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Canine Distemper: A Bibliometric Analysis of Global Research Trends (1980-2024)

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ABSTRACT

Canine distemper virus (CDV) is a significant infectious disease affecting domestic dogs and wild carnivores worldwide. However, there is a lack of systematic, quantitative assessments of this topic in the literature. This bibliometric analysis examined 2,842 publications from the Web of Science Core Collection spanning 45 years (1980–2024), evaluating research trends, geographical distribution by country and institution, and author collaboration networks in canine distemper studies. The analysis revealed distinct temporal phases in publication patterns, characterised by modest output during the foundation period (approximately 20 articles per year from 1980 to 1990), gradual acceleration coinciding with the adoption of PCR technology (mid-1990s to 2005), and exponential growth driven by advances in molecular diagnostics (2005–2015, reaching over 140 articles per year). A recent stabilization suggests that the field is maturing (2020–2024, approximately 115 articles per year). A geographic analysis revealed a regional concentration of research, with the United States dominating with 2,281 publications (38%). This was followed by China with 660 publications (11%) and Germany with 581 publications (10%). This reflects the importance of a well-established research infrastructure, as well as disparities in availability. Institutions such as the University of Bern (201 publications), the University of California system (186) and the University of Veterinary Medicine Hannover (164) consistently showcased their research. Author impact analysis identified Zurbriggen A. and Vandevelde M. as the most influential researchers, with a high citation impact (h-index of 33 for both) and high productivity (84 and 64 publications respectively). Keyword co-occurrence analysis revealed four distinct thematic clusters: molecular epidemiology and phylogenetics; wildlife conservation and interspecies transmission; clinical pathology and neurological manifestations; and diagnostic methodologies. This study provides a comprehensive, quantitative assessment of canine distemper research, identifying key contributors to veterinary medicine and wildlife conservation, as well as collaborative networks, knowledge gaps and future research priorities.

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INTRODUCTION

Canine distemper virus (CDV), a highly contagious Morbillivirus belonging to the Paramyxoviridae family, causes multisystemic disease in domestic dogs and wild carnivores worldwide (Appel & Summers, 1995; Martella et al., 2008). Despite effective vaccines having been available against this virus since the 1960s, CDV continues to pose a significant threat, particularly in areas with inadequate vaccination coverage (Beineke et al., 2015). Outbreaks of CDV in endangered species, including African wild dogs, Amur tigers and whales, have emerged as a significant threat to wildlife conservation (Deem et al., 2000; Seimon et al., 2013). The detection of CDV in uncommon hosts, including non-human primates, raises concerns about potential zoonotic impacts (Qiu et al., 2011).

Over the past four decades, the scientific literature on canine distemper has expanded significantly, driven by increased investment in research and a growing recognition of the disease's complex epidemiological dynamics. Bibliometric analysis provides a systematic, quantitative approach to evaluating the structure, evolution and trends within research fields, employing various metrics and indicators (Donthu et al., 2021; Moral-Muñoz et al., 2020). This methodology enables the identification of influential publications, productive authors and institutions, collaboration networks and emerging themes. Such analyses have proven valuable in veterinary medicine and infectious disease research, providing insight into research trajectories (Uzabaci et al., 2025; Elasan and Sahin, 2025).

This research conducts a comprehensive bibliometric analysis to uncover key publication trends, influential entities (authors/institutions), and international collaboration networks in the field, utilizing keyword co-occurrence patterns to map and delineate emerging research frontiers. This study aims to inform researchers and veterinarians about the landscape and development of canine distemper research.

MATERIAL and METHODS

Data Source and Search Strategy

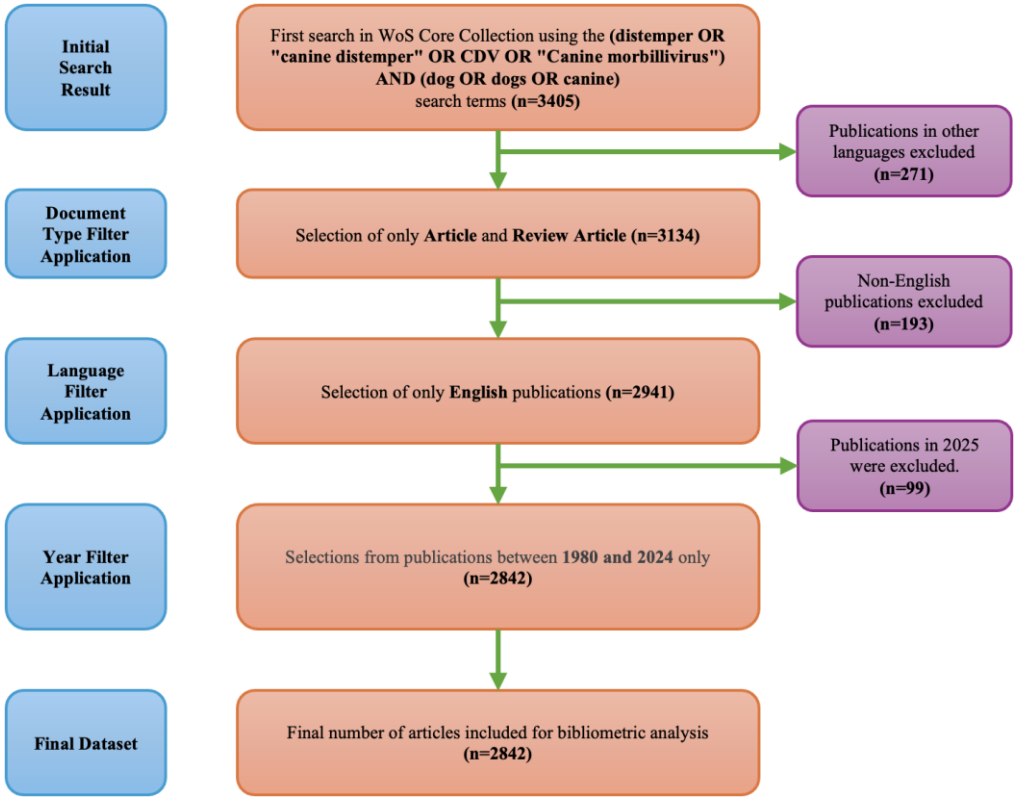
A comprehensive literature search was conducted using the Web of Science Core Collection (WoSCC) on September 20, 2025. WoSCC was chosen for its comprehensive coverage of peer-reviewed publications, comprehensive citation indexing, and standard format for reliable bibliometric analyses (Pranckutė, 2021).

The search query used in the topic field was (distemper OR "canine distemper" OR CDV OR "canine morbillivirus") AND (dog OR dogs OR canine), resulting in 3.405 publications.

Inclusion and Exclusion Criteria

Specific criteria were applied sequentially. First, the dataset was reduced to 3,134 publications by limiting document types to original research articles and review articles. Secondly, to ensure consistency, only English-language publications were included, resulting in 2,941 publications. Finally, the temporal scope of the publications was limited to the period 1980–2024, leaving 2,842 publications on which the analysis is based (Figure 1).

Figure 1. Data selection flowchart



Data Extraction and Processing

Bibliographic records were exported from WoSCC in plain text format, along with full records and cited references. The exported data included publication titles, author information, abstracts, keywords, publication year, journal information, and citation counts.

Bibliometric Analysis Methods

The performance analysis assessed indicators such as annual publication output and citation metrics (including the h-index, Hirsch, 2005), as well as identifying productive countries, institutions, authors and journals. Scientific mapping methods were used to visualise the intellectual structure and knowledge networks, including co-authorship analysis to identify collaboration patterns, co-citation analysis, and keyword co-occurrence analysis to identify major research themes and their temporal evolution.

Analytical Tools

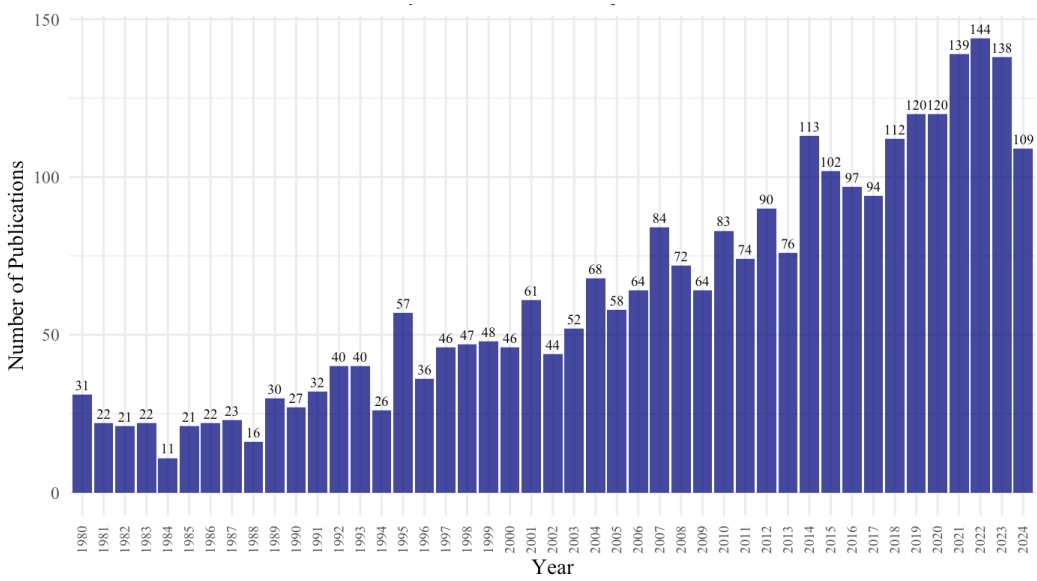
Statistical analyses, including bibliometric index calculations, temporal trend analyses (Aria and Cuccurullo, 2017), were performed using the Bibliometrix R package (version 4.1) within the R statistical environment. The ggplot2 (Wickham, 2016) package was also used for visualization. Network visualizations and keyword co-occurrence maps were created within the Bibliometrix framework.

RESULTS

Temporal Trends in Publication Output

Figure 2 illustrates the annual scientific output from 1980 to 2024. The first period (1980–1990) showed modest output of fewer than 20 articles per year. A gradual acceleration began in the mid-1990s. By 2005, output had reached around 70 articles per year. The most significant growth occurred during the period from 2005 to 2015 (an increase of over 75%), when annual output increased from 80 to over 140 articles. At its peak (2015–2020), output stood at around 135 articles per year. In recent years (2020–2024), the number of articles per year has stabilized at around 115.

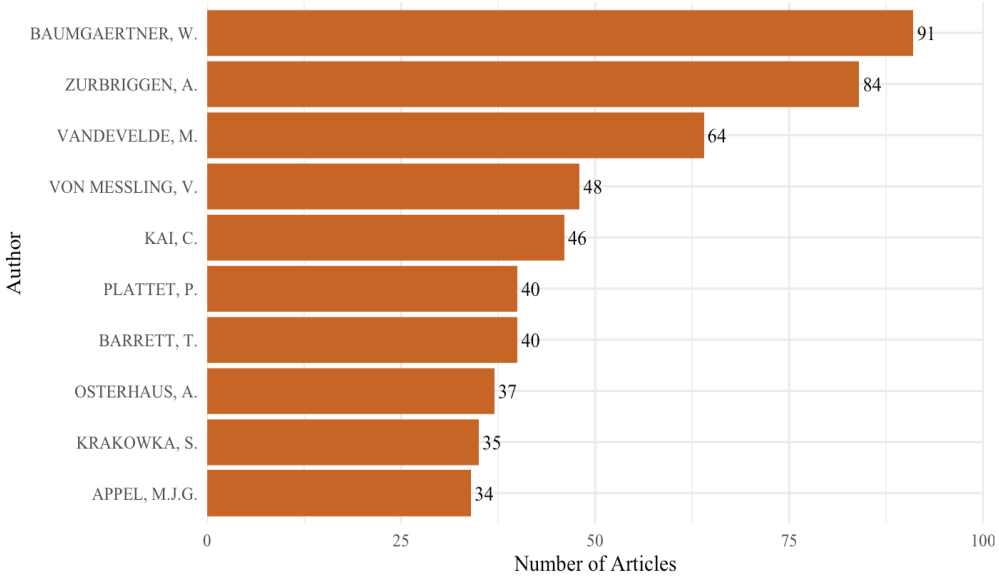
Figure 2. Annual publication output (1980-2024)



Most Productive Authors

Figure 3 shows the top 10 authors with the most publications on this topic, based on their number of publications. Baumgärtner W. leads with approximately 91 publications, followed by Zurbriggen A. and Vandevelde M. (84-64 publications).

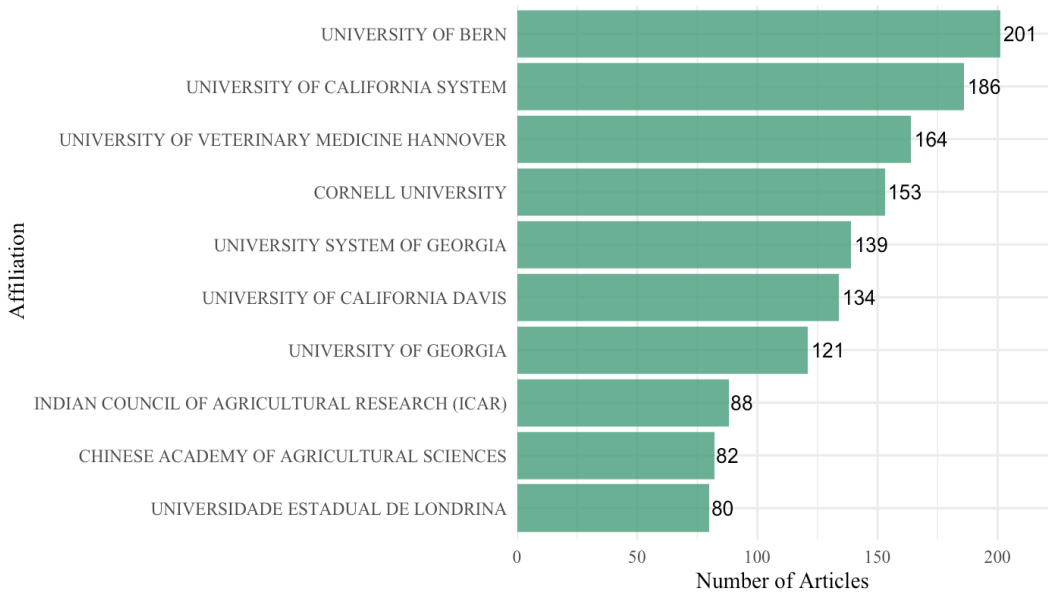
Figure 3. Most productive authors by publication count



Leading Institutions

Figure 4 shows the top 10 institutions ranked by publication frequency. The University of Bern is in first place with around 201 publications. Second place goes to the University of California System with 186 publications. Hannover University of Veterinary Medicine follows with 164 publications. Cornell University and the University of Georgia System complete the top five with 153 and 139 publications, respectively. The presence of specialised veterinary universities and government institutions emphasises the importance of sustained institutional support for productive research programs.

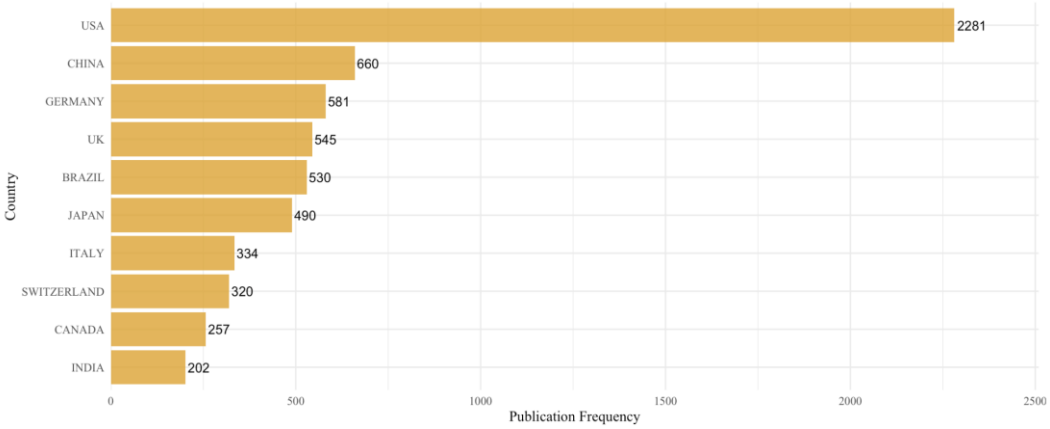
Figure 4. Most relevant affiliations by publication count



Country-Level Production

Figure 5 shows the top 10 countries ranked by the frequency of publications related to CDV. The United States is first with 2,281 publications, followed by China with 660. Germany is third with 581 publications, and the United Kingdom is fourth with 545 publications. Brazil (530 publications), Japan (490 publications), Italy (334 publications), Switzerland (320 publications), Canada (257 publications), and India (202 publications) round out the top ten.

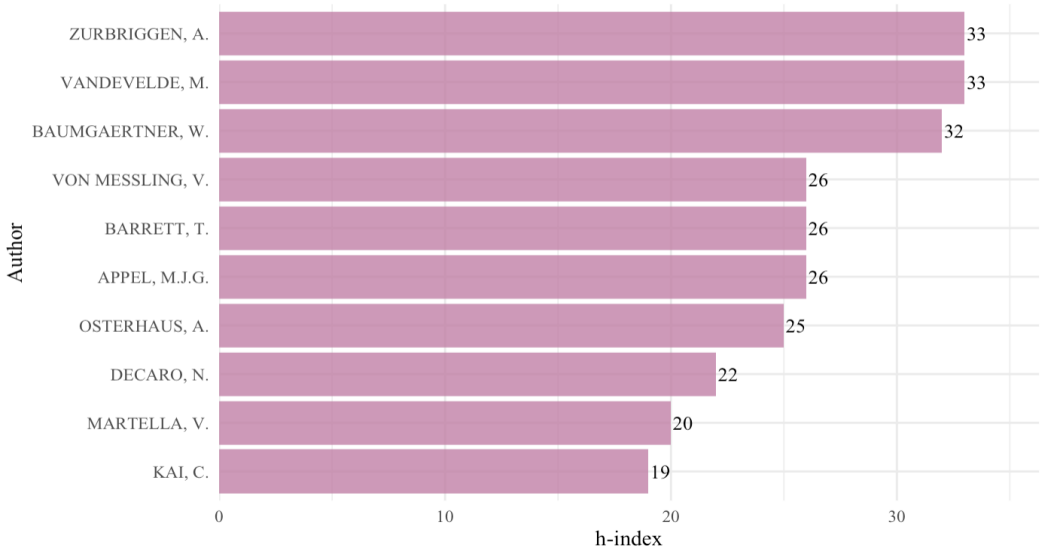
Figure 5. Country production by publication frequency



Author Impact Analysis

Figure 6 shows the h-index rankings of the authors, which measure both their productivity and the impact of their citations. Zurbriggen A. and Vandevelde M. have the highest h-index (33), meaning that each of their articles has received at least 33 citations. Baumgärtner W. (h-index = 32) and Barrett T., Von Messling V., Appel M.J.G. (h-index = 24) follow the rankings with an h-index. This figure illustrates the presence of multiple influential researchers who have achieved significant citation recognition.

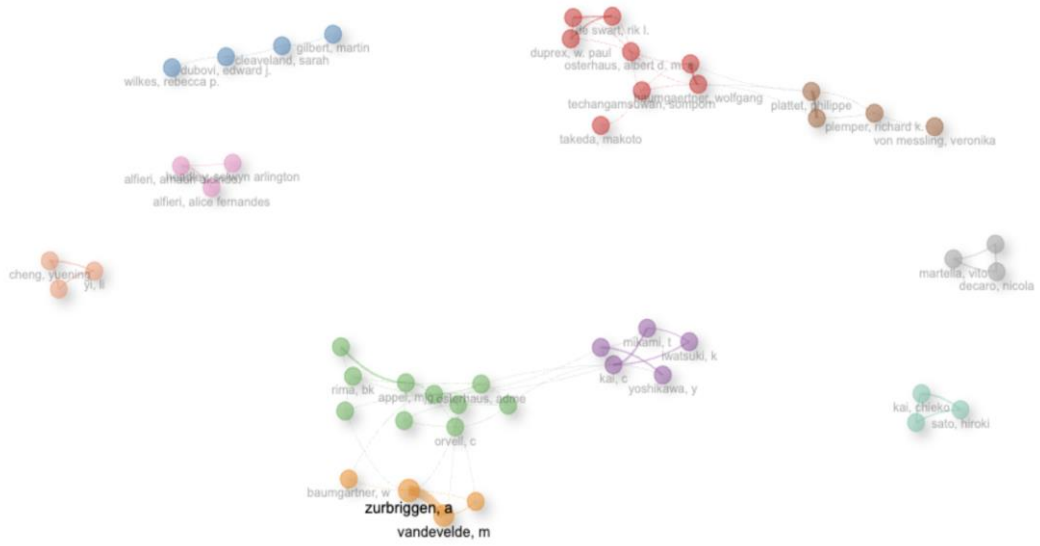
Figure 6. Author impact measured by h-index



Author Collaboration Network

Figure 7 illustrates the collaboration networks of authors working on this topic. The network tends to be clustered. Nodes represent authors and edges represent co-authored publications. Zurbriggen A. and Vandevelde M. occupy central positions within the network, with strong connections to many other authors. Clusters with high connectivity, including authors such as Dubovi E., Gilbert M. and Swart R. I. K., suggest that these researchers collaborate frequently and are involved in specific research topics. Other clusters have more limited connections and represent specific research groups or topics. Some authors, such as Decaro N. and Martella V., appear as more peripheral nodes in the network, suggesting that they collaborate less frequently or are involved in more independent research groups than other authors.

Figure 7. Author collaboration network



Keyword Co-occurrence Network

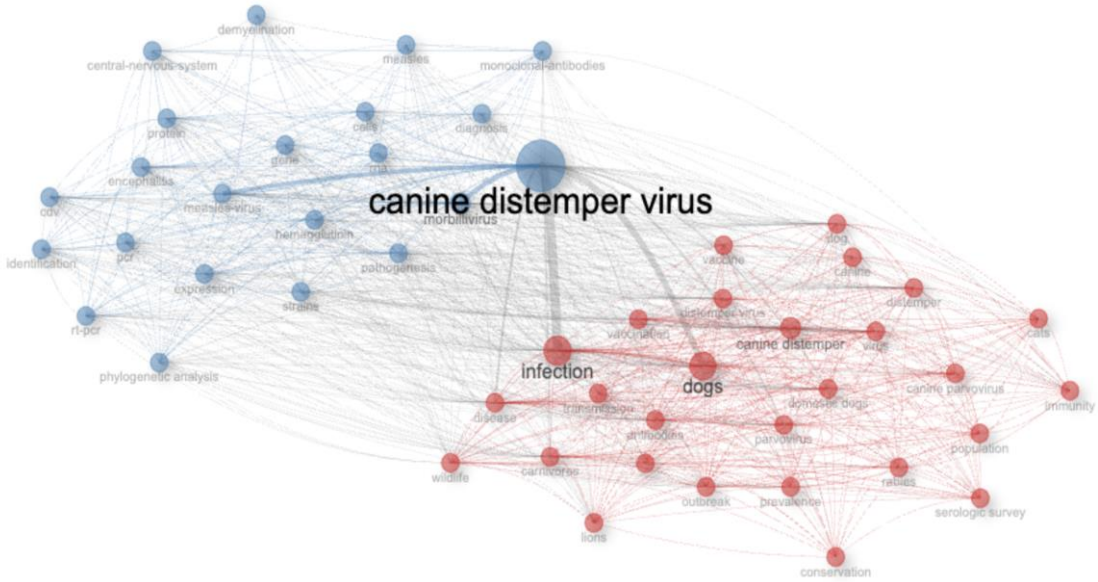
Figure 8 shows the co-occurrence of keywords related to the topic, where nodes represent keywords and edges represent their co-occurrence in documents. The largest and most central cluster contains key terminology such as "canine distemper virus," "infection," and "dogs."

The blue cluster represents a molecular cluster containing keywords such as "morbillivirus," "phylogenetic analysis," "genetic diversity," and "nucleotide sequence." This cluster highlights the importance of molecular epidemiology and genome characterization. Terms such as "encephalitis," "demyelination," "pathology," and "brain" form a clinical subcluster reflecting research on the neurological manifestations of the virus.

The red cluster contains a wildlife cluster containing keywords such as "wildlife," "wild carnivores," "ferrets," and "mink," reflecting the growing recognition of the disease's impact on wildlife conservation and research. There is also an epidemiological subcluster containing terms such as "prevalence," "PCR," "antibodies," and "serology," highlighting diagnostic and surveillance studies in this area.

Overall, this network shows that vaccine-related keywords are linked to both clinical and molecular clusters. The moderate size of the vaccine nodes suggests that the topic is current and that there is still potential for expanding vaccine research.

Figure 8. Keyword co-occurrence network revealing research themes



Word Cloud Visualization

Figure 9 presents a word cloud where word size reflects the frequency of the documents. As expected, the terms "canine distemper virus" and "CDV" are the most prominent, with the largest size. The large size of the terms "dog" and "dogs" suggests that domestic dogs remain the primary focus of research despite the spread of the disease to wildlife. The significant representation of the terms "infection," "morbillivirus," and "disease" confirms that the topic is an infectious disease. Molecular terms such as "PCR," "phylogenetic analysis," and "gene" have significant size, highlighting a strong molecular biology component. Clinical terms such as "encephalitis" and "brain" also show a notable presence. Wildlife terms such as "wildlife carnivores" and "wildlife" have moderate importance. Vaccine-related terms such as "vaccination" are moderately significant. This suggests that vaccination is an active, but not dominant, theme in the studies.

DISCUSSION

This bibliometric analysis of 2,842 publications spanning 45 years reveals the evolution of themes in canine distemper research and its current state. The findings demonstrate phases, geographic concentrations and thematic shifts that reflect technological advances and changing research priorities. Publication rates increased between 2005 and 2015, which coincided with the adoption of molecular diagnostic and sequencing technologies that transformed canine distemper virus (CDV) research from classical virology to genomic epidemiology (Shin et al., 2004; Panzera et al., 2015; Riley and Wilkes, 2015). The recent stabilisation at around 115 publications per year indicates the field's maturity, though research continues. Recent fluctuations may be attributed to the impact of the COVID-19 pandemic on veterinary education and research infrastructure (Mahdy, 2020), as the pandemic broadly disrupted academic publication dynamics across scientific disciplines (Lawson et al., 2025). A geographic analysis revealed a significant concentration of research, with the United States (38% of publications), China (11%) and Germany (10%) dominating global output. This indicates that countries with high incomes and established infrastructure are leading the way in scientific research, reflecting inequalities in research capacity and funding (Christopher and Marusic, 2013; Petersen, 2021). China's strong position indicates substantial

capacity growth in recent years, whereas emerging economies such as Brazil and India demonstrate growing yet limited research participation. Enhanced global collaboration, particularly through North–South partnerships, could address these inequalities and strengthen research capacity in underrepresented regions facing significant CDV disease burdens (Gebreyes et al., 2014). The concentration of studies at the University of Bern, the University of California system and the University of Veterinary Medicine Hannover highlights the importance of sustained institutional commitment to productive research programs. An analysis of the authors identified Zurbriggen A. and Vandevelde M. as the most influential researchers on this topic, with both achieving high productivity and high citation impact (each with an h-index of 33). Their pioneering work on CDV neuropathology and demyelination mechanisms has fundamentally shaped the current understanding of disease pathogenesis (Vandevelde and Zurbriggen, 2005; Zurbriggen et al., 1995). Collaboration networks represent moderately interconnected research communities with distinct geographical clusters. While international partnerships exist on this topic, more intensive intercontinental collaborations may provide opportunities to strengthen global connectivity through targeted exchange programs and collaborative funding mechanisms (Katz and Martin, 1997).

This analysis reveals several research opportunities. The limited interest in therapeutic interventions and new vaccine platforms highlights the need for translational research. Despite CDV's relevance to wildlife conservation and infections in uncommon hosts, the modest representation of One Health perspectives suggests a need for more integrated approaches (Zinsstag et al., 2011). The concentration of research in specific geographic areas underscores the necessity of capacity building in underrepresented regions.

CONCLUSION

This bibliometric analysis of 2,842 publications from 1980 to 2024 provides a comprehensive overview of global research into canine distemper. The topic has experienced significant growth, particularly between 2005 and 2015, due to advances in molecular technology and increased awareness of wildlife conservation. Geographic analysis revealed a concentration in high-income countries (the US accounting for 38%, China for 11%, and Germany for 10%), as well as enhanced global partnerships and capacity-building opportunities in underrepresented regions. The leading institutions involved (the University of Bern, the University of California system and the Hannover University of Veterinary Medicine) highlight the importance of sustained institutional support for this field of research. Zurbriggen A. and Vandevelde M. emerged as the most influential researchers, whose contributions to CDV neuropathology continue to shape current research (h-index = 33 each).

Key research gaps include a lack of interest in therapeutic interventions and vaccine development, poor integration of the One Health approach and uneven geographical research coverage. Future research should emphasise translational applications, strengthen global research partnerships, integrate One Health approaches and pay equal attention to fundamental biological questions and applied control strategies. The sustained publication output demonstrates that canine distemper is an area of ongoing relevance to veterinary medicine, wildlife conservation and comparative virology.

This study is intended to serve as a guide for researchers interested in the canine distemper virus. However, there are some limitations that should be considered. These include the limited availability of the reviewed studies within the Web of Science database, and the fact that only English-language publications were included, which may underrepresent research published in other languages and introduce a language bias into the findings (Amano et al., 2016). Despite these limitations, the analysis provides a comprehensive quantitative evaluation of research in the field of

canine distemper**.**

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Ethics Approval

This study did not involve animal subjects or human participants. All data were obtained from publicly available scientific databases.

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Conflict of Interest

The authors declare that they have no conflict interests regarding the publication of this article.

Author Contributions

Research Design (CRediT 1) Author 1 (%60) – Author 2 (%40)

Data Collection (CRediT 2) Author 1 (%100)

Research - Data analysis - Validation (CRediT 3-4-6-11) Author 1 (%40) – Author 2 (%60)

Writing the Article (CRediT 12-13) Author 1 (%100)

Revision and Improvement of the Text (CRediT 14) Author 1 (%40) – Author 2 (%60)

Sustainable Development Goals (SDG)

Sustainable Development Goals: 3 Good Health and Well-Being

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