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# Equity and Access in Cancer Immunotherapy: A Bibliometric Analysis of Global Research on Social Determinants and Health Disparities

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**Abstract:** Cancer immunotherapy has emerged as a breakthrough treatment, but access to this therapy is heavily influenced by social, geographic, and economic factors, potentially widening healthcare disparities. This study aimed to analyse global trends in scientific publications related to cancer immunotherapy within the context of social justice, service access, and social determinants of health through a bibliometric approach. Data were collected from the Scopus database (2017–2025) using a defined Boolean search query, and analysis was performed using VOSviewer, Publish or Perish, and Microsoft Excel. The results show a gradual increase in publications, with a significant spike in 2021 and a peak in 2024. The United States was the primary hub for knowledge production, followed by European countries, while developing regions such as Africa, Southeast Asia, and Latin America had minimal representation. International collaboration patterns revealed the dominance of North–North partnerships, with limited involvement from developing countries. Keyword analysis highlighted the importance of interdisciplinary approaches, addressing social determinants, healthcare access, and financing issues, but also revealed underexplored areas such as cultural contexts and social support. The findings emphasise the urgent need for more inclusive research agendas and international collaborations involving low- and middle-income countries. Strengthening capacity building, integrating regional and non-English databases, and prioritising social and cultural dimensions in future research are recommended strategies to ensure that advances in cancer immunotherapy contribute to reducing, rather than exacerbating, global health inequities.

**Keywords:** Cancer Immunotherapy; Social Determinants; Health Disparities; Equity; Access

## 1. Introduction

Cancer immunotherapy has become a breakthrough in cancer treatment, enabling the immune system to recognize and destroy cancer cells more specifically [1]. However, despite its proven clinical effectiveness, not all patients have equal access to this therapy. Access to immunotherapy is heavily influenced by social, geographic, and economic factors [2]. With advances in medical technology, concerns have arisen that innovative therapies, such as immunotherapy, might widen disparities in healthcare services [3]. Therefore, studies on equity and access are essential to examining how innovation is distributed within global health systems. Given the therapy's high costs and complex clinical requirements, equity and access in cancer immunotherapy have become critical issues [4]. Marginalized populations, such as the poor, ethnic minorities, and residents of low-income countries, of-

ten lack equal access to this treatment [5]. This inequality contributes to structural discrimination within modern healthcare systems. If left unaddressed, immunotherapy could potentially worsen longstanding health disparities [6]. Therefore, analyzing how scientific literature discusses these issues is essential for promoting a fair healthcare system.

The social determinants of health, such as education, employment status, physical environment, and access to health information, significantly influence a person's ability to access immunotherapy [7]. Patients from lower socioeconomic backgrounds are often less likely to be referred to or participate in immunotherapy clinical trials [8]. Unequal representation in these trials also introduces biases in data regarding the effectiveness and safety of therapies [9]. This imbalance creates a cycle of exclusion that worsens disparities. Therefore, it is crucial to systematically examine the social factors affecting access to immunotherapy and incorporate them into the global health equity agenda.

Most existing literature has focused on molecular and clinical aspects of immunotherapy, while equity and social determinants remain underexplored [10,11]. Research is dominated by institutions in high-income countries, leaving the needs and contexts of developing regions underrepresented. This creates a critical research gap requiring an interdisciplinary approach integrating medical, social, and policy perspectives [12]. The novelty of this study lies in being the first bibliometric analysis to systematically examine cancer immunotherapy research through the lens of equity and social determinants of health. In addition to mapping publication and citation trends, it identifies key actors, collaboration patterns, and thematic clusters, thereby producing a knowledge base that can inform inclusive, evidence-based policy [13].

This study aimed to analyze global trends in scientific publications related to cancer immunotherapy within the context of social justice, service access, and social determinants of health through a bibliometric approach. This review identifies the countries, institutions, and researchers who have contributed the most to this topic and maps collaborative networks and keyword distributions. Additionally, this article highlights gaps in research and potential directions for more inclusive future studies [14]. Through this approach, this analysis is expected to provide scientific and practical contributions to shaping equitable health policies. Therefore, this study serves as an initial step toward fostering a more inclusive and evidence-based health system transformation.

The bibliometric approach offers a systematic way to assess the patterns and volume of scientific publications, which is very useful for evaluating the scientific attention given to a specific topic [15]. In cancer immunotherapy and equity issues, bibliometrics help identify literature trends, collaboration networks, and the geographical spread of knowledge. Using reputable databases like Scopus and Web of Science, along with analytical tools such as VOSviewer and Bibliometrix, this study mapped relevant keywords like cancer immunotherapy, health equity, and social determinants of health [13]. This method can also show whether the research is inclusive or reflects the interests of developed countries. Bibliometrics are crucial for evaluating fairness in creating and distributing scientific knowledge.

Bibliometric analysis is instrumental in examining how equity and access are addressed in immunotherapy literature [16]. We can identify the disparities in contribution between countries and global regions by analysing publications and researcher collaborations. This study sought to determine whether vulnerable populations, such as low-income countries and minority groups, are included in developing immunotherapy through research and publications. These results can be used to formulate more inclusive policies and research directions [17]. In other words, bibliometrics is not only a descriptive tool but also an analytical tool for advocating equity in the health sciences.

This study addresses a gap in the literature by focusing on the social aspect of immunotherapy research, which has not been a primary focus until now [18]. Most previous studies have centered on immunotherapy's biological and pharmacological aspects, leading to a bias toward technical approaches. This study promotes an interdisciplinary approach combining medical science, social sciences, and health policy by emphasizing equity and social determinants. This perspective is crucial because it connects the development of innovations with fair access for end-users [19]. This study is expected to serve as a foundation for further research on integrating technology and social justice within the health system.

Inequality in access to immunotherapy highlights injustice between individuals and structural disparities among countries. Developed nations, such as the United States, the United Kingdom, and Germany, have led in publications on the use of immunotherapy. In contrast, developing countries face difficulties related to costs, human resources,

and infrastructure [20]. The WHO has stressed the importance of equity in health technology, but its implementation remains inconsistent [21]. The lack of research investment in countries of the Global South further widens the gap in information and services. Therefore, this study emphasizes the importance of solidarity and global justice in spreading immunotherapy.

## 2. Research Objectives

This study aimed to provide an overview of global research trends in Equity and Access in Cancer Immunotherapy over the past eight years. The research questions addressed in this study are as follows:

1) What are the publication and citation trends in equity and access in cancer immunotherapy research?
2) What is the geographic distribution of research on equity and access in cancer immunotherapy?
3) What are the patterns of research collaboration in equity and access in cancer immunotherapy?
4) What research focuses on equity and access in cancer immunotherapy?
5) What is the novelty of research on equity and access in cancer immunotherapy?

## 3. Methods

### 3.1. Study Design

This study employed a quantitative bibliometric design with a descriptive-analytical approach to explore publication and citation trends in global research related to justice and access in cancer immunotherapy [22]. This design adopts the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, developed by Moher et al. [23], to ensure transparency and replicability in the literature selection process. The primary focus of this study was to analyse publications relevant to cancer immunotherapy and terms related to equity, access, and social determinants of health in the context of global health systems. The analysis examined the quantity of publications and collaboration patterns, geographic distribution, and research gaps. This study does not directly involve human participants, but analyzes metadata from scientific journals [24].

### 3.2. Data Collection

Data were retrieved from the Scopus database, which is widely recognised as one of the most comprehensive and accurate bibliographic indices for international scientific publications. Scopus was selected over other databases such as Web of Science, PubMed, and Embase because of its broader coverage of journals across multiple disciplines, including oncology, immunology, and social sciences, as well as its reliable citation indexing and analytical features that are particularly suited for bibliometric studies. Previous comparative evaluations have shown that Scopus indexes more journals relevant to cancer research and health equity than Web of Science, thus providing a stronger foundation for capturing multidisciplinary perspectives [24]. The search strategy applied an exact Boolean query in the title, abstract, and keyword fields: TITLE-ABS-KEY (“cancer immunotherapy”) AND TITLE-ABS-KEY (“equity” OR “access” OR “health disparity” OR “health disparities” OR “social determinant” OR “social determinants” OR “health equity” OR “health inequality” OR “health inequities”).

The search was limited to documents published between 2017 and 2025, with no geographical restrictions, and was conducted on 26 July 2025, yielding 94 records. Only research articles and conference papers were retained during the screening stage, while other source types (e.g., reviews, editorials, book chapters, notes) were excluded, resulting in 51 documents. At the eligibility stage, only documents published in English were included, leading to the exclusion of one non-English document. Finally, 50 eligible documents were included in the bibliometric analysis. The PRISMA flow diagram illustrates the whole selection process (**Figure 1**).

### 3.3. Data Analysis

Data analysis was performed using three primary tools: VOSviewer, Publish, or Perish, and Microsoft Excel [22]. VOSviewer was used to visualise bibliometric networks, including relationships between authors (co-authorship), countries (country collaboration), and thematic connections based on the co-occurrence of keywords. This tool produces network maps and density visualisations that illustrate the strength of the relationships between elements in the literature.

Publish or Perish (PoP) was used to obtain citation data, the h-index, and author productivity based on publication metadata extracted from Scopus. This application also helps evaluate the contributions of key authors and institutions within the research theme. Microsoft Excel was employed for data cleaning, tabulation, and descriptive visualisation, such as trends in the number of publications per year, document distribution by country, and document type. This tabular analysis complements the visual exploration results of the VOSviewer and PoP. The data obtained were analysed based on (1) the number of publications and citations per year, (2) country collaboration, and (3) trends in frequently appearing keywords (main findings and novelty).

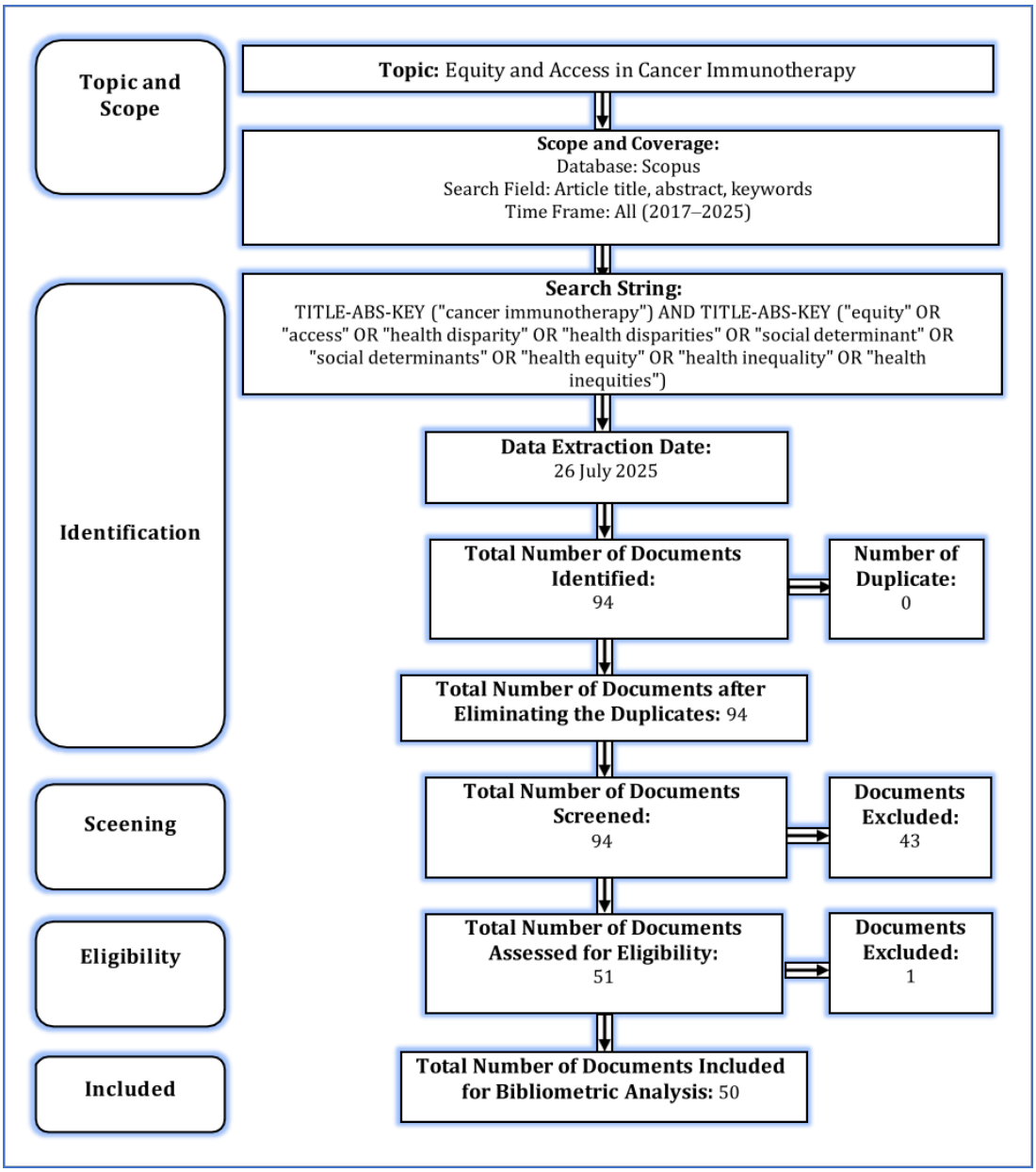



**Figure 1.** Data collection process.

## 4. Results and Discussion

### 4.1. Publication and Citation Trend

Based on **Figure 2**, the publication trend related to equity and access in cancer immunotherapy shows a gradual increase from 2017 to 2025. The number of publications began to rise in 2020, with a significant spike occurring

in 2021 (9 documents) and reaching its peak in 2024 (16 documents). Although the number of publications in the early years, such as 2017 and 2020, was still very low (one and two publications, respectively), a positive linear trend indicates that this topic is gaining increasing attention within the scientific community. This highlights the growing global awareness of the importance of equity in access to cancer immunotherapy, particularly after the COVID-19 pandemic, which has widened the systemic disparities in healthcare services [25,26]. This increase can also be linked to the emergence of scientific discourse on the social determinants of health in treatments, such as immunotherapy, which are both precise and expensive.

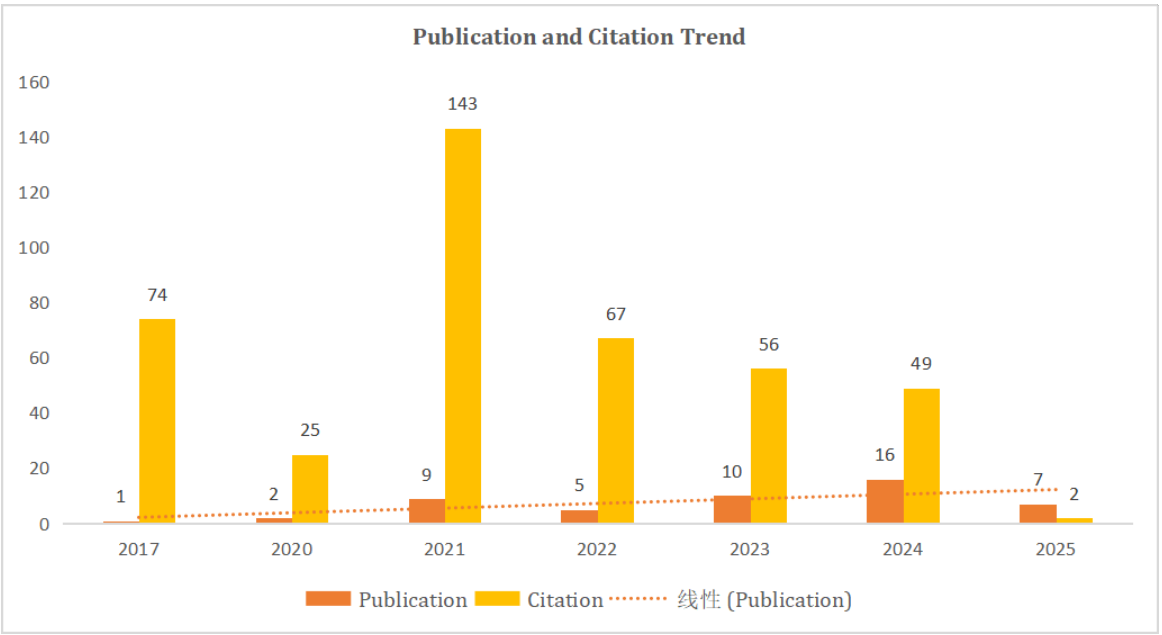



**Figure 2.** Publication and citation trend.

However, the graph also reveals an imbalance between the number of publications and citations received. The citation peak occurred in 2021, with 143 citations, even though there were only 9 publications, indicating the presence of a key document or seminal paper that was highly influential that year. Conversely, by 2024, although the number of publications was the highest (16), the number of citations was relatively lower (49). This could mean that new literature still requires time to gain citation impact or that these documents are more exploratory than theoretical or normative. This pattern reflects that productivity is not always linearly related to scientific impact, reinforcing the importance of combining output and influence analyses in bibliometric studies [27–29]. These results demonstrate that although research on equity and access in immunotherapy is still developing, some early contributions have become key references that have driven subsequent literature waves.

## 4.2. Geographical Distribution of Publications

Based on **Figure 3**, the authors' country of origin shows the geographical distribution of publications related to equity and access in cancer immunotherapy. The data demonstrate that the highest contribution comes from the United States, with 39 documents, making it the primary hub for knowledge production in this field. The dominance of the United States reflects its high research capacity, strong scientific infrastructure, and significant attention to the social aspects of cancer treatment technologies [13,30,31]. European countries such as Germany, the United Kingdom, the Netherlands, and Italy also show active involvement, each contributing two to three documents. Australia and China are also participating in the Asia-Pacific region, albeit in more limited numbers, but still reflect attention to equity issues in the development of immunotherapy.

By contrast, this chart also reveals disparities in research contributions globally, especially in developing countries. Most regions in Africa, Southeast Asia, and Latin America contributed only one document or were not represented at all. For example, Brazil, Mexico, Egypt, and Colombia have produced only one document each. Further-

more, Indonesia is not listed as a contributor to scientific publications related to this topic, either as an individual author or in international collaboration. This lack of representation points to a serious knowledge production gap, grounded in equity and social determinants in cancer therapy. The underrepresentation of Africa, Southeast Asia, and Latin America in this bibliometric landscape reflects disparities in research funding and systemic barriers to participation in global oncology research. Previous studies have shown that low- and middle-income countries face persistent challenges, such as inadequate infrastructure for clinical trials and dependence on donor-driven agendas [32,33]. These systemic constraints suggest that without targeted capacity-building programs and inclusive funding mechanisms, the global inequities in immunotherapy access are likely to persist or even worsen. Low participation from developing countries, such as Indonesia, signals challenges in research capacity, availability of funding, and access to global collaboration networks. Strategic measures are required to address this disparity, such as strengthening funding for interdisciplinary research, facilitating inclusive international collaborations, and integrating health equity topics into the national cancer research agenda. These efforts are crucial so that Global South countries, including Indonesia, are not merely subjects of health inequity but also active actors in building a more just and sustainable global health system [32–34].

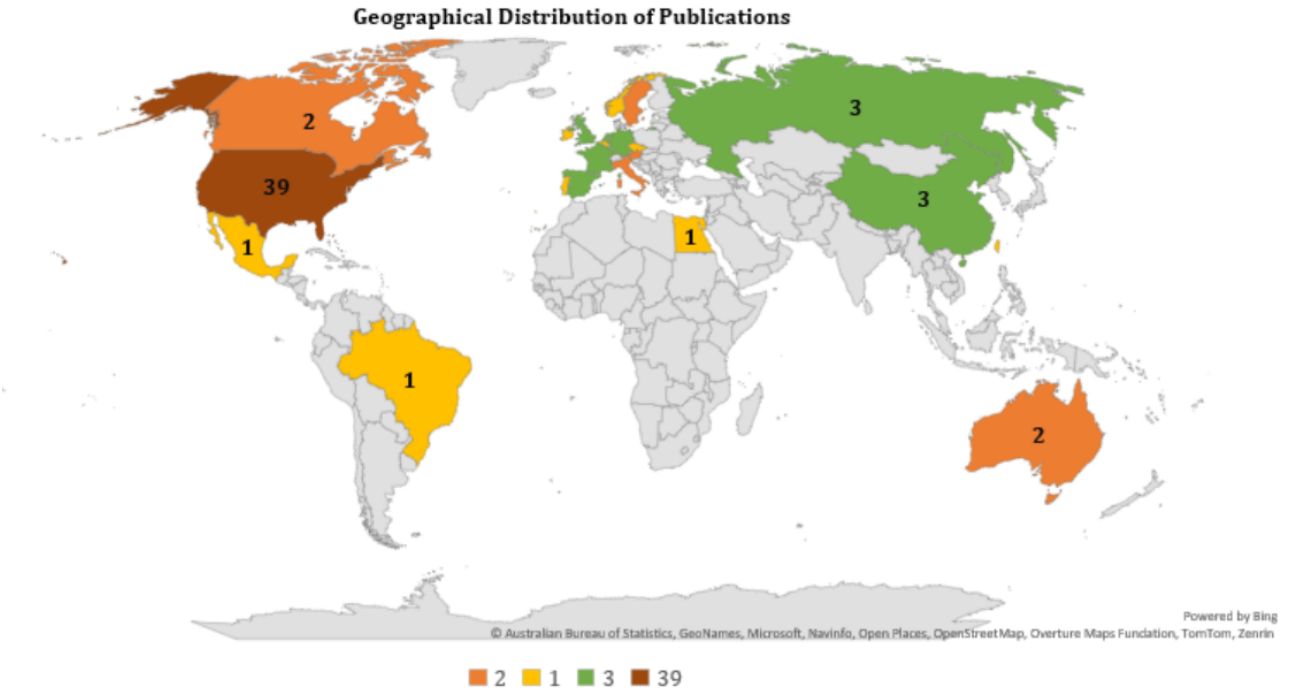



**Figure 3.** Geographical distribution of publications.

### 4.3. Collaboration Pattern

**Figure 4** illustrates the pattern of international collaboration between countries in scientific publications related to justice and access to cancer immunotherapy. The United States appears to be the dominant centre of global cooperation, forming scientific partnerships with various countries across continents, such as Canada, Mexico, Brazil, Barbados, China, Russia, France, Germany, the United Kingdom, and Australia. The presence of the United States as the central node with the highest connectivity reflects its position as a global research leader and primary facilitator in developing topics based on equity and social determinants within cancer therapy. Strong collaborations with Western European countries, such as France, the Netherlands, and Germany, demonstrate how this topic advances within a multilateral framework, particularly in regions with advanced research infrastructure and commitment to global health issues [21,35].

Nevertheless, this collaboration pattern also reveals a disparity in the involvement of developing countries, where most established connections still tend to be North–North collaborations, namely, between high-income

countries. Although there is some involvement from countries such as Mexico, Brazil, and China, their contributions remain limited and tend to fall within the collaborative orbit of developed nations. Countries in Southeast Asia, Africa, and the Pacific region, including Indonesia, are virtually unrepresented in this collaborative network, which does not appear in this relationship map. This imbalance can be explained by research capacity, access to international networks, and deeper economic, cultural, and political factors. From a financial perspective, the high costs of immunotherapy and related clinical trials make participation difficult for low- and middle-income countries, where research budgets are often overshadowed by competing priorities such as infectious disease control and maternal-child health programs. Culturally, limited public awareness and community mistrust toward experimental therapies frequently reduce recruitment into trials, particularly in regions where traditional medicine still plays a dominant role in cancer care. Politically, differences in regulatory environments further widen the gap: for example, Europe and North America benefit from harmonised and well-funded trial approval systems, whereas many Asian and African countries face regulatory delays, fragmented ethics committees, or a lack of policy incentives that discourage investment in large-scale trials. These combined factors demonstrate why developing countries remain underrepresented in the global collaboration network. Therefore, increasing the involvement of these regions in international partnerships should become a strategic agenda for promoting equity in the production and dissemination of health knowledge, including in the field of cancer immunotherapy [21,36,37].

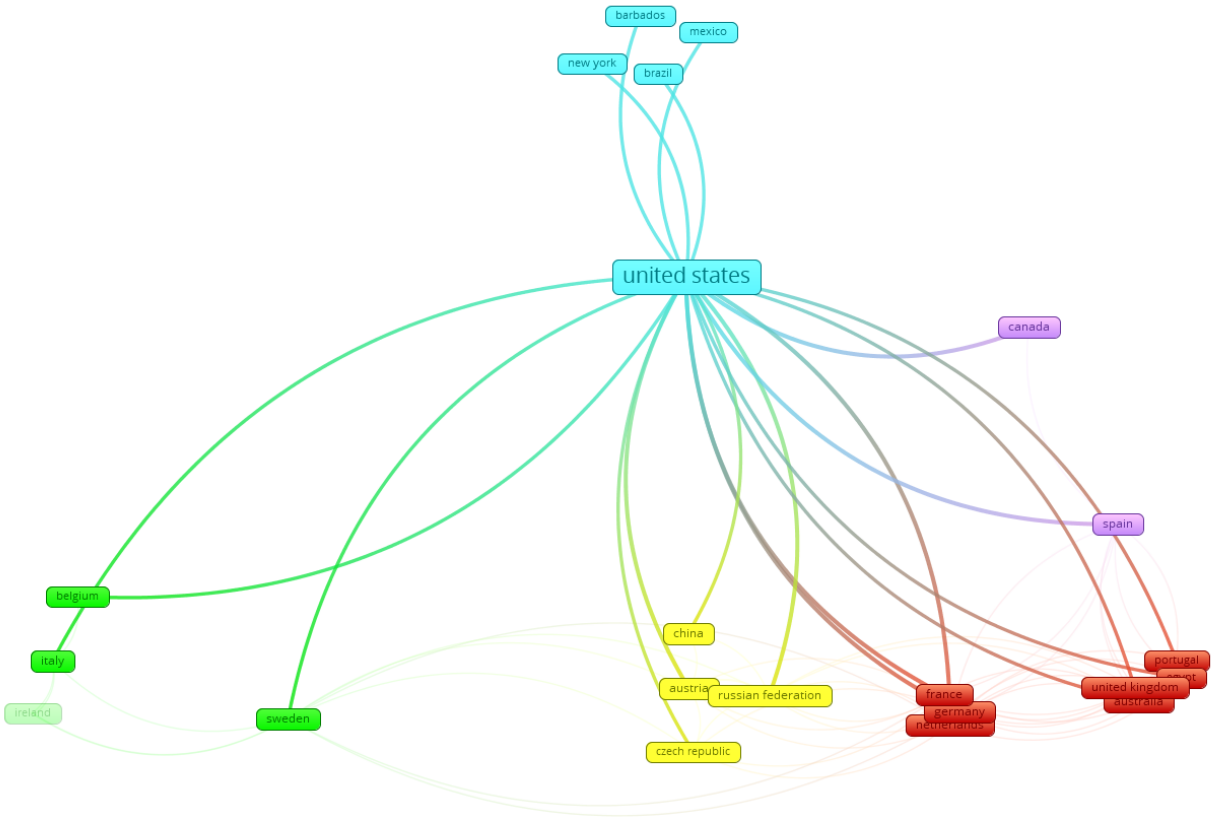



**Figure 4.** Collaboration pattern.

## 4.4. Research Focus

Based on **Figure 5**, the mapping of research focus is illustrated through keyword co-occurrence analysis using VOSviewer, which depicts dominant themes and their interconnections within the literature related to equity and access in cancer immunotherapy. The most prominent keyword located at the centre of the network is "cancer immunotherapy," which serves as the convergence point of various other topic dimensions such as "health disparities," "clinical outcome," "aged population," and "cancer therapy." This mapping indicates that the primary focus in the

literature is not only on the clinical aspects of immunotherapy, but also includes social and structural dimensions that affect access and cancer therapy outcomes. Keywords such as "health insurance," "Medicaid," "Medicare," and "social support" reinforce that issues of healthcare access and financing are significant concerns in this research, aligning with the global agenda to integrate social determinants into modern oncology systems [7,38,39].

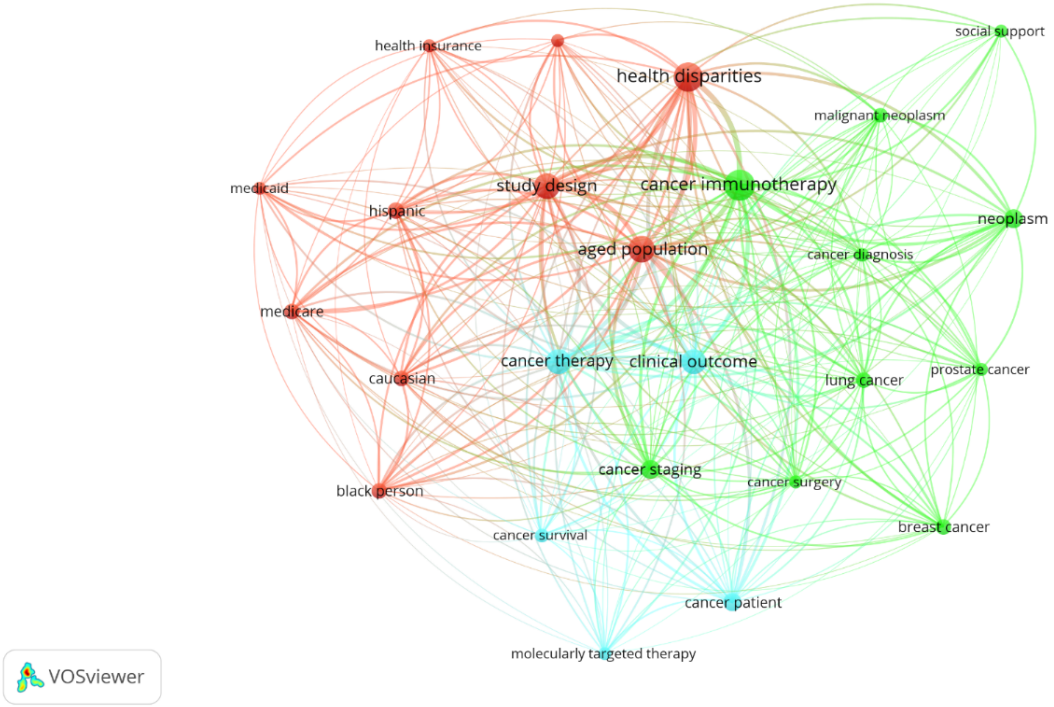
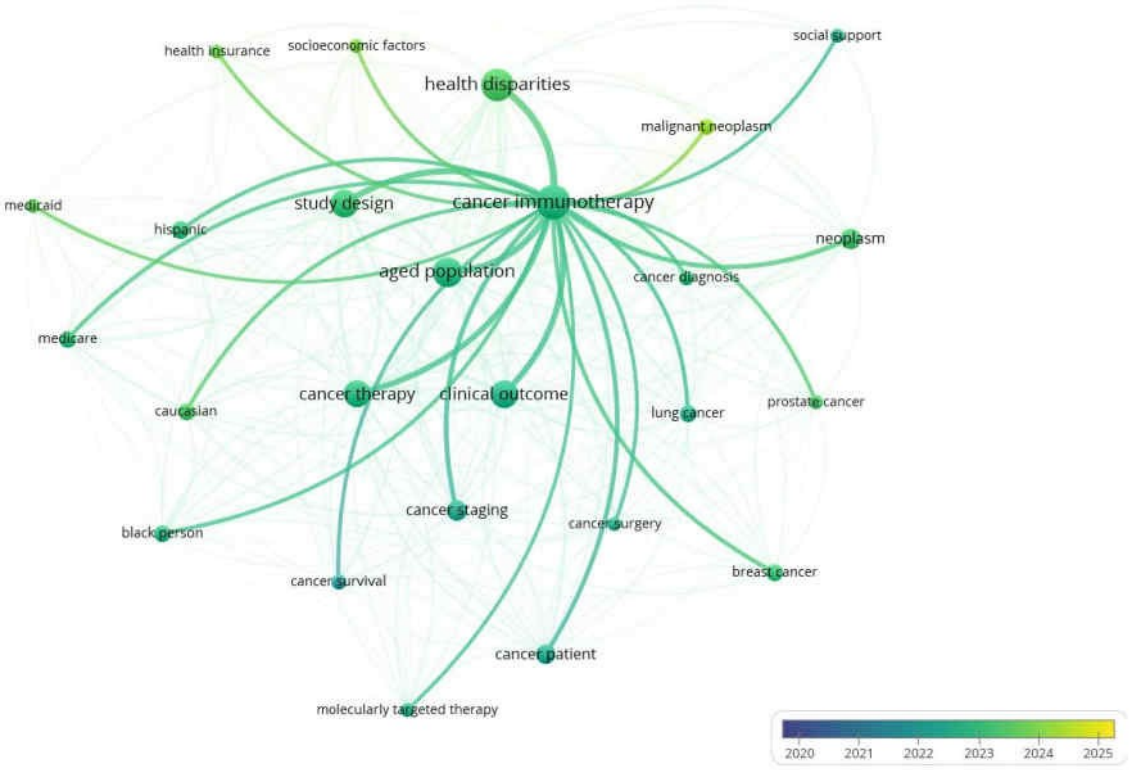



**Figure 5.** Research focus.

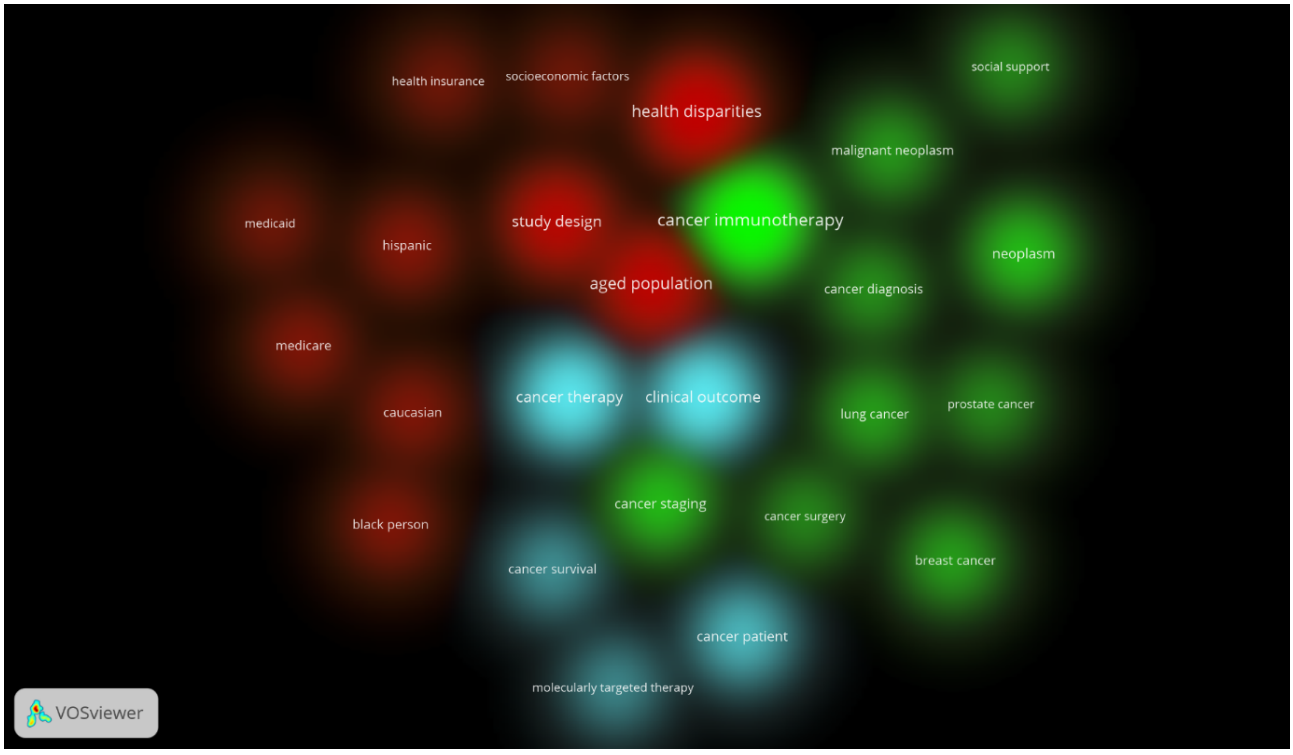
Additionally, the figure groups keywords into several colour clusters, indicating thematic specialisation. The red cluster represents themes of social inequality, such as race, insurance, and economic status; the green cluster focuses on specific cancer types, such as lung cancer, breast cancer, and prostate cancer, while the light blue and yellow clusters focus on technical dimensions, such as cancer staging, targeted therapy, and clinical outcomes. Interestingly, there is a strong connection between the terms "black person," "Hispanic," and "caucasian" with "health disparities," reflecting an awareness of racial issues in the distribution and response to cancer immunotherapy. These findings highlight the importance of an interdisciplinary approach to understanding the effectiveness of therapy from a biomedical perspective and social, cultural, and public policy viewpoints. Unfortunately, no keywords specifically refer to developing countries or Southeast Asia, including Indonesia, emphasising the ongoing lack of regional representation in global academic discourse on equity in immunotherapy [40–42].

## 4.5. Novelty of Research

**Figures 6(a)** and **(b)** displays a temporal keyword overlay visualisation, illustrating the evolution of the research focus over time. Blue represents keywords that dominated earlier publications (around 2020–2021), whereas yellow-green indicates the emergence of newer keywords that have become prominent in recent years (2023–2025). Keywords such as "cancer therapy," "cancer staging," "clinical outcome," and "health disparities" have appeared since the beginning and have consistently remained at the centre of research. However, in recent years, there has been an increased emphasis on keywords like "social support," "neoplasm," and "cancer diagnosis," indicating a shift in focus from purely clinical aspects toward greater attention to the social and psychosocial context of cancer patients. This demonstrates a conceptual transition in research towards a more holistic and multidimensional approach to addressing access to and equity in immunotherapy [43–45].




**(a)**




**(b)**

**Figure 6.** Novelty of research.

**Figures 6(a)** and **(b)** further reinforces these findings through keyword density map visualisation, which displays the concentration of research based on the frequency and strength of connections between terms. The brightest areas (red and light blue clusters) indicate topics with the highest research intensity, including "cancer immunotherapy," "health disparities," "clinical outcome," and "cancer therapy." Meanwhile, darker and peripheral areas, such as "social support," "molecularly targeted therapy," and "socioeconomic factors," reflect research domains that have not yet been fully explored and hold significant potential for novelty. While keyword mapping identifies health disparities and financing issues as central themes, the relative absence of terms related to cultural practices, patient advocacy, or indigenous health knowledge underscores a limited equity framing. This gap is particularly evident in underrepresented regions such as Africa, Southeast Asia, and Latin America, where socio-cultural determinants are central to healthcare acceptance. Addressing these gaps in future research will be critical, as integrating socio-cultural contexts is increasingly recognized as essential to the effectiveness of cancer therapies [46,47]. Thus, although the field is evolving, there remains substantial room for new contributions, especially from developing countries such as Indonesia, where expanding research beyond biomedical aspects could provide both scientific and social impact [46–49].

### 4.6. Implications

The findings of this study provide an essential foundation for developing equitable research policies and interventions for cancer immunotherapy. The dominance of publications from developed countries and the lack of representation from the Global South highlight the need for a more inclusive design in global research. Governments, donor agencies, and higher education institutions in developing countries such as Indonesia must increase support for interdisciplinary research integrating cancer's medical and social aspects. Policymakers can also use the results of this research to design training programs, collaborations, and funding mechanisms to address gaps in access and global scientific participation. Moreover, the keyword mapping results indicate the importance of expanding research agendas to underexplored areas, such as social support, financing structures, and the cultural context of cancer patients from marginalised populations.

### 4.7. Limitations

This study had several limitations that must be acknowledged. First, the analysis relied on a single database, Scopus, which, despite its breadth, still has limitations in source coverage and does not include articles from regional databases such as SINTA or LILACS, which may contain studies from developing countries. Second, the selection of documents was restricted to English-language articles and proceedings. This introduces a potential language bias, as relevant studies published in other languages may have been excluded, leading to an underrepresentation of research from non-English-speaking regions such as Latin America, Africa, and parts of Asia. Future studies should therefore expand the search strategy to incorporate non-English databases (e.g., CNKI, LILACS, SciELO) and include publications in multiple languages to provide a more comprehensive and inclusive mapping of global research. Third, the bibliometric approach is inherently quantitative and does not provide an in-depth assessment of individual studies' content or methodological quality, which limits contextual interpretation. Finally, although trends and connectivity can be visualised, the data do not directly capture normative dimensions such as structural bias, the influence of cultural and political factors, or the perspectives of patient communities.

## 5. Conclusion

This study successfully mapped global publication trends and research focused on equity and access to cancer immunotherapy from 2017 to 2025. The results reveal significant disparities in geographic contributions and international collaboration, with strong dominance by developed countries and minimal participation from Southeast Asia, including Indonesia. The dominant themes in the literature include the relationships between immunotherapy, health disparities, clinical outcomes, and financing systems. However, they remain limited in their ability to address deeper social contexts, such as the role of community support or the experiences of marginalised patients.

To overcome these barriers, several recommendations can be drawn. First, governments and funding agencies in developing countries should increase investment in interdisciplinary cancer research that integrates biomedical and social perspectives. Second, international research collaborations must be expanded to actively include low-

and middle-income countries, supported by capacity-building initiatives, equitable data-sharing agreements, and joint clinical trials. Third, research agendas should prioritise underexplored themes such as cultural influences, social support systems, and financing structures to ensure that cancer immunotherapy becomes accessible to diverse populations. Finally, integrating non-English regional databases in future bibliometric analyses is recommended to reduce language bias and capture a more comprehensive global evidence. By adopting these measures, future research and policy can move toward a more equitable and sustainable global health system, ensuring that advances in cancer immunotherapy do not widen existing health disparities but contribute to reducing them.

## Author Contributions

Conceptualization, D.B. and V.Y.L.; methodology, V.Y.L.; software, V.Y.L.; validation, D.B.; formal analysis, V.Y.L.; investigation, V.Y.L.; resources, D.B.; data curation, V.Y.L.; writing—original draft preparation, D.B.; writing—review and editing, D.B.; visualization, V.Y.L.; supervision, D.B.; project administration, D.B.; funding acquisition, D.B. All authors have read and agreed to the published version of the manuscript.

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Not applicable.

## Informed Consent Statement

Not applicable.

## Data Availability Statement

No experimental methods or clinical datasets were used for this article. All analyses are based on relevant documents from the journal Equity and Access in Cancer Immunotherapy. The data source is the Scopus website.

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## Conflicts of Interest

The authors declare no conflict of interest. This article is the original work of my team of authors, without the involvement of artificial intelligence (AI) in the writing process or the preparation of the manuscript's contents. We only use Grammarly software for grammar and spelling-checking purposes without relying on AI-based features that generate or compile text automatically. The entire contents of the manuscript, including the analysis, interpretation, and arguments presented, are entirely the result of the thoughts and efforts of the authors. All authors are fully responsible for this manuscript's authenticity and scientific integrity and are ready to accept academic consequences if there is any discrepancy with this statement.

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