital Stay	2.1573
Stay	2.1403

a significant keyword, is linked to worse outcomes in asthma patients, including more severe symptoms, higher healthcare costs, and reduced lung function (Polosa and Thomson, 2013). Despite the importance of allergens and pollution, they are absent from high-occurrence or relevance keyword tables, indicating insufficient research in these areas. This gap is concerning and suggests a need for more focused research on preventable CRD risk factors in the Mediterranean region.

STUDY LIMITATIONS

While the search strategy effectively covered many relevant publications on chronic respiratory diseases, it may not have been entirely comprehensive. Expanding keywords to include regional phrases or specific chronic respiratory disorders could capture more relevant literature, especially outside European countries. Although major databases like PubMed and Scopus were used, other studies, particularly those in regional languages such as Arabic, Turkish, Spanish, French, and Greek, may better represent the field. Including these languages could have yielded more results, highlighting studies not indexed in widely used global databases.

CONCLUSION

Chronic Respiratory Diseases (CRDs) pose a significant public health burden in the Mediterranean region. However, no such qualitative examination of the study environment, such as collaboration patterns and dominant thematic directions, has previously been done. This bibliometric analysis provides valuable insights into chronic respiratory disease research in the region and quantifies the Mediterranean area's high proportion (34.7%) of contribution to global research in CRDs. The findings show a significant contribution from this region, particularly from European countries, and emphasize the dedication of its researchers. The analysis identified key authors, leading universities, and potential collaboration areas, shedding light on major topics like risk factors and treatment strategies for CRDs in adults, with relative lack of concerns like allergens, air pollution, and psychological impact of CRDs. These insights can help identify research gaps, encourage collaboration, and support the development of effective CRD prevention and management strategies. Ongoing monitoring of research output in this region is essential to track progress, identify emerging trends, and inform evidence-based interventions and policies.

ABBREVIATIONS

CRDs: Chronic Respiratory Diseases; **COPD:** Chronic Obstructive Pulmonary Disease; **HADS:** Hospital Anxiety and Depression Scale; **MENA:** Middle East and North Africa.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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