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A bibliometric review of publications on postmortem interval

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Abstract

The postmortem interval (PMI), defined as the time between death and the discovery of the body, plays a crucial role in forensic medicine. Determining the time since death contributes not only to estimating the time and cause of death but also facilitates evidence collection in investigations. This study aims to map the global scientific landscape of PMI-related research and highlight Türkiye's position within this field. A retrospective search was conducted in the Web of Science database using the keyword "Postmortem Interval." Articles published between January 1, 2008, and January 1, 2024, were included. The articles were evaluated based on language, year, country of origin, authors and affiliations, journals, and citation counts. A total of 281 articles were identified, receiving 4381 citations in total. The majority (97.51%) were published in English. China contributed the highest number of publications (n=75, 26.69%). The most active journal was *Journal of Forensic Sciences* (n=36). The highest publication frequency occurred in 2017 (n=30). The difficulty in accurately determining PMI maintains the interest and diversity of related research. Bibliometric studies offer a valuable perspective for understanding the current state of forensic science and guiding future research. This study contributes to raising awareness of PMI research in Türkiye and encourages further interdisciplinary collaboration.

Keywords: Postmortem interval, bibliometrics, forensic medicine

Introduction

In forensic practice, the determination of the time of death is a critical component in clarifying investigations [1-3]. The term Postmortem Interval (PMI) refers to the time elapsed since death and is particularly significant in suspicious death cases for estimating the time of death [3,4]. PMI estimation plays a vital role in criminal investigations and crime scene evaluations [2,4,5].

Although PMI estimation methods have evolved over time, no single technique can provide definitive results [2,6]. This highlights the challenges associated with determining the time since death and the difficulty of developing reliable methods for forensic applications [3,6].

Postmortem changes such as rigor mortis (muscle stiffening), livor mortis (discoloration due to gravitational blood pooling), and algor mortis (body cooling according to environmental temperature) offer preliminary clues regarding PMI [1,3]. Initially, investigators estimated PMI based on the observable progression

of these changes, considering environmental factors such as temperature, humidity, and surrounding conditions [1,2,6]. Over time, these methods were supplemented with microbiological, histopathological, biochemical, and molecular analyses, including studies of chemical alterations in blood, tissues, and organs [7,8]. More recently, genetic analyses and the tracking of molecular changes have emerged as advanced techniques in PMI estimation. Moreover, technological advancements such as imaging modalities and artificial intelligence applications have further improved the precision of PMI assessments [7,8].

Bibliometric analysis is a quantitative approach that applies statistical and mathematical methods to examine the relationships among published studies [9]. It is primarily used to measure the progress and dynamic evolution of specific research domains. This methodology offers advantages such as simplicity, speed, comprehensiveness, and accuracy [10,11].

In recent years, bibliometrics has been widely used to analyze the characteristics of academic publications, including the

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identification of leading countries, journals, institutions, authors, references, and keywords [9,11,12]. Furthermore, various visualization tools are employed to map collaborations among countries, institutions, and authors. Bibliometric studies also help researchers to quickly understand the development and boundaries of a field, while the accurate interpretation of data directly influences the reliability and efficiency of scientific systems [9].

Material and Methods

Study Design and Data Collection

This bibliometric analysis was conducted using the Web of Science (WoS) database. A forward search was performed for articles that included the keyword “Postmortem Interval” in their titles. The search covered all articles indexed in the Science Citation Index (SCI), Science Citation Index Expanded (SCI-E) and Emerging Science Citation Index (ESCI).

The Web of Science (WoS) database was selected for this study because of its rigorous quality control, structured citation indexing, and compatibility with bibliometric analysis tools. WoS ensures standardized metadata, reliable citation tracking, and broad coverage of high-impact journals in forensic and biomedical sciences. These features make WoS a widely accepted and frequently preferred source for bibliometric studies in the health sciences.

Using the filtering tools of WoS, articles published between January 1, 2008, and January 1, 2024, were selected. Only those that contained the keyword “Postmortem Interval” in their titles and were published in health and natural sciences journals indexed in SCI, SCI-E and ESCI were included. Each article was categorized based on the language of publication, year of publication, journal of publication, publishing house, country of origin, institutional affiliations of the authors, and WoS subject categories. Citation counts for each article were recorded individually and collectively. The H-index for the analyzed set of articles was also evaluated.

Statistical Analysis

The collected data were transferred to a digital environment. Basic frequency analyses were performed using Statistical Package for the Social Sciences version 24 (SPSS, Chicago, IL, USA), while bibliometric visualizations and network analyses were carried out using VOSviewer (version 1.6.20). Frequency distributions and descriptive statistics were calculated, and comparative values were assessed at a 95% confidence interval. A p-value of <0.05 was considered statistically significant.

Limitations

This is a bibliometric study in the field of health sciences, limited to articles indexed in the SCI, SCI-E and ESCI collections within the WoS database. Publications listed in other indices, such as

the Social Sciences Citation Index (SSCI) and the Arts and Humanities Citation Index (AHCI), were excluded.

It should be acknowledged that the exclusive use of WoS may have led to the omission of relevant studies indexed in other databases such as Scopus, PubMed, Dimensions, or Embase. While WoS provides a robust foundation for citation-based analysis, Scopus covers a wider range of international and regional journals, PubMed includes additional biomedical and forensic science literature, and Dimensions or Embase capture interdisciplinary and clinical perspectives. Therefore, the findings of this study should be interpreted within the scope of WoS coverage. Future bibliometric analyses could benefit from multi-database search strategies to achieve a more comprehensive representation of PMI-related research.

Additionally, only articles with “Postmortem Interval” explicitly mentioned in their titles were included in this review. This strategy was adopted to ensure high specificity and to avoid retrieving studies where PMI was only briefly referenced without being the main focus. However, this approach may have inadvertently excluded relevant publications in which PMI was extensively discussed but appeared only in the abstract or keywords. Therefore, while the present study provides a focused overview of PMI-related literature, it may not fully reflect the scope of research in this field. Future bibliometric analyses could benefit from expanding the search strategy to include abstracts and author-provided keywords in order to achieve a more comprehensive mapping of the scientific landscape.

Ethics Approval

This study received ethical approval from the Non-Interventional Clinical Research Ethics Committee of İzmir Bakırçay University (Decision No: 1445, dated 31.01.2024).

Result

This study evaluated all scientific publications indexed in the Web of Science (WoS) database that included the keyword “Postmortem Interval” in their titles. A total of 382 publications were initially identified. During the search process, the time range was set from 2008 to 2024, the document type was filtered to “Article”, and the indexes SCI, SCI-E, and ESCI were selected using the WoS filtering tools. After applying these criteria, 281 articles met the inclusion conditions and were included in the final analysis. Of these, 257 articles (91.45%) were published in journals indexed in SCI-E, while 24 articles (8.55%) appeared in journals indexed in ESCI. No articles were found in journals indexed in SCI. These figures reflect the dataset as retrieved on the date of data extraction and subsequent updates to the WoS database may yield slightly different results.

The distribution of publications by year showed a clear increase over time, with the highest number of publications in 2017 (n=30, 10.68%). The yearly distribution of articles is illustrated in Figure 1.

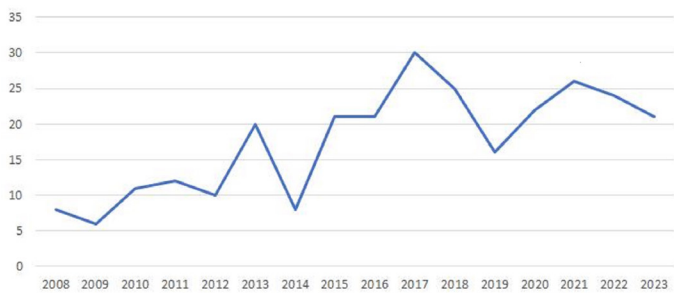


Figure 1. Annual distribution of PMI-related publications between 2008 and 2024.

A total of 4,381 citations were received by the included articles. The average number of citations per article was 32.67, and the H-index of the collection was calculated as 56. Annual citation data are presented in figure 2. Citation relationships between the articles are shown in figures 1 and 2, and author-specific citation networks are visualized in figures 3 and 4.

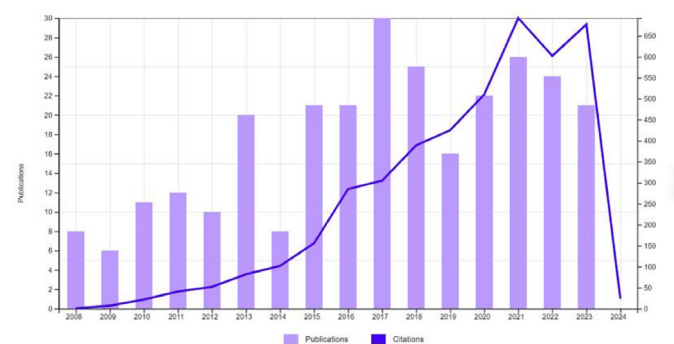


Figure 2. Yearly citation distribution of included articles

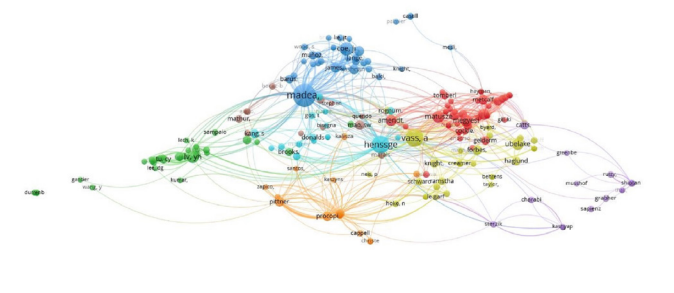


Figure 3. Collaboration network of authors with ≥ 3 reciprocal citations

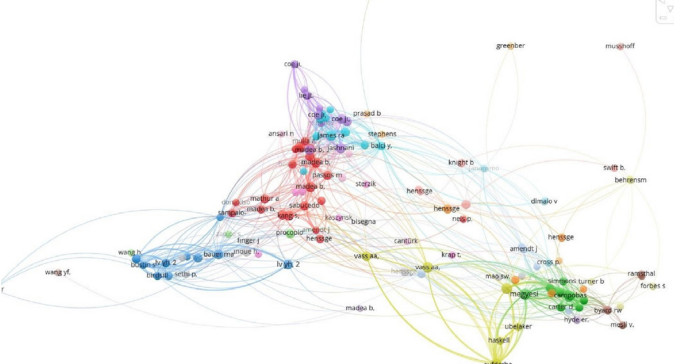


Figure 4. Bibliographic coupling of articles citing the same author

Analysis of the language of publication revealed that most articles were published in English (n=274, 97.51%). Additionally, 89 articles (31.67%) were open access.

Country-level distribution showed that China contributed the highest number of articles (n=75, 26.69%), followed by the United States (n=55, 19.57%) and Spain (n=17, 6.00%). Country-based distribution of articles is shown in figure 5.

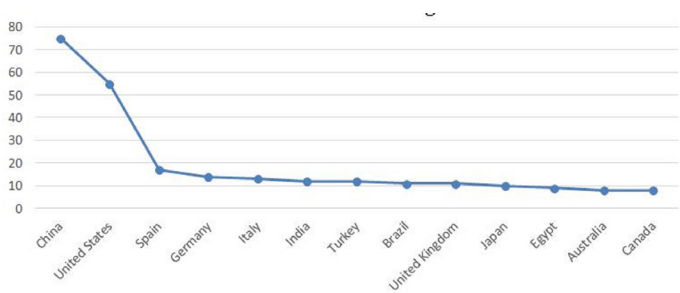


Figure 5. Country-level distribution of PMI-related publications

According to the WoS subject categories, the 281 articles were indexed in 38 different categories a total of 530 times, as some articles fell under multiple categories. The most common category was Forensic Science (n=151, 28.49%), followed by Pathology (n=25, 4.71%) and Entomology (n=20, 3.77%).

A total of 132 journals published the analyzed articles. The Journal of Forensic Sciences led with 36 publications (12.81%), followed by Forensic Science International (n=30, 10.68%) and International Journal of Legal Medicine (n=21, 7.47%) (Figure 6). Regarding publishing companies, Elsevier was the most prominent with 85 articles (30.25%), followed by Springer Nature (n=46, 16.37%), Wiley (n=43, 15.30%), and Oxford University Press (n=19, 6.76%).

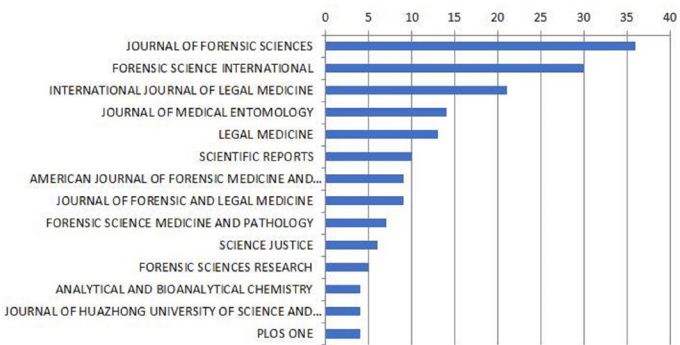


Figure 6. Journals with the highest number of PMI-related publications

Institutional analysis revealed that Soochow University (China) and Xi'an Jiaotong University were the most productive institutions, each contributing 18 articles (6.41%). These were followed by the Egyptian Knowledge Bank (EKB) and the State University System of Florida, each contributing 9 articles (3.20%) (Figure 7).

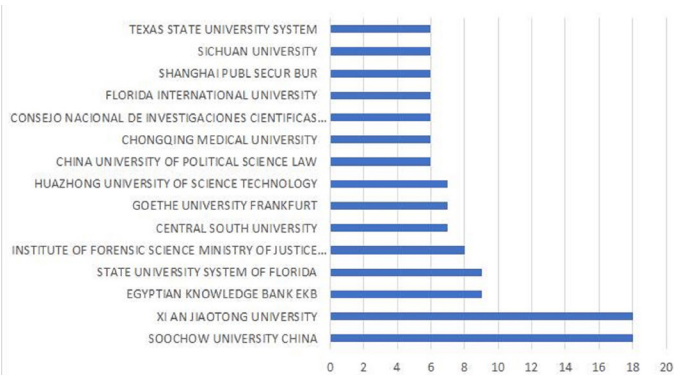


Figure 7. Top contributing institutions by number of PMI articles

Among the 281 articles analyzed, 164 (58.36%) were reported to have received financial support during the research and/or publication phase. Institutions providing support for 7 or more articles were as follows: The National Natural Science Foundation of China (NSFC) supported 54 articles (19.22%), the Priority Academic Program Development of Jiangsu Higher Education supported 12 (4.27%), and Japan’s Ministry of Education, Culture, Sports, Science and Technology (MEXT) supported 8 (2.85%). Data on 88 organizations that provided funding for seven or more articles are presented in Table 1.

Table 1. Major funding sources for PMI-related publications

Funding Agencies	n	%
National Natural Science Foundation of China NSFC	54	61.36
Priority Academic Program Development of Jiangsu Higher Education	12	12.64
Ministry of Education Culture Sports and Technology (MEXT), Japan	8	9.10
Grants-in Aid For Scientific Research (KAKENHI)	7	7.95
Japan Society for the Promotion of Science (JSPS)	7	7.95
Total	88	%100

Türkiye contributed a total of 12 publications to PMI-related literature between 2008 and 2024. These articles originated primarily from Türkiye Ministry of Justice, Ankara University, Tokat Gaziosmanpaşa University and Yıldız Technical University institutions. Highest citation count was from Eskisehir Osmangazi University with 22 total citations. Collectively, Türkiye-authored articles received 115 citations, corresponding to an average of 9.58 citations per publication. While Türkiye’s output is modest compared to leading contributors such as China and the United States, its presence demonstrates emerging interest in PMI research within the region.

Discussion

Bibliometric studies provide a systematic means of observing subject trends and citation relationships across disciplines [13]. In this study, 281 scientific articles published between 2008 and

2024 under the title “Postmortem Interval” (PMI) in the Web of Science database were analyzed. The findings demonstrate a growing scholarly interest in PMI over time, with increasing publication frequency and academic impact. These studies are multidisciplinary in nature, conducted on an international scale, and continue to hold a significant place in the forensic literature.

The year 2017 recorded the highest number of publications, and there has been a noticeable upward trend in the number of studies across the years. This rise suggests that technological advancements in forensic sciences have prompted an increased academic focus on developing new methodologies—both traditional and molecular—for estimating PMI. The inherent unpredictability of PMI and the limitations of existing methods necessitate continuous research in this area.

Citation count is widely regarded as a key indicator of a publication's academic influence. Highly cited works typically reflect central themes in their respective research areas. When evaluating a study's contribution to the literature, the extent to which it is referenced by other researchers, along with its H-index, becomes significant. In our analysis, the total number of citations was 4,381, with an average of 32.67 citations per article and an overall H-index of 56. These metrics suggest that the body of literature on PMI has achieved considerable academic impact. Therefore, PMI research forms a foundational element in forensic knowledge and represents the core themes referenced by practitioners and scholars alike. The high citation rates also reflect the practical relevance of PMI studies beyond academia.

One of the most striking findings is that the overwhelming majority of articles (n=274, 97.51%) were published in English, with nearly one-third (31.67%) offered as open access. This supports the notion that English has become the global language of scientific communication and that open access publishing enhances visibility and citation potential. The widespread dissemination of reliable and universally applicable forensic findings related to PMI appears to be ongoing. Increased academic visibility creates greater opportunities for researchers from developing countries to access, contribute to, and build upon existing knowledge.

In terms of geographical distribution, China led with the highest number of publications (n=75, 26.70%), followed by the United States (n=55, 19.57%) and Spain (n=17, 6.00%). China also emerged as the leading source of financial support, funding more than 150 articles in total. This underscores the country's strategic investment in forensic science and mirrors trends observed in other bibliometric analyses [14,15]. While the number of PMI-related publications from Türkiye is limited compared to global leaders, its inclusion among contributing countries highlights a growing academic presence. This reflects both existing interest and significant potential for future development. With increased support for interdisciplinary research and international collaboration, Türkiye is well-positioned to enhance its contributions to this critical area of forensic science.

The categorization of articles within WoS indicated that PMI research is inherently multidisciplinary. The highest citation frequencies were observed in Forensic Science (28.49%), Pathology (4.71%), and Entomology (3.77%). This suggests that PMI estimation encompasses both macroscopic and microscopic approaches. The prominence of entomology publications reflects the growing acceptance of insect life cycle-based PMI estimation techniques. In addition, emerging themes in recent literature include genetic analysis, AI-supported modeling, and the use of molecular biomarkers. Furthermore, studies investigating the estimation of postmortem interval using Glyceraldehyde-3-phosphate dehydrogenase (GAPDH) messenger ribonucleic acid (mRNA) levels in skin and heart tissues have also been identified in the literature [16].

Journal and publisher analyses revealed that Journal of Forensic Sciences, Forensic Science International, and International Journal of Legal Medicine were the most frequently chosen platforms for PMI-related publications. These high-impact, field-specific journals suggest that PMI is regarded as a high-value subject in both scientific and editorial terms. The dominance of major publishers such as Elsevier, Springer Nature, and Wiley further indicates that PMI research is well-integrated into the global academic publishing ecosystem.

Institutional analysis highlighted the leadership of Chinese universities—particularly Soochow University and Xi'an Jiaotong University—in PMI research. This not only illustrates the role of countries but also emphasizes how institutions can become strategic hubs for advancing specialized fields. The fact that a majority of the articles received funding suggests that PMI remains a priority area for many research agencies worldwide.

One major limitation of this study is the inclusion criterion that required “Postmortem Interval” to appear in the article title. While this ensured the specificity of our dataset, it may have excluded relevant articles addressing PMI within their content but not their titles. Furthermore, the study focused solely on articles indexed in SCI and SCI-E, thereby excluding potentially valuable contributions from social sciences and interdisciplinary databases. Nevertheless, the filtering approach maintained the specificity and homogeneity of the dataset.

This study maps the global distribution, collaboration patterns, and academic influence of research related to postmortem interval (PMI) over the last 15 years. The findings reveal a consistent rise in both the number of publications and citation metrics, reflecting the growing scientific and practical interest in PMI estimation within forensic medicine. The multidisciplinary nature of the field—encompassing forensic science, entomology, pathology, and molecular biology—underscores the complexity of accurately determining the time of death and the necessity of diverse methodological approaches. One of the key outcomes of this analysis is the identification of dominant countries, journals, and institutions shaping PMI research. The prominent role of Chinese academic centers and funding bodies,

alongside internationally recognized journals such as Journal of Forensic Sciences and Forensic Science International, points to structured and well-supported research ecosystems. These examples illustrate how institutional investment and research infrastructure directly correlate with academic productivity and impact. Although Türkiye’s representation in the field is currently limited, its inclusion among the contributing countries is a positive indicator. This presence highlights both existing academic engagement and the potential for further growth. With strategic support for interdisciplinary research, Türkiye is well-positioned to expand its role in PMI studies and contribute more actively to global forensic literature.

The multidisciplinary nature of PMI research is evident, encompassing classical forensic science approaches together with entomological methods [17], metabolomic and proteomic analyses [18], and, more recently, artificial intelligence-driven prediction models [19].

In line with our findings, other bibliometric reviews in forensic sciences—such as those on forensic odontology [20], RNA degradation and molecular markers [21], and proteomic or AI-supported PMI prediction models [22]—similarly emphasize the growing impact of multidisciplinary and technology-driven approaches.

Conclusion

This study represents the first bibliometric analysis evaluating research articles on Postmortem Interval (PMI) using the Web of Science (WoS) database. Looking ahead, future PMI research should prioritize the integration of emerging technologies, the validation of molecular and AI-based models, and the development of standardized estimation protocols. This bibliometric study not only provides an overview of past and current trends but also serves as a roadmap for guiding new investigations. By offering a clear picture of the research landscape, the study aims to inspire further scientific inquiry and enhance academic awareness—particularly within Türkiye, where PMI research holds significant promise for development.

Conflict of Interests

The authors declare that there is no conflict of interest in the study.

Financial Disclosure

The authors declare that they have received no financial support for the study.

Ethical Approval

The study received ethical approval from the Non-Interventional Clinical Research Ethics Committee of İzmir Bakırçay University (Decision No: 1445, dated 31.01.2024)

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