HSI Health Sciences Investigations Journal

share

Send us an email: hsijournal@ug.edu.gh
Visit us: https://www.hsijournal.ug.edu.gh

ISSN Online 2704-4890 | ISSN Print 2720-7609

Online first publication

Original Research Article

HSI Journal (2025) Volume 7 (Issue 2):1295-1304. https://doi.org/10.46829/hsijournal.2025.12.7.2.1295-1304

Open Access

Eighty-one years of research on congenital toxoplasmosis: A comprehensive bibliometric analysis

Isaac F ABOAGYE [1]*, Hannah E OFORI-KITI [1], Gertrude A ENCHILL [1]

[1] *Department of Animal Biology and Conservation Science, School of Biological Sciences, University of Ghana, Legon, Accra, Ghana*

Received July, 2025; Revised October, 2025; Accepted November,2025

Abstract

Background: Congenital toxoplasmosis poses significant health and socioeconomic challenges, necessitating effective research and control strategies.

Objective: The study evaluated global research output on congenital toxoplasmosis based on articles indexed in Scopus, assessed collaborations, and identified research gaps through co-authorship and author keyword co-occurrence data, with implications for research and improved disease control.

Methods: The review used the search term "congenital toxoplasmosis*" and "humans" to retrieve 1,382 research articles from Scopus (1942–June 2023). Co-authorship and author keywords co-occurrence analyses were performed on these articles based on author-affiliated countries that fulfilled the minimum thresholds of five documents, regardless of citations, and five keyword occurrences, respectively. The bibliometric maps were created using VOSviewer.

Results: The findings indicate that research output on the subject has increased steadily since 1966, with the most prolific authors and institutions based in France, the USA, and Brazil. Collaborative research networks were strongest among authors from the USA, France, the UK, Denmark, Italy, Austria, Sweden, and Brazil, with high total link strengths of 161, 137, 127, 103, 83, 73, 63, and 53, respectively. Frequently used keywords and their respective high occurrences and strong total link strengths included *Toxoplasma gondii* (209; 382), congenital toxoplasmosis (251; 370), toxoplasmosis (172; 331), and pregnancy (75; 185). In contrast, terms such as abortion, microcephaly, prenatal diagnosis, risk factors, prevention, and knowledge appeared less frequently (5 – 33), with weak link strengths ranging from 6 to 87.

Conclusion: The findings highlight critical gaps in congenital toxoplasmosis research and emphasise the need for greater focus on risk factors, prevention, diagnosis, and stakeholder collaboration to enhance control efforts. Future research and policy should prioritise early detection strategies, maternal education, and preventive interventions to reduce the disease burden and improve neonatal outcomes.

Keywords: Congenital toxoplasmosis, bibliometric analyses, VOSviewer, research gaps

Cite the publication as Aboagye IF, Ofori-Kiti HE, Enchill GA (2025) Eighty-one years of research on congenital toxoplasmosis: A comprehensive bibliometric analysis. HSI Journal 7 (2):1295-1304. https://doi.org/10.46829/hsijournal.2025.12.7.2.1295-1304

INTRODUCTION

Toxoplasmosis is a common parasitic zoonotic disease [1] caused by *Toxoplasma gondii*, an apicomplexan protozoan parasite [2]. *T. gondii* is widely distributed geographically [3,4] and can infect and replicate within any nucleated mammalian or avian cell [5]. Domestic cats and related species (family Felidae), definitive hosts for *T. gondii*, shed unsporulated oocysts in faeces, which sporulate and become infective in the environment after 1 - 5 days. Intermediate hosts, including birds and rodents [6,7], become infected after ingesting soil, water, or plant material contaminated with oocysts. The oocysts transform into tachyzoites, which localise in neural and muscle tissues and develop into bradyzoite-containing tissue cysts. Most feline infections occur through consumption of prey harbouring tissue cysts of *T. gondii* or, rarely, through ingestion of sporulated oocysts, although congenital infections have also been reported [8].

In humans, the principal routes of transmission of *T. gondii* infection are through ingestion of oocyst-contaminated soil

* *Corresponding author*
Email: iaboagye@ug.edu.gh

share
Send us an email: hsijournal@ug.edu.gh
Visit us: https://www.hsijournal.ug.edu.gh

and water, tissue cysts in undercooked meat, and congenital transmission [9]. Rare instances of transmission may also occur through organ transplantation [9,10], blood transfusion [9,11] and accidental inoculation of tachyzoites [9]. Human infection with *T. gondii* is widespread, as one-third of the world's population is exposed to the infection [12], with pregnant women estimated to have a latent toxoplasmosis prevalence of 33.8% [13]. Although most infections are subclinical [14], several studies indicate that the disease manifests when acquired congenitally or in immunocompromised patients [15,16], causing neurological complications or toxoplasmic encephalitis [15].

Latent toxoplasmosis is associated with depression [17], suicidal behaviour [17,18], and increased risk of other mental health disorders, particularly autism and schizophrenia [12]. The rate of transplacental Toxoplasma infection is estimated at 50% in untreated mothers and 25% in treated mothers [19,20], with several clinical features reported to correlate with infection. Congenital infection is associated with stillbirth [21], seizures [22], hydrocephaly, microcephaly, and ocular or neurological complications during childhood or early adulthood [21,22]. Its severity is increased if infection occurs during the early stages of pregnancy [22]. These pathologies have an enormous socioeconomic burden, hence necessitating a comprehensive and effective approach to the control of congenital toxoplasmosis.

Bibliometric reviews are important as they provide a systematic, data-driven means of synthesising the rapidly expanding scientific literature. By using indicators such as citations, co-authorships, and keyword co-occurrences, they offer objectivity, transparency, and insight into significant scientific research findings and knowledge gaps [23]. By complementing traditional reviews, which provide detailed conceptual and critical analysis, bibliometric analyses add a quantitative overview that uncovers patterns, tracks research dynamics, and guides literature selection [24]. Together, they provide a more comprehensive understanding of a research area, supporting future research, policymaking, and resource allocation. This review evaluated global research output on congenital toxoplasmosis using Scopus articles, assessed collaborations, and identified research gaps through co-authorship and author keyword co-occurrence data, with implications for research and improved disease control.

MATERIALS AND METHODS

Data source, search strategy, and eligibility criteria

The search for articles on congenital toxoplasmosis in humans was conducted on June 21, 2023, in Scopus, one of the largest curated abstract and citation databases with wide global and regional coverage of scientific journals, conference proceedings, and books [25,26]. It indexes high-quality bibliometric data [25] and a greater number of unique sources [26], making it suitable for academic research.

Based on a previous search strategy [27], the initial search across article titles, abstracts, and keywords using the search term "congenital toxoplasmosis*" AND "humans", with no year limit, identified 3,008 documents. Limiting it to articles published in English, the query string for the search, TITLE-ABS-KEY ("congenital toxoplasmosis*" AND "human") AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (LANGUAGE, "English")), retrieved 1,382 articles. Only research articles were included, as they constitute the primary source of original scientific knowledge and are subject to formal peer-review standards. Restricting the analysis to research articles, therefore, provides a more accurate representation of the core scientific output. All other document types, including review, letter, conference paper, note, editorial, short survey, book chapter, and erratum, were excluded from the study as they often serve secondary purposes such as summarising existing work, providing commentary, or reporting preliminary findings, which may distort citation patterns and comparability.

Method of accessing publication output, author and institutional information

The numbers of articles on congenital toxoplasmosis in humans, published per year from 1942 to June 2023, were used to calculate the cumulative research output. Figure 1, illustrating research output on congenital toxoplasmosis in humans, was generated using the chart tool in Microsoft Excel (version 16). Research information on the 10 most prolific authors (Table 1) and 10 most productive institutions (Table 2) was retrieved from their respective Scopus pages.

Creation of bibliometric maps

Citations and bibliographical information, abstracts, keywords, and references of the 1,382 articles were exported to VOSviewer (version 1.6.19, Centre for Science and Technology Studies, Leiden University, The Netherlands), a software tool used to construct and visualise bibliometric maps [28]. Based on the objective of the review, bibliometric maps were generated to analyse co-authorships among researchers and their affiliated countries, as well as co-occurrence patterns of author keywords.

In the co-authorship and co-occurrence analyses, as previously described [27], the objects of interest (items) were the affiliated countries of the authors and author keywords, respectively. The co-authorship analysis used country as the unit of analysis and included 42 of the 140 author-affiliated countries that fulfilled the minimum thresholds of five documents, regardless of citations. The countries were visualised using the overlay mode in VOSviewer (Figure 2). For each of the 42 countries, the number of documents published, the total citations received, and the total strength of co-authorship links with other countries were recorded (Table 3). The co-occurrence

share
Send us an email: hsijournal@ug.edu.gh
Visit us: https://www.hsijournal.ug.edu.gh

analysis used author keywords as the unit of analysis and included 76 out of the 1,386 keywords. The keywords were visualised using the network mode in VOSviewer (Figure 3). Their occurrences and total link strengths were recorded (Table 4). These thresholds were set to strike a balance between inclusiveness and analytical clarity, allowing for the inclusion of countries and keywords with sufficient representation while excluding those that occurred too infrequently, in order to provide meaningful insights.

RESULTS

Between 1942 and 1965, the number of publications per year on congenital toxoplasmosis was very low. However, the publication numbers generally fluctuated but increased steadily from 1966 to the second quarter of 2023, reaching a cumulative total of 1,382 (Figure 1). Table 1 presents the 10 most prolific authors in human congenital toxoplasmosis research, their publication statistics, and affiliated institutions and countries. These authors were affiliated with France, the United States of America, and Denmark, with first publication years ranging from 1958 to 1996 and total publications ranging from 78 – 552. Table 2 presents the 10 most productive institutions, located in France, the United States of America, and Brazil, that have contributed substantially to congenital toxoplasmosis research.

Figure 2 presents a bibliometric map of co-authorships in overlay visualisation mode, showing nine country clusters represented by different colours, with 176 links (relationships among author-affiliated countries), and a total link strength of 591. In this context, co-authorship link

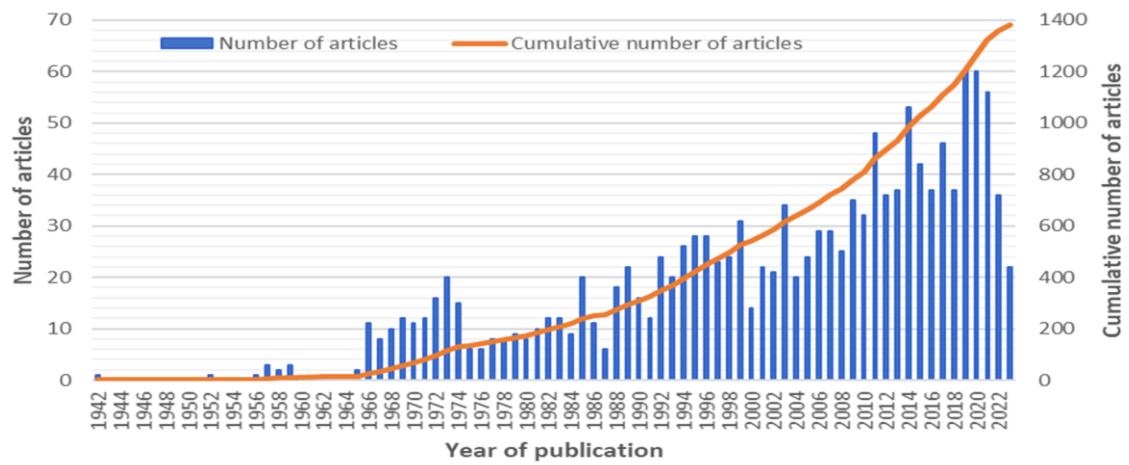

Figure 1. Annual and cumulative numbers of research articles on congenital toxoplasmosis in humans indexed in Scopus from 1942 to June 2023

Table 1. List of the 10 most prolific authors in congenital toxoplasmosis research

No.	Author	Scopus author ID	Year of first publication*	TP (h-index)	TC	Current affiliation	Country
1	Wallon, Martine	7004601589	1991[b]	140 (39)	5185	Hopital de la Croix-Rousse	France
2	Peyron, Francois M	7005573406	1982[b]	215 (44)	6348	Hopital de la Croix-Rousse	France
3	McLeod, Rima L.	56686310300	1977[a]	180 (59)	9250	The University of Chicago	USA
4	Pelloux, Hervé	55249619800	1991 [a]	222 (43)	6607	Université Grenoble Alpes, Saint Martin d'Heres	France
5	Petersen, Eskild	7202854790	1978[b]	326 (58)	11191	Aarhus Universitet	Denmark
6	Thulliez, Philippe	7005003087	1980[b]	181 (61)	10967	Institut de Puériculture et de Périnatalogie	France
7	Villena, Isabelle	7004871144	1996[b]	208 (40)	5777	CHU de Reims	France
8	Remington, Jacks S.	35449545000	1958[a]	552 (95)	31791	Stanford University School of Medicine	USA
9	Fricker-Hidalgo, Hélène	6701772133	1995[a]	78 (26)	2266	Centre Hospitalier Universitaire de Grenoble	France
10	Pinon, Jean Michel	35870519300	1969[b]	155 (30)	3040	Université de Reims Champagne-Ardenne	France

* Role in co-authorship, superscripts; [a]: first author; [b]: co-author
TP: Total Publications; TC: Total Citation; h-index: Hirsch index; USA: United States of America

share
Send us an email: hsijournal@ug.edu.gh
Visit us: https://www.hsijournal.ug.edu.gh

strength reflects the number of publications co-authored between two countries [28]. Authors affiliated with the USA, France, the UK, Denmark, Italy, Austria, Sweden, and Brazil contributed the most to congenital toxoplasmosis research, with high total link strengths of 161, 137, 127, 103, 83, 73, 63, and 53, respectively (Table 3).

Author keywords frequency and link strengths

Figure 3 shows a bibliometric map of author keywords co-occurrence in network visualisation mode. Among the 76 author keywords that met the minimum threshold of five occurrences, Toxoplasma gondii, congenital toxoplasmosis, toxoplasmosis, and pregnancy were the most frequent, with occurrences and total link strengths of

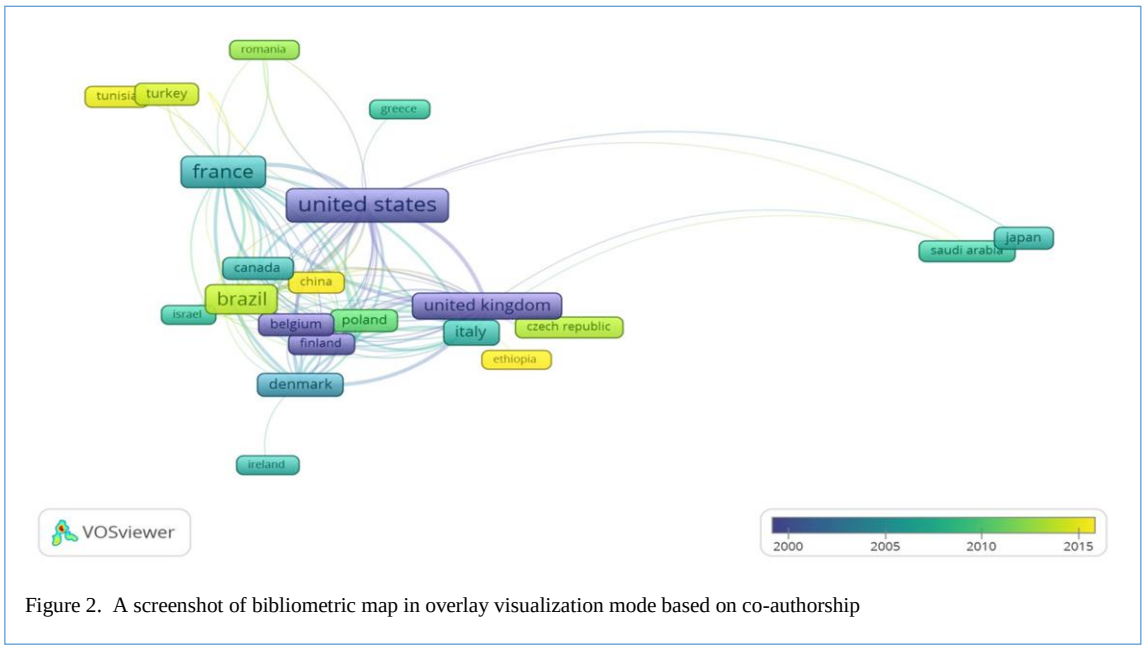

Figure 2. A screenshot of bibliometric map in overlay visualization mode based on co-authorship

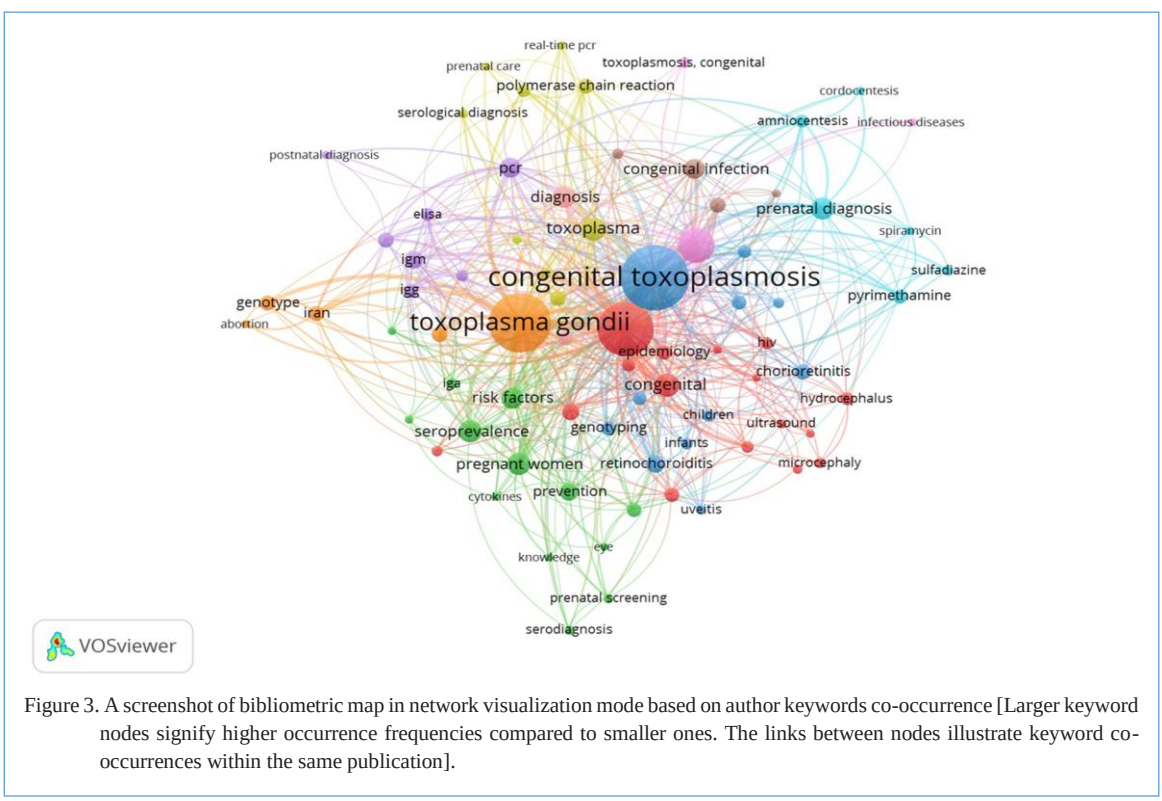

Figure 3. A screenshot of bibliometric map in network visualization mode based on author keywords co-occurrence [Larger keyword nodes signify higher occurrence frequencies compared to smaller ones. The links between nodes illustrate keyword co-occurrences within the same publication].

share
Send us an email: hsijournal@ug.edu.gh
Visit us: https://www.hsijournal.ug.edu.gh

Table 2. Top ten most productive institutions researching and publishing on congenital toxoplasmosis

No.	Institution	Scopus affiliation ID	Number of documents in Scopus	Years of first and recent publications	Country
1	Inserm	60000905	55	1986; 2023	France
2	Hôpital de la Croix-Rousse	60010942	56	1984; 2022	France
3	The University of Chicago	60029278	34	1994; 2023	USA
4	Fundacao Oswaldo Cruz	60026004	32	1968; 2023	Brazil
5	Universidade Federal de Minas Gerais	60030074	32	2000; 2022	Brazil
6	AP-HP Assistance Publique – Hôpital de Paris	60021567	32	2006; 2022	France
7	Universidade de São Paulo	60008088	28	1976; 2023	Brazil
8	Université Paris Cité	60123796	29	1988; 2023	France
9	Universidade Federal de Uberlândia	60015104	22	2002; 2023	Brazil
10	Université Grenoble Alpes	60104653	26	2002; 2023	France

* USA: United States of America

Table 3. Citations of published documents and the total strength of co-authorship links with other countries

Country	*Documents	†Citations	**Total link strength
United States of America	281	14829	161
France	228	11875	137
United Kingdom	105	4704	127
Denmark	41	2695	103
Italy	79	2214	83
Austria	26	1378	73
Sweden	24	1052	63
Brazil	172	3095	53
Poland	30	1099	48
Canada	36	1412	33
Germany	30	3385	30
Belgium	33	1186	29
Norway	19	623	26
Switzerland	27	1221	25
Netherlands	28	1887	23
Australia	16	888	22
Colombia	24	625	22
Finland	18	927	21
China	16	496	15
Argentina	13	218	13
Spain	7	180	13
Mexico	16	195	7
Iran	35	347	6
Romania	8	80	6
Morocco	9	37	5
Japan	26	253	4
Malaysia	7	87	4
Pakistan	5	21	4
Serbia	6	68	4
Thailand	6	77	4
Turkey	24	213	4
Israel	6	116	3
Egypt	12	91	2
Saudi Arabia	14	107	2
Tunisia	12	191	2
Czech Republic	10	170	1
Ethiopia	6	115	1
Greece	7	824	1
Iraq	5	3	1
Ireland	5	48	1
India	25	209	0
Taiwan	5	97	0

*The number of documents published by authors affiliated with the countries. †The total number of citations received by the documents. **The total strength of the co-authorship links with other countries (extent of collaboration a given country has with other countries, based on co-authored publications).

share
Send us an email: hsijournal@ug.edu.gh
Visit us: https://www.hsijournal.ug.edu.gh

Table 4. Author keywords, their occurrences, and total strength of the co-occurrence links with other keywords

Keyword	Occurrence of keyword	^Total link strength
Toxoplasma gondii	209	382
Congenital toxoplasmosis	251	370
Toxoplasmosis	172	331
Pregnancy	75	185
Congenital	33	87
Prenatal diagnosis	29	73
PCR	24	72
Diagnosis	31	70
Seroprevalence	30	68
Risk factors	26	67
Pregnant women	30	66
IgM	18	62
Toxoplasma	32	59
Congenital infection	23	46
Iran	15	44
IgG	12	43
Prevention	18	42
Screening	16	39
Amniocentesis	11	38
Serology	14	38
Placenta	14	37
Chorioretinitis	14	36
Polymerase chain reaction	15	36
Treatment	14	36
Elisa	11	35
Prevalence	15	34
Pyrimethamine	12	33
Retinochoroiditis	19	33
Epidemiology	13	32
Genotype	15	32
Vertical transmission	15	30
Amniotic fluid	10	27
Brazil	10	27
Congenital infections	12	25
IgG avidity	7	25
Newborn	12	25
Ocular toxoplasmosis	12	25
Neonatal screening	11	24
Cytomegalovirus	9	23
Genotyping	12	22
Antibodies	8	21
Spiramycin	5	21
HIV	8	20
Hydrocephalus	10	20
IgA	7	20
Infection	11	20
Sulfadiazine	7	18
Antibody	6	17
Children	8	16
Public health	7	16
Transmission	5	16
Uveitis	6	15
Women	5	15
Incidence	7	14
Infants	9	14
Prenatal screening	6	14
Serological diagnosis	6	14
Cytokines	5	13
Real-time PCR	5	13
Risk factor	7	13
Cordocentesis	5	12
Prenatal	5	12
Serodiagnosis	6	12
Abortion	5	11
Eye	5	11
Microcephaly	7	11
Reactivation	5	11
Prenatal care	5	10
T. gondii	5	10
Infant	5	9
Postnatal diagnosis	5	9
Zika virus	6	9
Knowledge	5	8
Ultrasound	6	8
Infectious diseases	5	6
Toxoplasmosis, congenital	7	6

sum of a keyword's co-occurrences with all other keywords

209 and 382, 251 and 370, 172 and 331, and 75 and 185, respectively. Other keywords, such as abortion, microcephaly, prenatal diagnosis, risk factors, prevention, and knowledge, appeared less often, with occurrences ranging from 5 to 33 and link strengths from 6 to 87 (Table 4).

DISCUSSION

Toxoplasmosis research interest and publication output

Human infection with *T. gondii* is widespread globally, with a reported strong association between maternal immunoglobulin G (IgG) positivity and placental *T. gondii* deoxyribonucleic acid [29], indicating the risk of mother-to-child transmission. The wide geographical distribution of the infection and its complications, particularly when acquired congenitally or in immunocompromised patients [15,16], prompted this review. Although the number of yearly publications on the subject indexed in Scopus between 1942 and 1965 was very low, it has generally increased steadily from 1966 to the second quarter of 2023, with a cumulative number of 1,382 (Figure 1). However, author keyword co-occurrences (number of publications in which keyword pairs appear together) and their respective total link strengths (sum of a keyword's co-occurrences with all other keywords) show that various aspects of toxoplasmosis received limited research attention over the period because of the fewer occurrences and low link strengths ranging from 5 – 33 and 6 – 87, respectively (Table 4). These include risk factors, knowledge, prevention, transmission, and prenatal diagnosis of congenital toxoplasmosis, requiring more research into these aspects of the disease.

share
Send us an email: hsijournal@ug.edu.gh
Visit us: https://www.hsijournal.ug.edu.gh

Authors, countries, and international collaboration for toxoplasmosis research

International collaboration is one way to address societal challenges and may take a variety of forms, including research collaborations [30], which have the potential to generate new knowledge to tackle global challenges [31]. The publication statistics of the 10 most prolific authors, affiliated with France, the USA, and Denmark (Table 1) suggest that they are experienced researchers and may serve as valuable collaborators for research in congenital toxoplasmosis. The 10 most productive institutions researching and publishing on the subject are located in France, the USA, and Brazil (Table 2). Collaborative research networks (CRNs) were strongest among authors from the USA, France, the UK, Denmark, Italy, Austria, Sweden, and Brazil (Table 3), who demonstrated high publication output and total link strength. However, CRNs in other parts of the world, such as Asia, Africa, and Australia/Oceania, were weaker. In general, funding, surveillance capacity, and journal access strongly shape collaborative research networks, influencing publication output, citation impact, and link strength. Adequate funding enables international partnerships and higher-impact outputs, with co-funded studies showing more publications and citations [32]. Limited surveillance capacity restricts data quality and novelty, weakening collaboration ties and reducing network visibility [33]. Conversely, while restricted journal access in many low- and middle-income countries constrains dissemination and citation opportunities, open access has been shown to enhance visibility, citation counts, and collaborative link strength, underscoring the negative effects of access barriers on research impact [34]. Addressing these gaps requires expanding targeted funding initiatives, investing in surveillance infrastructure and training, and promoting affordable open access publishing to strengthen global research networks.

In Africa, for example, only four countries (Morocco, Egypt, Tunisia, and Ethiopia) met the minimum thresholds of five documents and zero citations per country, with weaker research collaboration statistics and lower research output on the disease (Table 3) as previously reported [35]. This is largely due to competing health priorities, inadequate funding, weak diagnostic capacity, and the absence of routine screening and surveillance systems. These challenges, together with fragmented research networks, small-scale study designs, and publication in non-indexed journals, contribute to low visibility and poor citation rates. There is a need to foster multi-country toxoplasmosis research consortia and integrate toxoplasmosis studies into existing maternal and child health programmes to enhance research quality and increase output in indexed journals. Research collaboration helps build capacity for research and knowledge [36] through training as well as the transfer of knowledge and skills, and can be explored at individual, institutional, and national levels. The goal of such collaboration should emphasise the risk that congenital toxoplasmosis poses to public health, particularly maternal, fetal, and neonatal health, while highlighting the importance of basic and applied research in its control. This requires greater recognition of the risk by stakeholders, including funders, governments and institutions as well as the involvement of early and mid-career researchers to help sustain this research effort for effective control of the disease.

Research themes and challenges of toxoplasmosis control

This review identified the following research themes on congenital toxoplasmosis for consideration in future research based on less frequently used keywords in publications and link strengths indicative of fewer publications in which the keywords occur together:

1. Risk factors, knowledge, and prevention of congenital toxoplasmosis.
2. Transmission and epidemiology of congenital toxoplasmosis.
3. Pathologies associated with congenital toxoplasmosis.
4. Toxoplasma IgG Avidity and immunoglobulin M (IgM) testing in pregnant women.
5. Prenatal diagnosis of congenital toxoplasmosis and treatment of pregnant women.

The control of toxoplasmosis is associated with several challenges, which include a lack of in-depth knowledge about risk factors, control strategies, and research opportunities [37], low awareness among healthcare professionals [38], and pregnant women [39]. There is also a need for a more effective vaccine against T. gondii and for the prevention of disease reactivation following treatment. Preventive measures based on hygiene practices and treatment in cases of maternal seroconversion reduce the risks of infection and symptomatic congenital toxoplasmosis, respectively. However, in many parts of the world, there is no systematic toxoplasmosis screening, mainly due to high cost, which may partly explain the low awareness among healthcare professionals and pregnant women. Maternal and prenatal screening offer the advantage of early detection and treatment to prevent congenital toxoplasmosis, as recommended by Picone et al. (2020) [40].

Considerable progress has been made in the search for a vaccine against *T. gondii*. Deoxyribonucleic acid [41,42] and protein [43-45] vaccine candidates, as well as live-attenuated [46,47] and inactivated whole-pathogen [48] vaccines, have achieved high protection against *T. gondii*, reducing the number of brain cysts. However, concerns exist regarding the lack of strong cross-protection against different strains of T. gondii and the reactogenicity of highly immunogenic live-attenuated strains, underscoring the need for improvement in the search for more effective T. gondii vaccines. Although current drug treatments are effective in eliminating replicating tachyzoites, one key challenge is their inability to eliminate tissue cysts, creating opportunities for reactivated toxoplasmosis, particularly in

share
Send us an email: hsijournal@ug.edu.gh
Visit us: https://www.hsijournal.ug.edu.gh

immunocompromised patients and recurrent ocular toxoplasmosis in immunocompetent individuals. Therefore, investigation into new therapeutic targets of T. gondii [49,50] may aid the discovery of more effective drugs against toxoplasmosis.

Implications for congenital toxoplasmosis research and control

The risk of *Toxoplasma* infection is particularly high among immunocompromised individuals [51,52]. Moreover, contact with cats [51], consumption of raw vegetables [51,53], gravidity, and age [51,54] are major risk factors for infection. The widespread distribution of *T. gondii* [3,4] generally poses a risk to individuals with inadequate knowledge of its biology and epidemiology, or those with poor personal hygiene. Human behaviour not only plays an important role in the spread of emerging infectious diseases [55] but also facilitates the transmission of several protozoan zoonoses, including toxoplasmosis [56]. Contact with companion animals such as cats, consumption of undercooked meat infected with Toxoplasma, and inadequate potable water supply [56] are key factors in the spread of toxoplasmosis. Knowledge correlates positively with attitudes and behaviours related to the prevention of *T. gondii* infection [57]. Therefore, adequate knowledge of the risk factors, modes of transmission, and pathologies associated with toxoplasmosis can promote behavioural changes that help prevent infection. Moreover, proper food preparation, control of stray and feral animal populations, improved hygiene, adequate potable water supply, and the development of diagnostic and therapeutic interventions are fundamental to effective control. These findings highlight the importance of conducting further applied research for effective control of congenital toxoplasmosis.

Limitations of the review

This review was limited to English-language articles retrieved exclusively from Scopus, although numerous articles are indexed across multiple databases. As a result, relevant studies published in languages other than English or indexed in databases other than Scopus may have been excluded. This restriction introduces potential biases related to language and database coverage, which could affect the completeness and generalizability of the findings. Moreover, because citations accumulate slowly, citation delay bias may cause recent publications to appear underrepresented. Complementing citation counts with co-authorship and keyword co-occurrence analyses, which highlight recent work regardless of citation age, reduces the impact of this limitation.

Conclusion

Authors affiliated with the USA, France, the UK, Denmark, Italy, Austria, Sweden, and Brazil co-authored the highest number of publications on congenital toxoplasmosis, with high total link strengths ranging from 53 to 161. The 10 most prolific authors were affiliated with France, the USA, and Denmark, while the most productive institutions were located in France, the USA, and Brazil. Although annual publications on the disease have steadily increased since 1966, keywords with low occurrence (5–33) and weak link strengths (6–87), suggest the need for further research on risk factors, knowledge, prevention, transmission, pathologies, and diagnosis of congenital toxoplasmosis. These findings underscore the importance of stakeholder collaboration in strengthening research and knowledge capacity for the effective control of congenital toxoplasmosis. Moreover, incorporating bibliometric evidence into research policy and funding decisions can direct resources toward emerging fronts, underexplored areas, and collaborations with high potential for innovation and impact.

DECLARATIONS

Ethical consideration

Not Applicable

Consent to publish

All authors agreed on the content of the final paper.

Funding

None

Competing Interest

The authors declare no conflict of interest

Author contribution

IFA conceived the research idea, designed the study, searched for the articles, analysed and interpreted the data, and wrote the manuscript. HEO-K and GAE were involved in the search for articles and data analysis. All authors read and approved the final manuscript.

Acknowledgement

The authors appreciate the Department of Animal Biology and Conservation Science and the University of Ghana for providing the office space and Scopus access, respectively.

Availability of data

Data is available upon request to the corresponding author

REFERENCES

1. Tenter AM, Heckeroth AR, Weiss LM (2000) Toxoplasma gondii: from animals to humans. Int J Parasitol 30:1217–1258.
2. Dardé ML, Ajzenberg D, Smith J (2007) Population structure and epidemiology of Toxoplasma gondii. In: Toxoplasma gondii, pp 49–80. Academic Press.
3. Dubey JP (2021) Toxoplasmosis of Animals and Humans, 3rd edn. Boca Raton: CRC Press.
4. Webster JP, Dubey JP (2010) Toxoplasmosis of Animals and Humans. Parasit Vectors 3:112.
5. Bahia-Oliveira LM, Jones JL, Azevedo-Silva J, Alves CC, Oréfice F, Addiss DG (2003) Highly endemic, waterborne

Toxoplasma gondii in north Rio de Janeiro state, Brazil. Emerg Infect Dis 9:55–62.

6. Jones JL, Kruszon-Moran D, Wilson M (2003) Toxoplasma gondii infection in the United States, 1999–2000. Emerg Infect Dis 9:1371–1374.

7. Dubey JP, Jones JL (2008) Toxoplasma gondii infection in humans and animals in the United States. Int J Parasitol 38:1257–1278

8. Elmore SA, Jones JL, Conrad PA, Patton S, Lindsay DS, Dubey JP (2010) Toxoplasma gondii: epidemiology, feline clinical aspects, and prevention. Trends Parasitol 26:190–196.

9. White SL, Rawlinson W, Boan P, Sheppeard V, Wong G, Waller K, Opdam H, Kaldor J, Fink M, Verran D, Webster A, Wyburn K, Grayson L, Glanville A, Cross N, Irish A, Coates T, Griffin A, Snell G, Alexander SI, Campbell S, Chadban S, Macdonald P, Manley P, Mehakovic E, Ramachandran V, Mitchell A, Ison M (2019) Infectious disease transmission in solid organ transplantation: donor evaluation, recipient risk, and outcomes of transmission. Transplant Direct 5:e416.

10. Bahhaj R, Ahmadpour E, Mahami-Oskouei M, Fallah E, Shamsasenjan K, Safaiyan A (2017) Toxoplasma gondii infection and related risk factors among blood donors in northwest Iran. Arch Clin Infect Dis 12:e62005.

11. Flegr J, Horáček J (2020) Negative effects of latent Toxoplasma gondii on mental health. Front Psychiatry 10:1012.

12. Rostami A, Riahi SM, Gamble HR, Fakhri Y, Shiadeh MN, Danesh M, Behniafar H, Paktinat S, Foroutan M, Mokdad AH, Hotez PJ, Gasser RB (2020) Global prevalence of latent Toxoplasma gondii in pregnant women: a systematic review and meta-analysis. Clin Microbiol Infect 26:673–683.

13. Pal M, Berhanu G, Steinmetz CH, Durglishvili N (2021) Toxoplasmosis: an emerging and re-emerging zoonosis of global public health concern. Am J Infect Dis Microbiol 9:32–38.

14. McFarland MM, Bartlett M, Davis P (2016) Toxoplasmic encephalitis. In: Encephalitis. Telangana: Avid Science.:2–52

15. McAuley JB (2014) Congenital Toxoplasma gondii infection. J Pediatr Infect Dis Soc 3:S30–S35.

16. Kamal AM, Kamal AM, Abd El-Fatah AS, Rizk MM, Hassan EE (2022) Latent Toxoplasma gondii is associated with depression and suicidal behavior. Arch Suicide Res 26:819–830.

17. Desmettre T (2020) Toxoplasmosis and behavioural changes. J Fr Ophtalmol 43:e89–e93.

18. Sepúlveda-Arias JC, Gómez-Marin JE, Bobić B, Naranjo-Galvis CA, Djurković-Djaković O (2014) Toxoplasmosis as a travel risk. Travel Med Infect Dis 12:592–601.

19. Frenkel JK (2000) Biology of Toxoplasma gondii. In: Ambroise-Thomas P, Peterse E (eds) Congenital toxoplasmosis: scientific background, clinical management and control. Paris: Springer-Verlag; 9–25

20. Robert-Gangneux F, Dardé ML (2012) Epidemiology of and diagnostic strategies for toxoplasmosis. Clin Microbiol Rev 25:264–296. https://doi.org/10.1128/cmr.05013-11

21. Khan K, Khan W (2018) Congenital toxoplasmosis: an overview of the neurological and ocular manifestations. Parasitol Int 67:715–721. https://doi.org/10.1016/j.parint.2018.07.004

22. Ding S (2025) Insights into bibliometric analyses. JBI Evid Synth 23:564–565.

23. Öztürk O, Kocaman R, Kanbach DK (2024) How to design bibliometric research: an overview and a framework proposal. Rev Manag Sci 18:3333–3361.

24. Baas J, Schotten M, Plume A, Côté G, Karimi R (2020) Scopus as a curated, high-quality bibliometric data source for academic research in quantitative science studies. Quant Sci Stud 1:377–386. https://doi.org/10.1162/qss_a_00019

25. Wouters P, Thelwall M, Kousha K, Waltman L, De Rijcke S, Rushforth A, Franssen T (2015) The metric tide. Literature review. Supplementary report I to the independent review of the role of metrics in research assessment and management. Available from: https://doi.org/10.13140/RG.2.1.5066.3520

26. Aboagye IF (2024) Over half a century of research on tick infestation in livestock: a comprehensive bibliometric analysis. Nativa 12:320–328.

27. Van Eck NJ, Waltman L (2023) Manual for VOSviewer version 1.6.19. CWTS meaningful metrics. Universiteit Leiden. Available from: https://www.vosviewer.com/download

28. Kwofie KD, Ghansah A, Osei JHN, Frempong KK, Obed S, Frimpong EH, Boakye DA, Suzuki T, Ohta N, Ayi I (2016) Indication of risk of mother-to-child Toxoplasma gondii transmission in the Greater Accra Region of Ghana. Matern Child Health J 20:2581–2588.

29. Coburn CE, Penuel WR (2016) Research–practice partnerships in education: Outcomes, dynamics, and open questions. Educ Res 45:48–54.

30. Karram G (2013) A review of Globalization and Internationalization in Higher Education: Theoretical, Strategic and Management Perspectives, edited by F Maringe & N Foskett. Leadersh Policy Sch 12:178–180.

31. Bozeman B, Youtie J (2017) Socioeconomic impacts and public value of government-funded research: Lessons from four US National Science Foundation initiatives. Res Policy 46:1387–1398. https://doi.org/10.1016/j.respol.2017.06.003

32. Head MG, Fitchett JR, Cooke MK, Wurie FB, Hayward AC, Atun R (2013) UK investments in global infectious disease research 1997–2010: a case study. Lancet Infect Dis 13:55–64.

33. Ezema IJ, Onyancha OB (2017) Citation impact of health and medical journals in Africa: does open accessibility matter? Electron Libr 35:934–952.

34. Mulakoli F, Musembi H, Kimani A (2025) Bibliometric analysis of congenital toxoplasmosis: A ten-year (2013–2023) review of research publications. East Afr Sci J 7:28–38.

35. Haley A, Alemu SK, Zerihun Z, Uusimäki L (2022) Internationalisation through research collaboration. Educ Rev 1:1–16.

36. Manuel L, Santos-Gomes G, Noormahomed EV (2020) Human toxoplasmosis in Mozambique: gaps in knowledge and research opportunities. Parasites Vectors 13:1–10.

share
Send us an email: hsijournal@ug.edu.gh
Visit us: https://www.hsijournal.ug.edu.gh

37. Ben-Harari RR, Connolly MP (2019) High burden and low awareness of toxoplasmosis in the United States. Postgrad Med 131:103–108.

38. Khan W, Rahman HU, Fadladdin YAJ, Rafiq N, Naz R, De los Rios-Escalante PR, Ahmad S, Alrobaish SA, Al-Sowayan NS (2023) Toxoplasmosis—Awareness and Knowledge of Pregnant Women in Rural Areas of Malakand Region, Pakistan. J Parasitol Res 2023:4603066.

39. Picone O, Fuchs F, Benoist G, Binquet C, Kieffer F, Wallon M, Wehbe K, Mandelbrot L, Villena I (2020) Toxoplasmosis screening during pregnancy in France: Opinion of an expert panel for the CNGOF. J Gynecol Obstet Hum Reprod 49:101814.

40. Wang T, Yin H, Li Y, Zhao L, Sun X, Cong H (2017) Vaccination with recombinant adenovirus expressing multi-stage antigens of Toxoplasma gondii by the mucosal route induces higher systemic cellular and local mucosal immune responses than with other vaccination routes. Parasite 24:1–13.

41. Xu Y, Zhang NZ, Tan QD, Chen J, Lu J, Xu QM, Zhu XQ (2014) Evaluation of immuno-efficacy of a novel DNA vaccine encoding Toxoplasma gondii rhoptry protein 38 (TgROP38) against chronic toxoplasmosis in a murine model. BMC Infect Dis 14:525.

42. El Temsahy MM, El Kerdany ED, Eissa MM, Shalaby TI, Talaat IM, Mogahed NM (2016) The effect of chitosan nanospheres on the immunogenicity of Toxoplasma lysate vaccine in mice. J Parasitol Dis 40:611–626.

43. Dimier-Poisson I, Carpentier R, N'Guyen TTL, Dahmani F, Ducournau C, Betbeder D (2015) Porous nanoparticles as delivery system of complex antigens for an effective vaccine against acute and chronic Toxoplasma gondii infection. Biomaterials 50:164–175.

44. Xu Y, Zhang NZ, Wang M, Dong H, Feng SY, Guo HC, Zhu XQ (2015) A long-lasting protective immunity against chronic toxoplasmosis in mice induced by recombinant rhoptry proteins encapsulated in poly (lactide-co-glycolide) microparticles. Parasitol Res 114:4195–4203.

45. Wang JL, Li TT, Elsheikha HM, Chen K, Cong W, Yang WB, Bai MJ, Huang SY, Zhu XQ (2018) Live attenuated Pru: Δcdpk2 strain of Toxoplasma gondii protects against acute, chronic, and congenital toxoplasmosis. J Infect Dis 218:768–777.

46. Fox BA, Bzik DJ (2015) Nonreplicating, cyst-defective type II Toxoplasma gondii vaccine strains stimulate protective immunity against acute and chronic infection. Infect Immun 83:2148–2155.

47. Zorgi NE, Galisteo AJ, Sato MN, Do Nascimento N, de Andrade HF (2016) Immunity in the spleen and blood of mice immunised with irradiated Toxoplasma gondii tachyzoites. Med Microbiol Immunol 205:297–314.

48. Müller J, Hemphill A (2023) Toxoplasma gondii infection: novel emerging therapeutic targets. Expert Opin Ther Targets 27:293–304.

49. Di Cristina M, Dou Z, Lunghi M, Kannan G, Huynh MH, McGovern OL, Schultz TL, Schultz AJ, Miller AJ, Hayes BM, Van Der Linden W (2017) Toxoplasma depends on lysosomal consumption of autophagosomes for persistent infection. Nat Microbiol 2:1–7.

50. Odeniran PO, Omolabi KF, Ademola IO (2020) Risk factors associated with seropositivity for Toxoplasma gondii in population-based studies among immunocompromised patients (pregnant women, HIV patients and children) in West African countries, Cameroon and Gabon: a meta-analysis. Acta Trop 209:105544.

51. Wang ZD, Liu HH, Ma ZX, Ma HY, Li ZY, Yang ZB, Zhu XQ, Xu B, Wei F, Liu Q (2017) Toxoplasma gondii infection in immunocompromised patients: a systematic review and meta-analysis. Front Microbiol 8:389.

52. Akubuilo AS, Amali O, Onekutu A (2020) Seroprevalence of Toxoplasma gondii infection among pregnant women attending antenatal clinic in major health centers in Jos North, Nigeria. Open J Biosci Res 1:44–54.

53. Ayi I, Sowah AOK, Blay EA, Suzuki T, Ohta N, Ayeh-Kumi PF (2016) Toxoplasma gondii infections among pregnant women, children and HIV-seropositive persons in Accra, Ghana. Trop Med Health 44:1–8.

54. Yan QL, Tang SY, Xiao YN (2018) Impact of individual behaviour change on the spread of emerging infectious diseases. Stat Med 37:948–969.

55. Macpherson CN (2005) Human behaviour and the epidemiology of parasitic zoonoses. Int J Parasitol 35:1319–1331.

56. Nurseha FT, Mashuri YA, Pamungkasari EP, Maulani UN (2023) Knowledge, attitudes, and behavior to prevent transmission of Toxoplasma gondii among cat owners. Al-Sihah 15:23–32.