

A BIBLIOMETRIC ANALYSIS OF TZU CHI FOUNDATION'S RESEARCH PUBLICATIONS USING THE WEB OF SCIENCE FROM 1990 TO 2023

MALCOLM KOO¹ A-B,D-F
• ORCID: 0000-0002-9242-9167

¹ Department of Nursing, Tzu Chi University, Hualien, Taiwan

A – study design, B – data collection, C – statistical analysis, D – interpretation of data, E – manuscript preparation, F – literature review, G – sourcing of funding

ABSTRACT

Background: The Tzu Chi Foundation, a prominent Buddhist non-profit organization, has significantly contributed to global humanitarian efforts and academic research. However, its scholarly output has not been comprehensively analyzed.

Aim of the study: This bibliometric study aimed to analyze the research publications of individuals affiliated with the Tzu Chi academic community, indexed in the Web of Science (WoS) from 1991 to 2023.

Material and methods: Data were extracted from the Science Citation Index Expanded edition of the WoS Core Collection. Publications with authors affiliated with Tzu Chi institutions were identified using relevant keywords. Only original articles were included. Bibliometric indicators were assessed using Bibliometrix 4.1 and VOSviewer 1.6.20.

Results: A total of 9,510 original articles were published by Tzu Chi affiliates between 1991 and 2023, showing an annual growth rate of 18.7%. The most frequent subject categories were “general and internal medicine”, “pharmacology and pharmacy”, “oncology”, and “biochemistry and molecular biology”. *PLoS One* was the top published journal. Keyword analysis highlighted apoptosis, inflammation, and stroke as prominent research topics, with emerging areas such as immune checkpoint inhibitors and COVID-19.

Conclusions: This bibliometric study provided an overview of the Tzu Chi Foundation's scholarly contributions from 1991 to 2023, showing significant growth in research output and the diversification of research topics. Future efforts should focus on expanding unique research areas such as the Silent Mentor Program, stem cell research and precision medicine, and vegetarian research to enhance Tzu Chi's global research impact, improve patient care, and foster a compassionate and effective healthcare system.

KEYWORDS: Tzu Chi, research output, publications, bibliometric analysis, thematic evolution, Bibliometrix

BACKGROUND

The Tzu Chi Foundation, established by the Taiwanese Dharma Master Shih Cheng Yen in 1966, is a Buddhist non-profit organization based in Taiwan and a nongovernmental organization under the United Nations umbrella. Initially focused on local charity, the foundation has grown into an international entity that has made significant global contributions in humanitarian aid, disaster relief, environmental protection. Tzu Chi's mission is encapsulated in its four

major areas of work: charity, medicine, education, and culture, which have later extended to include international relief, bone marrow donation, community volunteerism, and environmental protection [1,2].

Over the years, the Tzu Chi Foundation has established two universities and several hospitals in Taiwan, contributing to its mission of academic and medical excellence. The Tzu Chi Junior College of Nursing, established in 1989, marked the beginning of Tzu Chi's mission of education. The college was subsequently restructured as the Tzu Chi University of Science and

Technology in 2015 to broaden its scope to offer more diverse academic disciplines. Furthermore, the Tzu Chi College of Medicine, founded in 1994, was restructured as Tzu Chi University in 2000. The two universities set to merge in August 2024, with a continued focus on practical research and development. This merger aims to leverage combined resources, enhance academic collaboration, and foster innovation. This strategic union will also enable them to address global challenges more effectively through interdisciplinary approaches and community engagement.

Currently, there are eight Tzu Chi hospitals and one clinic in Taiwan: Hualien Tzu Chi Medical Center, Dalin Tzu Chi General Hospital, Taipei Tzu Chi Hospital, Taichung Tzu Chi Hospital, Yuli Tzu Chi Hospital, Kuanshan Tzu Chi Hospital, Douliou Tzu Chi Hospital, Sanyi Tzu Chi Chinese Medicine Hospital, and Chiayi Tzu Chi Clinic [3]. Together, these educational and medical institutions function as hubs for interdisciplinary research and facilitate translating research findings into practical applications.

Despite the wealth of studies examining different aspects of the Tzu Chi Foundation, such as its humanitarian effort [4], social impact [5], social entrepreneurship [6], volunteerism [7], relief work [8], and environmental protection [9], there is a notable gap in the literature regarding its academic output. Addressing this gap could provide a more comprehensive understanding of the foundation's overall impact, measure its contributions to scientific communities, and identify potential areas for future development. Such an analysis would also enhance the visibility of Tzu Chi's scholarly work, encouraging greater recognition and fostering new collaborations that leverage the foundation's resources.

Bibliometrics is the quantitative analysis of academic literature and publications. It involves using statistical methods to analyze publications and assess the impact and productivity of research within specific research fields, scientific journals, or research institutions [10]. Bibliometric methods are increasingly used to benchmark research performance in institutions and universities [11–14], influencing funding decisions and strategic planning within the academic and research community [15,16]. By identifying areas for improvement, institutions can develop targeted strategies to enhance their research profiles. However, no research has analyzed the scholarly contributions produced by the Tzu Chi Foundation.

AIM OF THE STUDY

This bibliometric study aimed to comprehensively analyze the impact and productivity of the research output from individuals affiliated with Tzu Chi using data from the Web of Science (WoS) database.

MATERIAL AND METHODS

Data source and search query

The Science Citation Index Expanded (SCI-EXPANDED) edition of the WoS Core Collection (Clarivate Analytics, Philadelphia, PA, USA) was used to identify publications with authors affiliated with the Tzu Chi academic community using the search field "affiliation" was used. Seven related terms were auto-suggested by the WoS and they were "Buddhist Tzu Chi General Hospital," "Dalin Tzu Chi Hospital," "Hualien Tzu Chi Hospital," "Taichung Tzu Chi Hospital," "Taipei Tzu Chi Hospital," "Tzu Chi University," and "Tzu Chi University of Science & Technology." The search period was limited to the first year with identified publications, from 1991 to December 31, 2023, based on the final publication date. The search was conducted on a single date, May 26, 2024, to avoid changes in the content due to updates in the database. Only the document type of "article" was included in this analysis, excluding other document types such as reviews.

Data analysis

Complete bibliometric data fields were exported from each record. Authors' supplied keywords were used to generate word clouds, keyword trend analysis, and co-occurrence network analysis. The journal impact factors and ranking were obtained from Journal Citation Reports 2022 database. In addition, H-index values were obtained from the WoS database to provide a standardized measure of academic influence. The H-index is a metric that quantifies both the productivity and citation impact of a researcher's publications, defined as the number of papers (h) that have received at least h citations each [17]. Moreover, the conceptual structure of research themes was explored using thematic analysis to track topical trends over time [18].

Bibliometrix 4.1 (Naples, Italy) package in R [19] was used to conduct subject-level, journal-level, and author-level analyses. VOSviewer version 1.6.20 for Microsoft Windows (Centre for Science and Technology Studies, Leiden University, The Netherlands) [20] was used for co-occurrence network analysis to visualize author-supplied keywords based on the fractional counting approach [21].

RESULTS

Quantity and trends analysis of original articles

Of the 12,710 documents identified from the SCI-EXPANDED edition of the WoS from 1991 to 2023,

9,510 were original articles. These articles were included in this bibliometric analysis. Figure 1 shows a plot of the number of original articles authored by individuals affiliated with the Tzu Chi academic community, indexed in the WoS, from 1991 to 2023. The plot illustrates a steady growth in the annual number of original articles over the years, rising from below 100 in the early 1990s to over 800 by 2022. The annual growth rate of publications was 18.7%.

The 9,510 original articles were indexed across 179 different WoS subject categories. Figure 2 displays the top 50 WoS subject categories with highest frequency of original articles. “General and internal medicine” showed the highest frequency of 920 articles, followed by “pharmacology and pharmacy”, “oncology”, and “biochemistry and molecular biology”, each with around 500 to 600 articles. Categories such

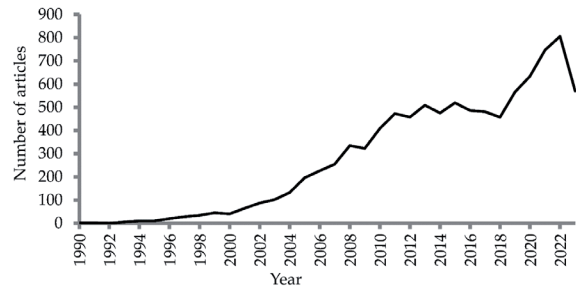


Figure 1. A plot of the annual number of original articles authored by individuals affiliated with the Tzu Chi academic community, indexed in the Web of Science, from 1991 to 2023

as multidisciplinary sciences, neuroscience, surgery, cell biology, and clinical neurology also showed publication frequencies of over 400 articles.

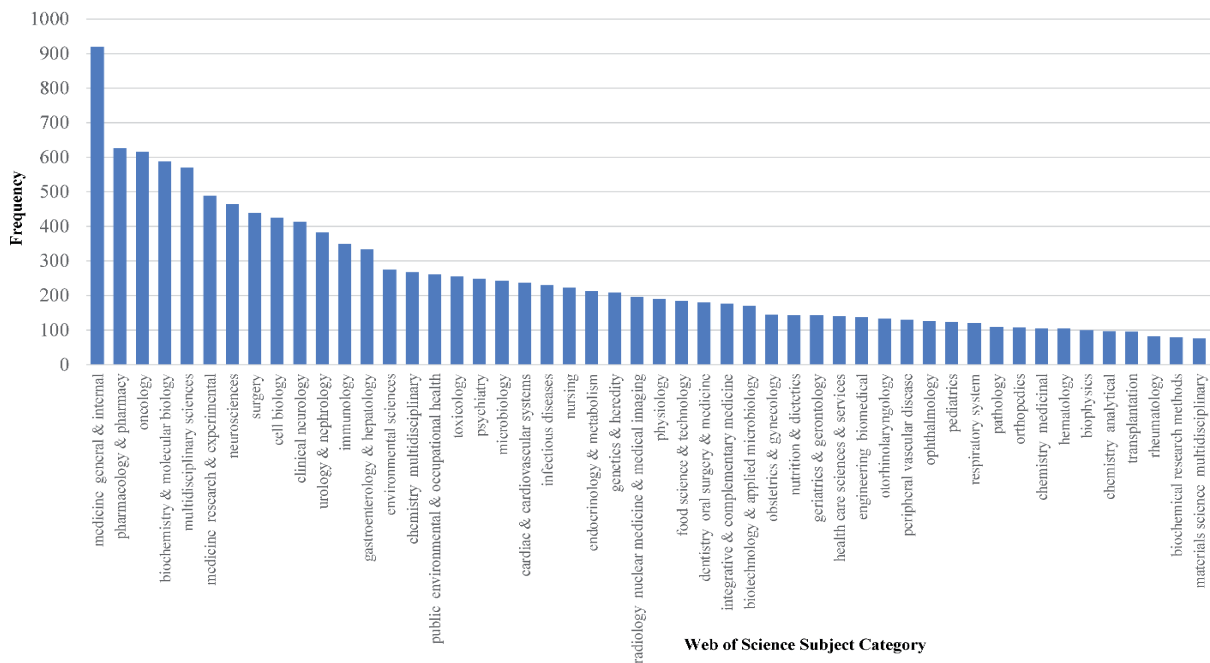


Figure 2. The top 50 Web of Science subject categories with highest frequency of original articles authored by individuals affiliated with the Tzu Chi academic community, indexed in the Web of Science, from 1991 to 2023

Analysis of journals and highly cited original articles

A total of 2,126 different journals published original articles by individuals affiliated with the Tzu Chi

academic community, indexed in the WoS, from 1991 to 2023. An overview of the top 10 journals is shown in Table 1. The journal with the highest number of articles was *PLoS One*, accounting for 3.65% of the total articles (n=347). The *Journal of the Formosan*

Table 1. The top 10 journals published original articles authored by individuals affiliated with the Tzu Chi academic community, indexed in the Web of Science, from 1991 to 2023 (N=9,510)

Rank	Journal (Publisher)	Number of Articles (%)	2022 Journal Impact Factor	Web of Science Category [Journal impact factor Quartile]
1	<i>PLoS One</i> (Public Library Science)	347 (3.65)	3.7	Multidisciplinary Sciences [2]
2	<i>Journal of the Formosan Medical Association</i> (Elsevier Taiwan)	211 (2.22)	3.2	Medicine, General & Internal [2]

Table 1 contd.

Rank	Journal (Publisher)	Number of Articles (%)	2022 Journal Impact Factor	Web of Science Category [Journal impact Factor Quartile]
3	<i>Medicine</i> (Lippincott Williams & Wilkins)	180 (1.89)	1.6	Medicine, General & Internal [3]
4	<i>Scientific Reports</i> (Nature Portfolio)	166 (1.75)	4.6	Multidisciplinary Sciences [2]
5	<i>International Journal of Molecular Sciences</i> (MDPI)	146 (1.54)	5.6	Biochemistry & Molecular Biology [1]
6	<i>International Journal of Environmental Research and Public Health</i> (MDPI)	116 (1.22)	4.6 in 2021*	Public, Environmental & Occupational Health [2] Environmental Sciences [2]
7	<i>Journal of Dental Sciences</i> (Elsevier Taiwan)	93 (0.98)	3.5	Dentistry, Oral Surgery & Medicine [2]
8	<i>Journal of Clinical Medicine</i> (MDPI)	70 (0.74)	3.9	Medicine, General & Internal [2]
9	<i>Journal of Microbiology Immunology and Infection</i> (Elsevier Taiwan)	61 (0.64)	7.4	Immunology [1] Infectious Diseases [1]
10	<i>Journal of Biomedical Science</i> (BMC)	60 (0.63)	11.0	Cell Biology [1] Medicine, Research & Experimental [1]

**International Journal of Environmental Research and Public Health* was delisted from the Web of Science Master Journal List in March 2023 [28].

Medical Association follows with 2.22% (n=211) of the articles. *Journal of Biomedical Science* exhibited the highest impact factor (11.0) among the top ten but contributed only 0.63% (n=60).

Table 2 shows the top 10 original articles with the highest citations, authored by individuals affiliated with the Tzu Chi academic community or who served as collaborative investigators in international research groups. The leading article, authored by Zinman B and the EMPA-REG OUTCOME Investigators was published in the *New England Journal of Medicine* in 2015 and accrued 4,566 citations. The second-highest cited article, by Giugliano RP and

the ENGAGE AF-TIMI 48 Investigators, also published in the *New England Journal of Medicine*, received 3,402 citations. It is noteworthy that in six of these ten highly cited articles, individuals affiliated with Tzu Chi were not the primary authors but served as collaborative investigators within the respective research groups. Among the remaining four articles, Tzu Chi affiliates were co-authors, except for the article "Mesenchymal stem cells," published in *Cell Transplantation* by Ding DC and colleagues from the Department of Obstetrics and Gynecology, Hualien Tzu Chi Hospital, which received 484 citations.

Table 2. The top 10 original articles with highest citations by individuals affiliated with the Tzu Chi academic community, indexed in the Web of Science, from 1991 to 2023 (N = 9,510)

Rank	First Author (No. of Total Authors)	Article Title (DOI)	Journal	Year of Publication	Total Citations*	Total Citations per Year
1	Zinman B (12) & EMPA-REG OUTCOME Investigators*	Empagliflozin, cardiovascular outcomes, and mortality in type 2 diabetes (10.1056/NEJMoa1504720)	<i>New England Journal of Medicine</i>	2015	4566	456.6
2	Giugliano RP (21) ENGAGE AF-TIMI 48 Investigators*	Edoxaban versus warfarin in patients with atrial fibrillation (10.1056/NEJMoa1310907)	<i>New England Journal of Medicine</i>	2013	3402	283.5
3	Wanner C (10) EMPA-REG OUTCOME Investigators*	Empagliflozin and progression of kidney disease in type 2 diabetes (10.1056/NEJMoa1515920)	<i>New England Journal of Medicine</i>	2016	2068	229.8
4	Yang HI (10) & the Taiwan Community-Based Cancer Screening Project Group*	Hepatitis B e antigen and the risk of hepatocellular carcinoma (10.1056/NEJMoa013215)	<i>New England Journal of Medicine</i>	2002	947	41.2
5	Fitchett D (10) & EMPA-REG OUTCOME investigators*	Heart failure outcomes with empagliflozin in patients with type 2 diabetes at high cardiovascular risk: results of the EMPA-REG OUTCOME® trial (10.1093/eurheartj/ehv728)	<i>European Heart Journal</i>	2016	710	78.9
6	Yu SL (23)	MicroRNA signature predicts survival and relapse in lung cancer (10.1016/j.ccr.2007.12.008)	<i>Cancer Cell</i>	2008	674	39.6

Table 2 contd.

Rank	First Author (No. of Total Authors)	Article Title (DOI)	Journal	Year of Publication	Total Citations*	Total Citations per Year
7	Austin PF (12)	The standardization of terminology of lower urinary tract function in children and adolescents: update report from the Standardization Committee of the International Children's Continence Society (10.1016/j.juro.2014.01.110)	<i>Journal of Urology</i>	2014	572	52.0
8	Chung WH (15)	Granulysin is a key mediator for disseminated keratinocyte death in Stevens-Johnson syndrome and toxic epidermal necrolysis (10.1038/nm.1884)	<i>Nature Medicine</i>	2008	529	31.1
9	Ding DC (3)	Mesenchymal stem cells (10.3727/096368910x)	<i>Cell Transplantation</i>	2011	484	34.6
10	Yang HI (12) & REVEAL-HBV Study Group*	Associations between hepatitis B virus genotype and mutants and the risk of hepatocellular carcinoma (10.1093/jnci/djn243)	<i>Journal of the National Cancer Institute</i>	2008	458	26.9

* Individuals affiliated with the Tzu Chi academic community are not listed as authors of the articles but are included due to their role as collaborative investigators in the respective international study groups (EMPA-REG OUTCOME Investigators, ENGAGE AF-TIMI 48 Investigators, Taiwan Community-Based Cancer Screening Project Group, and REVEAL-HBV Study Group).

Analysis of authors

Table 3 presents the top 10 most relevant authors with Hann-Chorng Kuo from the Department of Urology, Hualien Tzu Chi Hospital and Tzu Chi University leading with 272 articles (2.86%) and an H-

index of 43. Chih-Yang Huang from the Department of Medical Research, Hualien Tzu Chi Hospital follows with 191 articles (2.01%). Bang-Gee Hsu from the Division of Nephrology, Department of Internal Medicine, Hualien Tzu Chi Hospital, has 178 articles (1.87%).

Table 3. The top 10 most relevant authors with highest number of original articles by individuals affiliated with the Tzu Chi academic community, indexed in the Web of Science, from 1991 to 2023 (N = 9,510)

Rank	Name of author	Number of original articles (%)	Total number of publications*	H-index**
1	Kuo, Hann-Chorng	272 (2.86)	379	43
2	Huang, Chih-Yang	191 (2.01)	217	22
3	Hsu, Bang-Gee	178 (1.87)	244	22
4	Lin, Shinn-Zong	148 (1.56)	186	36
5	Ding, Dah-Ching	130 (1.37)	161	25
6	Liao, Kuan-Fu	126 (1.32)	232	25
7	Wang, Jen-Hung	120 (1.26)	149	17
8	Koo, Malcolm	116 (1.22)	154	23
9	Lu, Ming-Chi	114 (1.20)	116	20
10	Tzeng, I-Shiang	109 (1.15)	138	16

* The total number of publications counts only publications with at least one of the following affiliations: Buddhist Tzu Chi General Hospital, Dalin Tzu Chi Hospital, Hualien Tzu Chi Hospital, Taichung Tzu Chi Hospital, Taipei Tzu Chi Hospital, Tzu Chi University, and Tzu Chi University of Science & Technology.

** Total H-index was obtained from the Web of Science on June 1, 2024.

Figure 3 illustrates the publication activity of the top 10 most relevant authors, where each circle represents the number of articles published by an author in a given year. Larger circles indicate a higher number of publications, and the color intensity reflects the total citations per year, with darker shades representing higher citation

counts. Hann-Chorng Kuo demonstrates significant and consistent productivity throughout 2006 to 2023. Chih-Yang Huang's productivity peaks around 2019 to 2023 and Kuan-Fu Liao's productivity is notable around 2017. Overall, the year 2015 appears to be increasingly productive for multiple authors.

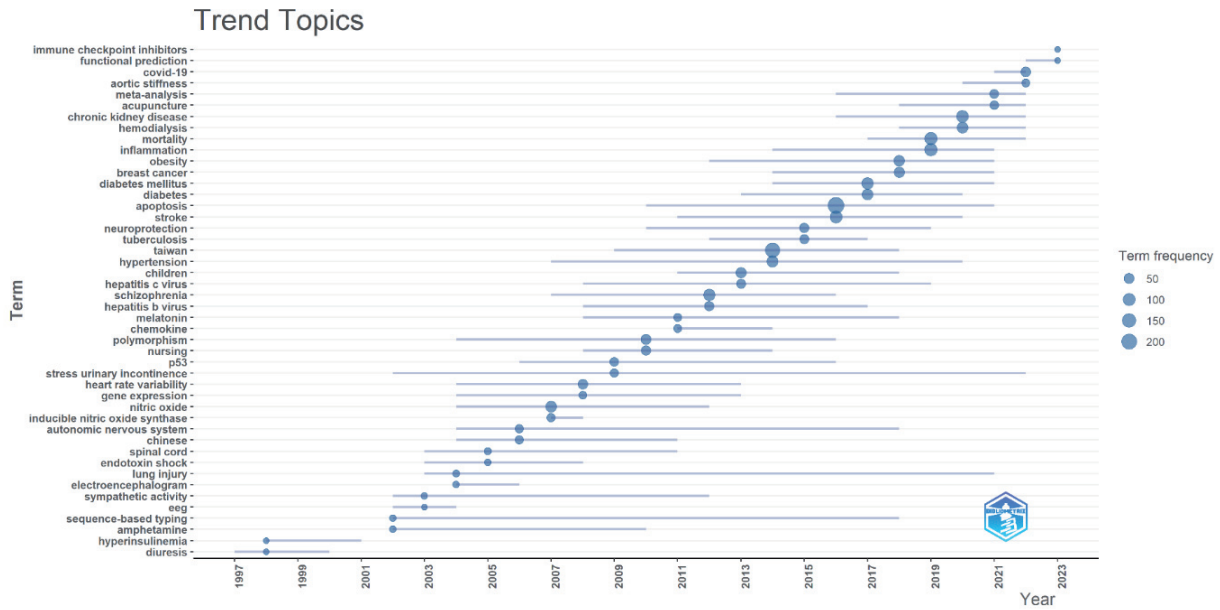


Figure 5. A trend topic plot of authors’ keywords of original articles authored by individuals affiliated with the Tzu Chi academic community, indexed in the Web of Science, from 1991 to 2023

mentioned, with larger circles corresponding to higher frequencies in the research literature during that specific time period. The position of the circles along the x-axis timeline corresponds to the years in which the terms were actively researched. The plot revealed notable trends, including “immune checkpoint inhibitors,” “functional prediction,” “COVID-19,” “aortic stiffness,” “meta-analysis,” and “chronic kidney disease” appearing in recent years. Terms such as “apoptosis,” “hypertension,” “polymorphism,” “stress urinary incontinence,” “autonomous nervous system,”

“lung injury,” and “sequence-based typing” showed sustained research interest over a long time.

The thematic evolution of the authors’ keywords is shown as a Sankey diagram in Figure 6. Three time slices were used: 1990–2012, 2013–2019, and 2020–2023 to visualize both persistent and emerging themes. Overall, themes like “urodynamics” and “Parkinson’s disease” were prominent in earlier periods but did not sustain prominence. Conversely, themes such as “apoptosis” and “mortality” demonstrated persistent relevance, while themes such as

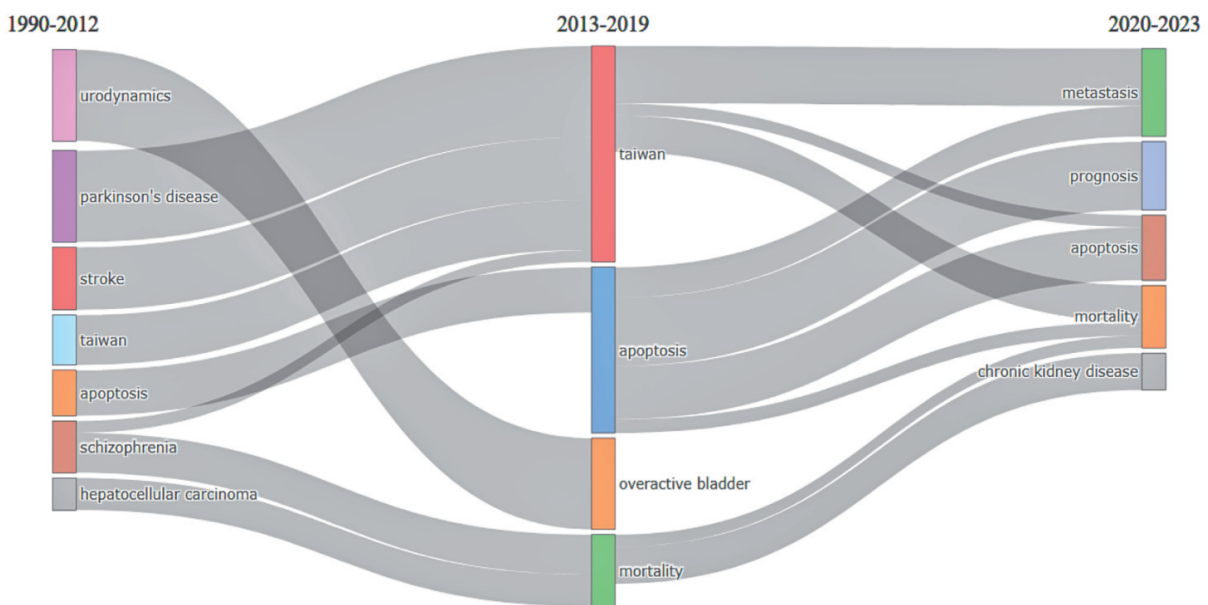


Figure 6. A Sankey diagram showing the thematic evolution of authors’ keywords of original articles authored by individuals affiliated with the Tzu Chi academic community, indexed in the Web of Science, from 1991 to 2023

“metastasis,” “prognosis,” and “chronic kidney disease” emerged in recent years.

Moreover, Figures 7a, 7b, and 7c show the progression of research themes based on authors’ keywords across three time periods. Each figure categorizes themes based on their development degree (density) and relevance degree (centrality). During the 1990–2012 period (Figure 7a), niche themes such as “hepatocellular carcinoma,” “insulin resistance,” and “hepatitis B virus” were highly developed but less central, indicating specialized but not widely connected research areas. In contrast, motor themes such as

“nitric oxide” and “acute lung injury” attracted significant research interest. Over time, as depicted in Figure 6b, basic themes such as “mortality,” “diabetes mellitus,” and “chronic kidney disease” gained prominence and became foundational to ongoing research. In the most recent period (2020–2023), (Figure 7c), highly central and developed motor themes emerged, including “mortality,” “COVID-19,” and “Taiwan,” reflecting their importance in recent scientific inquiry. In addition, emerging themes such as “metastasis” and “prognosis” indicated shifting priorities in the research.

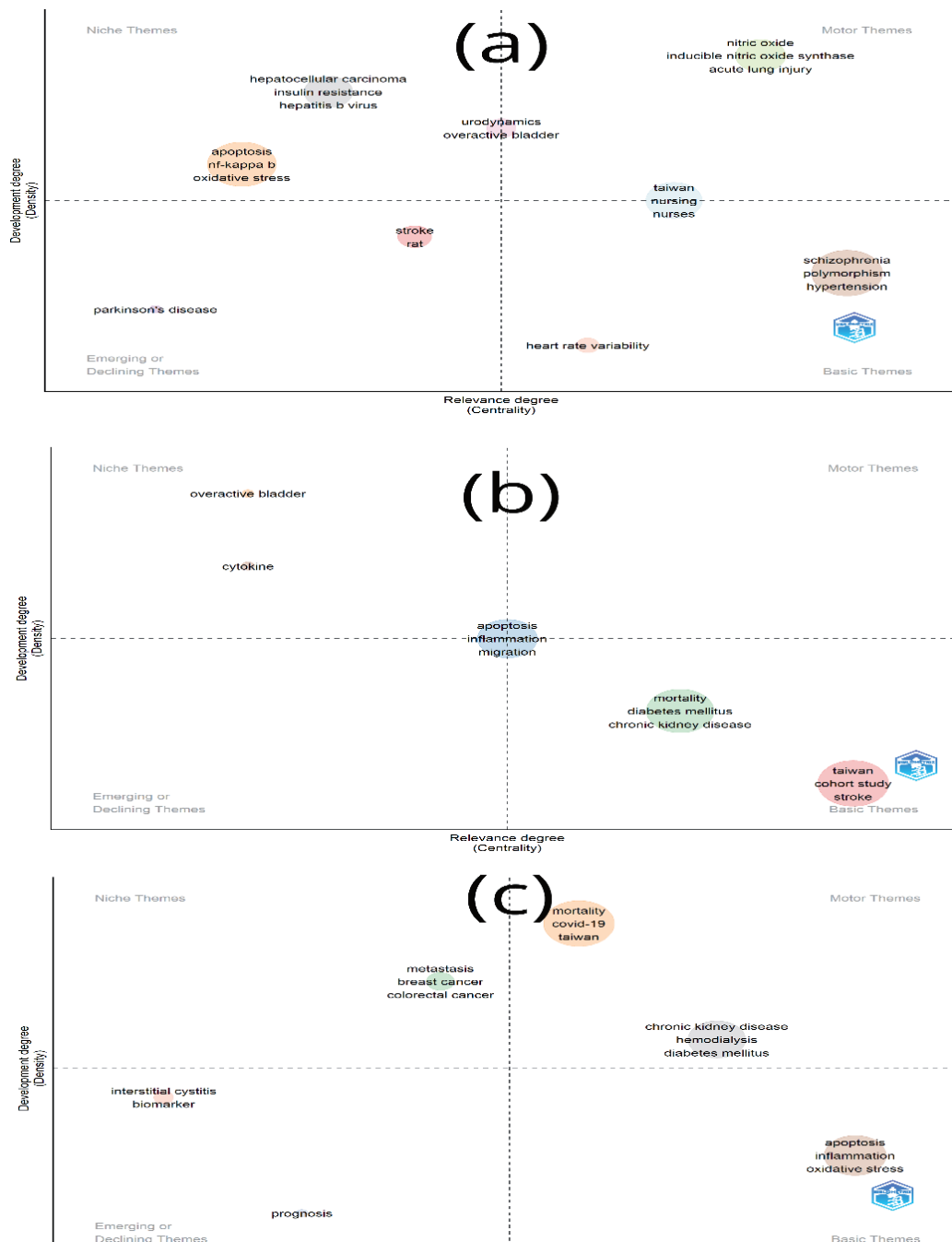


Figure 7. A thematic mapping of authors’ keywords original articles authored by individuals affiliated with the Tzu Chi academic community, indexed in the Web of Science, from 1991 to 2023, divided into three periods: (a) 1990–2012, (b) 2013–2019, and (c) 2020–2023

Co-occurrence network analysis of authors' keywords

The co-occurrence network diagram of authors' keywords is shown in Figure 8. The size of the nodes represents the frequency of keyword occurrences, while the thickness of the connecting lines indicates the strength of the co-occurrence relationships between keywords. The network diagram shows seven main clusters. The most prominent cluster is represented by apoptosis, which is interconnected with prognosis, breast cancer, metastasis, survival, prostate cancer, and colorectal cancer. The second cluster is represented by Taiwan, which included keywords such as stroke, cohort studies, older adults, Parkin-

son's disease, and National Health Insurance Research Database. The third cluster is diabetes, which included keywords such as schizophrenia, polymorphism, and heart rate variability. The fourth cluster is inflammation, which included keywords such as nitric oxide, oxidative stress, cytokines, and reactive oxygen species. The fifth cluster is mortality, which included keywords such as chronic kidney disease, hypertension, hemodialysis, metabolic syndrome, and obesity. The sixth cluster is liver cancer, which is associated with keywords such as hepatitis b virus, hepatitis c virus, cirrhosis, and genotype. The seventh cluster is represented by children and is associated with keywords such as biomarkers, overactive bladder, interstitial cystitis and urodynamics.

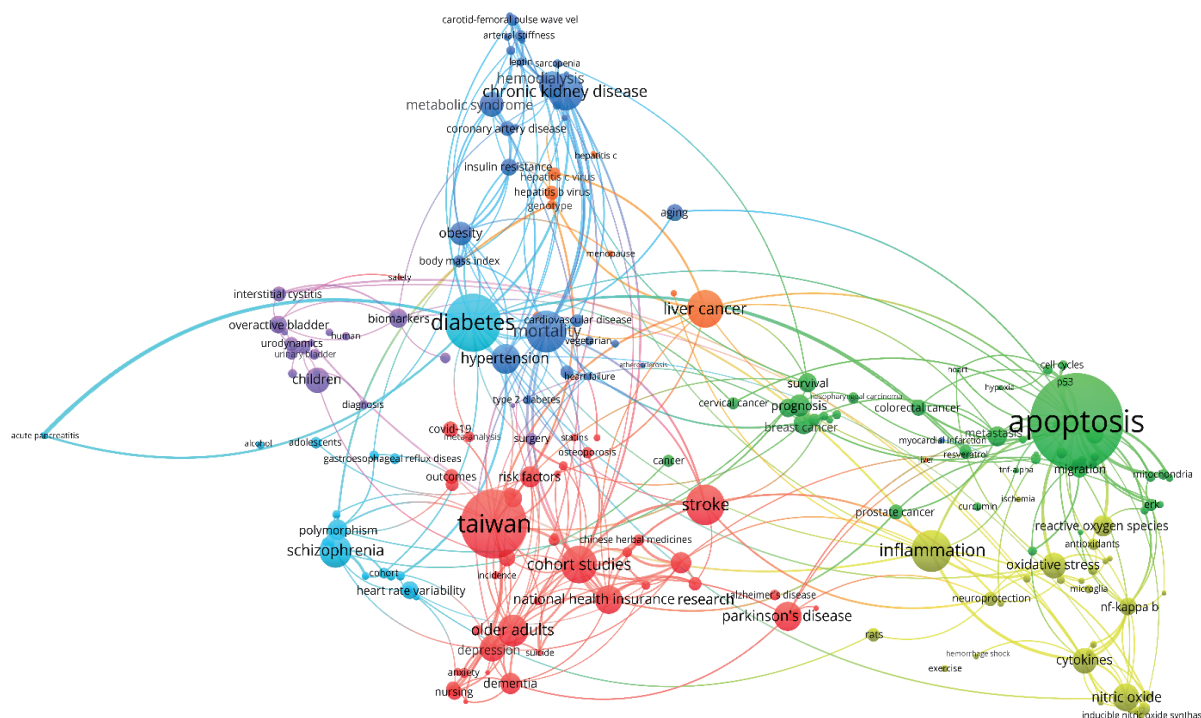


Figure 8. A co-occurrence network of authors' keywords of original articles authored by individuals affiliated with the Tzu Chi academic community, indexed in the Web of Science, from 1991 to 2023

DISCUSSION

This bibliometric analysis of research output by individuals affiliated with the Tzu Chi academic community from 1991 to 2023 revealed a steady growth in its scholarly publications. The distribution of the 9,510 original articles across different WoS subject categories reflected the multidisciplinary nature of the research. "General and internal medicine" emerged as the most prolific category, followed by "pharmacology and pharmacy", "oncology", and "biochemistry and molecular biology". This concentration in medical and life sciences reflected the active involvement of hospital-affiliated authors in ad-

ressing health issues and advancing clinical practice through research.

The analysis of journals revealed a strategic selection of high-impact outlets. *PLoS One*, the journal with the highest number of articles, signifies a preference for open-access platforms that maximize accessibility and citation potential. In fact, all top 10 journals shown in Table 1 are open access, which maximizes the visibility and accessibility of research findings, potentially leading to higher citation rates and greater dissemination. In addition, three of these journals, namely the *Journal of the Formosan Medical Association*, *Journal of Dental Sciences*, and *Journal of Microbiology Immunology and Infection* are

affiliated with professional societies. Researchers who are members of these societies are more likely to publish in these journals as this ensures their research reaches a relevant audience and supports the professional recognition of the authors within their respective fields.

The analysis of the top 10 original articles with the highest citations revealed that Tzu Chi affiliates were not the primary authors but served as collaborative investigators in six of these ten highly cited articles. This indicates the value of international collaborations in achieving research excellence and increasing the visibility of Tzu Chi's scholarly contributions. To further enhance their impact and recognition, it is strategic for Tzu Chi researchers to aim for primary authorship in such collaborations by proactively initiating research projects with leading global research institutions and increasing involvement in key stages of research.

The word cloud visualization of authors' keywords showed that "apoptosis," "inflammation," and "stroke" were prominent research topics. The trend topic plot further revealed the emergence of new areas of interest, such as "immune checkpoint inhibitors" and "COVID-19," indicating the responsiveness to recent advances in cancer immunotherapy and current global health challenges. The thematic evolution analysis demonstrated the dynamic nature of research at Tzu Chi, with persistent themes like "apoptosis" and "mortality" maintaining relevance, whereas new themes like "metastasis" and "prognosis" gained prominence.

The co-occurrence network diagram of authors' keywords showed dense interconnections between clusters, indicating multidisciplinary research approaches. For instance, the links between apoptosis, inflammation, and various cancers reflected the intertwined nature of cellular processes and disease pathways. Moreover, the co-occurrence of terms such as hypertension, obesity, diabetes, and cardiovascular diseases showed the interconnected risk factors and comorbidities. The prominence of the Taiwan cluster reflected the studies based on the availability of health claim data from Taiwan's National Health Insurance Research Database, which provided insights into various associations that may be worth further exploration using investigator-initiated studies [22].

While the co-network analysis demonstrated Tzu Chi's diverse research initiatives, some distinct research areas appeared underrepresented. For example, the Silent Mentor Program, which empha-

sizes empathy and respect through body donors, has attracted international acclaim [23,24]. Future research should evaluate its long-term impacts on medical practice and patient care. Moreover, the work of the Center of Stem Cell and Precision Medicine at Hualien Tzu Chi Hospital has advanced the field of stem cell research and the treatment of hematological disorders [25]. Continued research should focus on understanding stem cell biology and leverage artificial intelligence to enhance precision medicine and patient outcomes. Another important topic for future focus is vegetarian research. Tzu Chi promotes compassion and respect for all sentient beings, including animals. There is growing recognition that plant-based diets promote good health [26]. Future research should assess the long-term health benefits of vegetarian diets across different cultural groups and life stages through prospective cohort studies. In addition, developing and evaluating community engagement strategies will be essential in promoting vegetarianism and supporting individuals in maintaining a vegetarian lifestyle.

Several study limitations should be mentioned. First, the analysis was restricted to publications indexed in the WoS database, scholarly output in other fields, and in other languages [27], such as in religious studies and humanity, was not evaluated. Second, the reliance on citation metrics, while useful, may not fully capture the quality or real-world impact of the research.

CONCLUSIONS

This bibliometric analysis of the 9,510 original articles with Tzu Chi's affiliation, based on the WoS Core Collection database, offered an understanding of its scholarly contributions and strategic priorities. The thematic progression and co-occurrence network analyses revealed a research landscape characterized by both continuity in established fields such as "apoptosis" and an embrace of emerging topics like "immune checkpoint inhibitors" and "COVID-19," the Tzu Chi academic community demonstrated a balanced approach to research innovation and relevance. By expanding research on unique and impactful areas, such as the Silent Mentor Program, stem cell research and precision medicine, and vegetarian research, the institution will improve patient care and foster a compassionate and effective healthcare system worldwide.

REFERENCES

1. Buddhist Tzu Chi Charity Foundation. Tzu Chi Foundation [online] 2022 [cited 7.08.2024]. Available from URL: <https://global.tzuchi.org>.
2. Huang CJ. Charisma and compassion: Cheng Yen and the Buddhist Tzu Chi movement. Cambridge, MA: Harvard University Press; 2009.

3. Buddhist Tzu Chi Medical Foundation. Medical system [online] 2024 [cited 7.08.2024] Available from URL: <https://www.tzuchi.com.tw/home/>.
4. Lee C, Han L. Becoming INGO: a case study on Taiwan's Tzu-Chi in the United States. *Voluntas* 2020; 31(6): 1201–1211.
5. Yao YS. Taiwan's Tzu Chi as engaged Buddhism: origins, organization, appeal and social impact. Leiden: Global Oriental/Brill; 2012.
6. Yan HD, Wu CY, Lin RF. Social entrepreneurship and charismatic leadership: master Cheng Yen and Tzu Chi Foundation. *Int J Innov Reg Dev* 2018; 8(4): 136–158.
7. Lau AL, Cornelio JS. Tzu Chi and the philanthropy of Filipino volunteers. *Asian J Soc Sci* 2015; 43(4): 376–399.
8. Madsen R. Tzu Chi: Buddhist compassion relief and the bodhisattva path to a good society. In: King SB, editor. *Buddhist visions of the good life for all*. Oxon, New York: Routledge, 2021: 176–191.
9. Lee C, Han L. Recycling Bodhisattva: the Tzu-Chi movement's response to global climate change. *Social Compass* 2015; 62(3): 311–325.
10. Donthu D, Kumar S, Mukherjee D, Pandey N, Lim WM. How to conduct a bibliometric analysis: an overview and guidelines. *J Bus Res* 2021; 133(5): 285–296.
11. Lepori B, Geuna A, Mira A. Scientific output scales with resources. A comparison of US and European universities. *PloS one* 2019; 14(10): e0223415.
12. Lancho-Barrantes BS, Cantu-Ortiz FJ. Quantifying the publication preferences of leading research universities. *Scientometrics* 2021; 126(3): 2269–2310.
13. Wu C, Yan LL, Long Q, Liu Y, Tan J, Lou Z, Tang S. Trends in global health research among universities in China: a bibliometric analysis. *Glob Health Res Policy* 2023; 8(1): 10.
14. Guseva AI, Kalashnik VM, Kaminskii VI, Kireev SV. Key performance indicators of Russian universities for 2015–2018: dataset and benchmarking data. *Data Brief* 2021; 40: 107695.
15. Ellegaard O, Wallin JA. The bibliometric analysis of scholarly production: how great is the impact? *Scientometrics* 2015; 105(3): 1809–1831.
16. Szluka P, Csajbók E, Györfy B. Relationship between bibliometric indicators and university ranking positions. *Sci Rep* 2023; 13(1): 14193.
17. Hirsch JE. An index to quantify an individual's scientific research output. *Proc Natl Acad Sci U S A*. 2005; 102(46): 16569–16572.
18. Aria M, Cuccurullo C, D'Aniello L, Misuraca M, Spano M. Thematic analysis as a new culturomic tool: the social media coverage on COVID-19 pandemic in Italy. *Sustainability* 2022; 14(6): 3643.
19. Aria M, Cuccurullo C. Bibliometrix: an r-tool for comprehensive science mapping analysis. *J Informetr* 2017; 11(4): 959–975.
20. van Eck NJ, Waltman L. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics* 2010; 84(2): 523–538.
21. Perianes-Rodriguez A, Waltman L, van Eck NJ. Constructing bibliometric networks: a comparison between full and fractional counting. *J Informetr* 2016; 10(4): 1178–1195.
22. Hsieh CY, Su CC, Shao SC, et al. Taiwan's national health insurance research database: past and future. *Clin Epidemiol* 2019; 11: 349–358.
23. Santibañez S, Boudreaux D, Tseng GF, Konkel K. The Tzu Chi silent mentor program: application of Buddhist ethics to teach student physicians empathy, compassion, and self-sacrifice. *J Relig Health* 2016; 55(5): 1483–1494.
24. Chu SY, Tseng TC, Ho YC, Tseng GF. The impact of a gross anatomy curriculum with donor family interaction: thematic analysis of student letters to silent mentors. *Acad Med* 2022; 97(7): 1065–1070.
25. Li CC, Tsai XC, Huang WH, Wang TF. Recent advancements in hematopoietic stem cell transplantation in Taiwan. *Tzu Chi Med J* 2024; 36(2): 127–135.
26. Viroli G, Kalmpourtzidou A, Cena H. Exploring benefits and barriers of plant-based diets: health, environmental impact, food accessibility and acceptability. *Nutrients* 2023; 15(22): 4723.
27. Buddhist Tzu Chi Charity Foundation. Tzu Chi Forum [online] 2022 [cited 7.08.2024] Available from URL: https://global.tzuchi.org/about-us_global-partnerships.
28. Brainard J. Fast-growing open-access journals lose impact factors. *Science* 2023; 379(6639): 1283–1284.

Word count: 3995

• Tables: 3

• Figures: 8

• References: 28

Sources of funding:

The research was funded by the author.

Conflicts of interests:

The author reported that there were no conflicts of interest.

Cite this article as:

Koo M.

A bibliometric analysis of Tzu Chi Foundation's research publications using the Web of Science from 1990 to 2023.

Med Sci Pulse 2024;18(3):62-73. DOI: 10.5604/01.3001.0054.7423.

Corresponding author:

Malcolm Koo

Email: mkoo@gms.tcu.edu.tw

Department of Nursing, Tzu Chi University

Section 2, 880 Chien-Kuo Road, Hualien City, Taiwan

Sent to editorial office: 8 July 2024

Accepted after review: 18 September 2024

Published: 27 September 2024