Pharmacy Education (2025) 25(1) 293 - 304
https://doi.org/10.46542/pe.2025.251.293304

RESEARCH ARTICLE

The development and focus trend of clinical pharmacists education over past 60 years: A bibliometric analysis base on global English literature

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Keywords
Bibliometric analysis
Clinical pharmacy
Education
Pharmacist
Training

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Abstract

Background: Pharmacy educators have long been interested in the training programmes for pharmacists. This study aims to summarize the history and current status of Clinical Pharmacy Education (CPE) research over the past six decades through a bibliometric analysis of English publications. **Method:** Web of Science (WoS) core collection database is used to retrieve English literature published globally between January 1968 and January 2024, including articles, reviews, editorials, notes, letters and book chapters. The CiteSpace software is used to visualize all the key elements in this study. **Result:** Out of 2190 retrieved papers, research on CPE was low (less than ten per year) until 1991, then surged in 2019, peaking in 2021. The United States led with 916 papers (41.8%), followed by England (123, 5.6%) and China (121, 5.5%). The focus of CPE has shifted from drug therapy management to improving overall healthcare quality. **Conclusion:** The establishment and advancement of Continuing Professional Education (CPE) over the past six decades has been thrilling. Pharmacists, led by pioneers from the USA and UK, have actively contributed to health care services, with involvement from countries worldwide. The evolving focus on improving the quality of life in CPE aims to enhance patient health care in the future.

Introduction

As we all know, clinical pharmacy practice originates from developed countries, advanced firstly by the USA and the UK subsequently. Correspondingly, Clinical Pharmacy Education (CPE) also dates back to the USA and UK, where the role of clinical pharmacists at the beginning acted as indirect patient care and then changed to taking part in clinical patient treatment directly. In modern healthcare settings, nearly all large hospitals have clinical pharmacy departments to ensure that patients receive the correct medicine at the optimal time through an efficient management system. As key participants in the healthcare system, clinical pharmacists are responsible for applying pharmaceutical expertise to ensure maximum efficacy and minimise toxicity (Calvert, 1999). As the complexity of drug therapy has increased, pharmacy education and training have evolved and improved over the past half-century to ensure that pharmacists are adequately prepared to provide high-quality patient care. This study aims to examine the development and trends in CPE over nearly the past 60 years and explore how future educational systems can continue to develop pharmacists who are prepared to meet evolving healthcare demands.

In the 1960s, Calder G (Calder & Barnett, 1967) pioneered clinical pharmacy practice in hospital wards,

where pharmacists reviewed medication orders and guaranteed prescription safety. Following this, clinical pharmacy practice rapidly expanded in the UK during the 1960s and 1970s (Baker *et al.*, 1988), and a similar trend occurred in the USA (McLeod & Miller, 1981). The United States established the American College of Clinical Pharmacy (ACCP), which promoted the development of clinical pharmacy education and practice (Kelly, 1980). In the late 1980s and the 1990s, both the UK and USA governments recognised the important role of clinical pharmacists in improving patient care and gradually increased support for clinical pharmacy training and education. In China (Hu *et al.*, 2014), clinical pharmacist education was first established at the West Chinese Medical University in 1989. In 2015, the National Health and Family Planning Commission officially issued the "*Management Measures for Clinical Pharmacists*", clarifying the responsibilities of pharmacists and promoting the development of the CPE.

Despite the ongoing development in pharmacy education (Dekhtawala *et al.*, 1996; NABP, 1996; Brodie & Smith, 1985; Lal & Rao, 2005; Walker *et al.*, 2011; Grover *et al.*, 2014; Cobaugh, 2016; Allard & Raimi-Abraham, 2019; Gray *et al.*, 2019), several key issues persist. It is still challenging to identify key researchers in the field of CPE, access the current state of CPE based on existing literature and determine which articles or journals should be prioritised in systematic reviews. This study utilises bibliometrics methodology (Ninkov*et et al.*, 2022) to address these questions and provide valuable insights that will help guide future research and contribute to the development of more impactful studies in CPE.

Methods

Design

This study was conducted in August 2024. Web of Science (WoS) core collection database ensures globally recognised research from diverse English-spoken regions and also gathers high-quality English-language articles from a wide range of non-English-speaking countries. It can collect global academic research in English by combined retrieval functions and is used for literature search (Vanderstraeten & Vandermoere, 2021). WoS core collection database can retrieve global academic papers based on advanced search function using the 'AND' and 'OR' search codes, described as follows: TS = (xxx* AND/OR xxx*).

The following string was used for the literature search of this paper: TS = ("*clinical pharmacist*" OR "*clinical pharmacists*" OR "*clinical pharmacy*") AND ("*education*" OR "*educational*" OR "*oriented education*" OR "*educative*" OR "*educate*" OR "*care education*" OR "*instruction*" OR "*training*" OR "*teaching*").

In this study, according to the designed search codes, the articles, reviews, editorials, and book chapters indexed in the WoS core collection database between January 1968 and January 2024 were included and focused on CPE. The following types of literature were excluded, such as meeting abstracts, conference proceedings, retracted papers, and papers that were not directly related to CPE. Additionally, papers published in languages other than English were excluded (see details in Figure 1).

The CiteSpace software is used to rank and visualise the occurrence frequency of all the key elements in this study (Chen, 2006; Chen*et al.*, 2010; Han*et al.*, 2020; Song*et al.*, 2016). In the CiteSpace network, each node represents an object and is shown with a colourful circle, and parts of the objects are linked by lines. The thickness of the link between different objects indicates the relationship power. The colour is designed to correspond to the study year time. Based on different node types (e.g. cited author, country, institute, keyword, cited journal, document, etc.), the corresponding co-occurrence network would be plotted to reflect the dynamic status of the target node topic over the past nearly 60 years in this study. The node's size (or font size) reflects the frequency of the node type occurring in the dataset. The larger the node size, the higher the frequency. The current research trend of CPE has been explored through keyword clustering maps and burst word analysis. Cluster analysis was used to detect the emergence of research trends over time and identify the target of research trends at a specific time. The relationship between different research trends can also be revealed through clustering analysis. Burst words were defined as keywords with a substantial increase of occurrences in a short timeframe, indicating those articles had provoked massive attention in the corresponding year.

The trends of global development of CPE research were summarised following a critical literature analysis of 2190 papers. The selection criteria for analysis were based on parameters described as follows. The g-index as a metric was used to measure the productivity and citation impact of the publications, ensuring the inclusion of influential studies. Local Reference Frequency (LRF) determines the minimum number of times a paper or author should be cited within a given period. Link/Node ratio (L/N) ensured that only highly relevant publications were linked in the co-citation network. As regards Last Year of Publication (LBY), the inclusion criteria used a minimum of five years' worth of

data, ensuring the representation of a wide span of time for analysis. A value of 1.0 e (Edge Weighting) was used to give equal importance to all edges in the co-citation network. These criteria helped to ensure that only the most relevant and impactful literature was included in the study, enhancing the reliability of the bibliometric analysis.

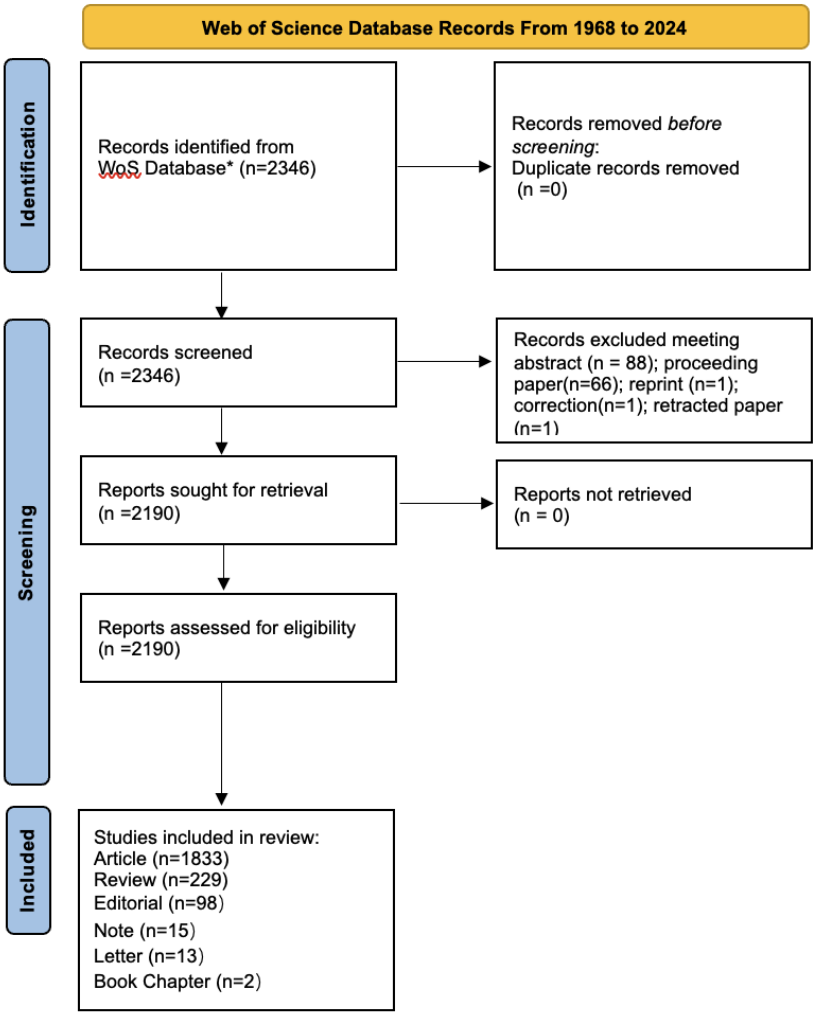


Figure 1: Flowchart of publications' selection

Results

General profile of the literature type

In this study, the selection of papers was conducted systematically using predefined inclusion and exclusion criteria (Figure 1). A comprehensive search was conducted in the WoS core collection database to identify literature related to CPE published from January 1968 to January 2024. Articles, reviews, editorials, and book chapters were considered for inclusion. A total of 2190 English-language literature were retained for analysis. Among these, 83.7 percent (1833/2190) are journal articles, while the remaining 16.3 percent (357/2190) consist of other types of publications, including reviews, editorials, notes, letters and book chapters.

Distribution of publication time

Figure 2 delineated the trend of published paper counts in the field of CPE over the past nearly 60 years, spanning from 1968 to 2024. The number of published research papers in this study remained at a low level (less than ten per year) until 1991, and then the count steadily increased from 1992 to 2018. In 2019, the number reached 189 with a sharp growth slope. The digits per year between 2020 and 2023 remained stable at a high level.

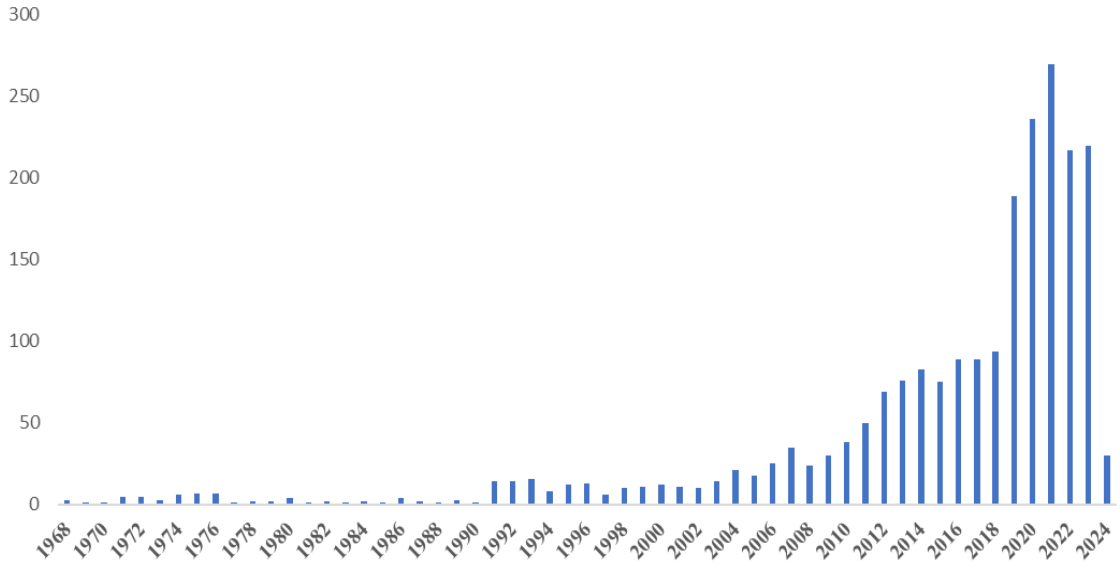
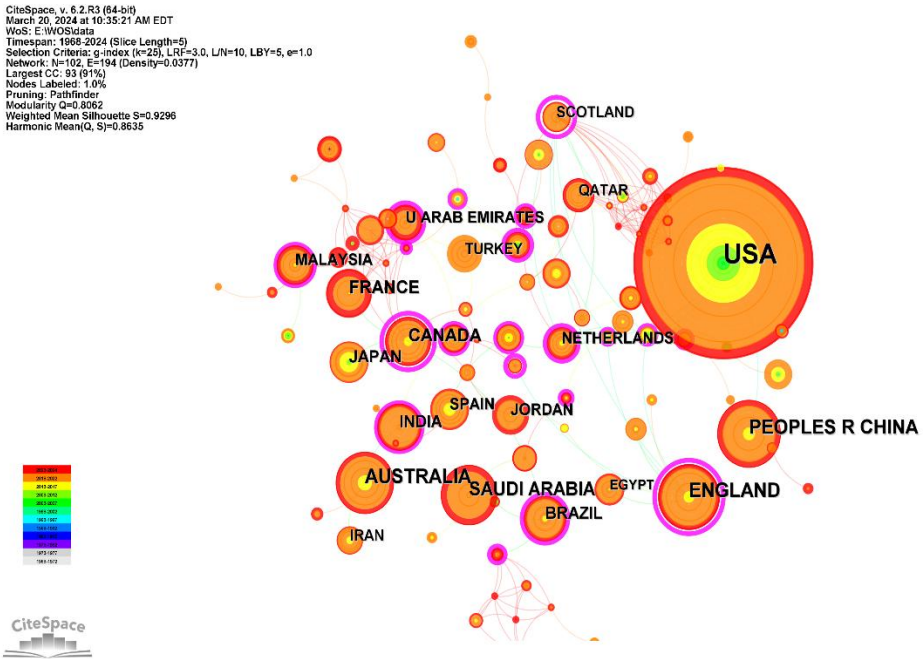


Figure 2: The number of published papers over time

Distribution and co-occurring network of countries/institutes

In the co-occurring network of countries (Figure 3), the time slice length is five. the criteria of data selection are g-index (k = 25), LRF = 3.0, L/*N* = 10, LBY = 5, and e = 1.0.There are 102 nodes and 191 links. Each node represents a country, and the node's size reflects the number of published articles in that country. Notably, the United States issued the most papers (n = 916, 41.8%), followed by England (n = 123, 5.6%) and China (n = 121, 5.5%).



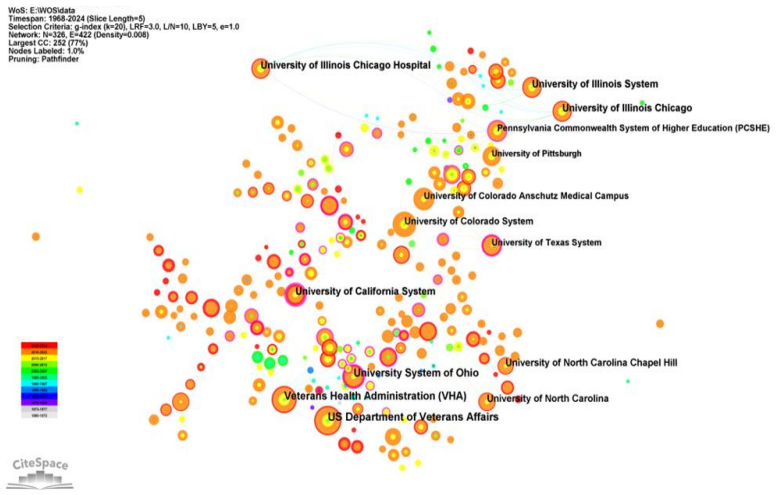
Top 10 Countries

Country	Count	Starting Year
USA	916	1973
ENGLAND	123	1993
PEOPLES R CHINA	121	1993
AUSTRALIA	121	1997
SAUDI ARABIA	103	1978
CANADA	89	1992
FRANCE	80	2005
INDIA	69	2002
JAPAN	56	2002
BRAZIL	55	2005

Figure 3: Countries' co-occurring network

In the co-occurring network of the institute (Figure 4), the time slice length is five. The criteria of data selection are g-index (k = 20), LRF =3.0, L/*N* = 10, LBY = 5, and e = 1.0. There are 326 nodes and 422 links. Each

node represents an institute, and the node's size reflects the number of published articles in that institute. The top ten institutes based on paper-issued numbers were all from the United States, with the highest issue volume in the USA Department of Veterans Affairs (n = 96, 10.5%), followed by Veterans Health Administration (n = 90, 9.8%) and University System of Ohio (n = 72, 7.8%).

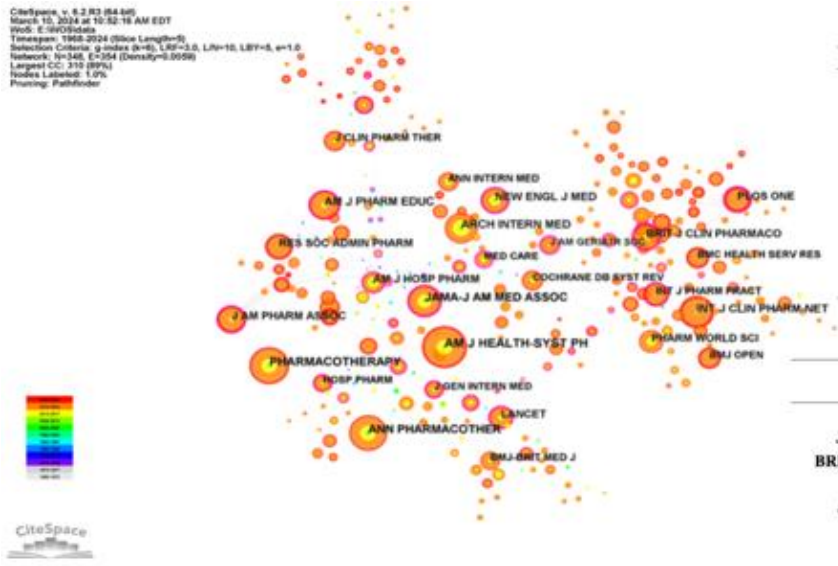


Institute	Count	Starting Year
US Department of Veterans Affairs	96	1991
Veterans Health Administration (VHA)	90	1991
University System of Ohio	72	1974
University of Illinois System	61	1986
University of California System	60	1999
University of Illinois Chicago	60	1986
University of Illinois Chicago Hospital	59	1986
University of North Carolina	53	1998
University of North Carolina Chapel Hill	51	1998
University of Colorado System	45	2005

Figure 4: Institute co-occurring network

Journal co-citation network

The selection criteria are g-index (k = 6), LRF = 3.0, L/*N* = 10, LBY = 5, and e = 1.0. The Journal co-citation network shown in Figure 5 highlights the most frequently co-cited journals.



Top 10 most co-cited journal

Journal	Cited Count	Starting Year
AM J HEALTH-SYST PH	889	1995
PHARMACOTHERAPY	695	1991
ANN PHARMACOTHER	634	1993
JAMA-J AM MED ASSOC	591	1989
ARCH INTERN MED	520	1991
AM J PHARM EDUC	489	1968
INT J CLIN PHARM-NET	458	2013
NEW ENGL J MED	411	1989
J AM PHARM ASSOC	377	1974
BRIT J CLIN PHARMACO	358	1998

Cited journal sorted by centrality

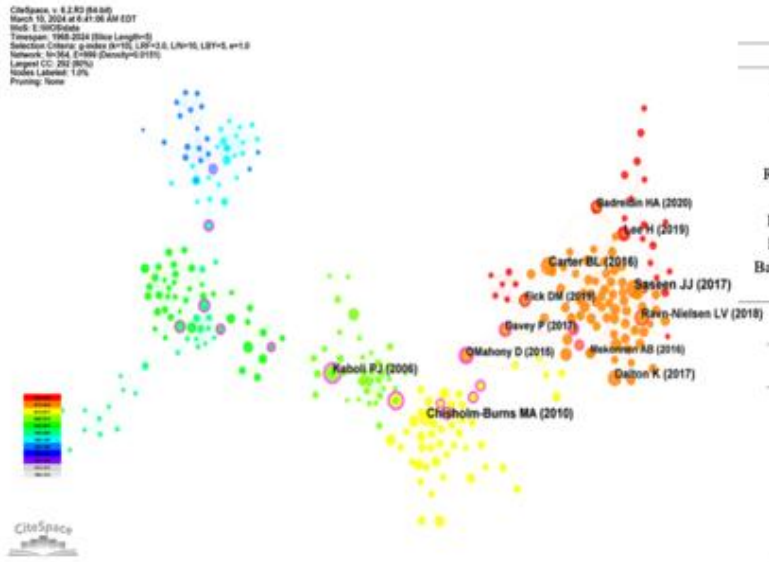
Co-cited journal	Count	Centrality	Starting year
MED CARE	227	0.67	1991
J AM GERIATR SOC	203	0.63	1993
BRIT J CLIN PHARMACO	358	0.61	1998
AM J MED	172	0.41	1991
AM J HOSP PHARM	356	0.37	1968
CLIN INFECT DIS	180	0.32	1999
NEW ENGL J MED	411	0.31	1989
JAMA-J AM MED ASSOC	591	0.26	1989
J GEN INTERN MED	229	0.24	1993
LANCET	292	0.22	1993

Figure 5: Co-cited journal network

To remove excessive links, network pruning is used through the Pathfinder strategy (Chen & Morris, 2003). In this analysis, there were 348 nodes and 354 links. The more frequently the journal was co-cited, the larger the node size. Among them, "*AM J HEALTH-SYST PH*", "*PHARMACOTHERAPY*", "*ANN PHARMACOTHER*", "*JAMA-J AM MED ASSOC*", and "*ARCH INTERN MED*" embraced the top five most co-citations. In Figure 5, the journals with betweenness centrality values greater than or equal to 0.2 were shown with the highest centrality (0.67) for the journal "*MED CARE*". The high centrality indicated a large extent of importance for the journal.

Document co-citation network analysis

Figure 6 shows the co-citations network of various documents identified by the popular papers and their authors, where the time slice length is five. The selection criteria are g-index (k = 10), LRF = 3.0, L/N = 10, LBY = 5, and e = 1.0. Network pruning is a Pathfinder strategy. There are 354 nodes and 999 links. In accordance with the journal co-cited analysis, a published paper was shown as a node with the first author's name and the publication year. The top ten documents are introduced in Figure 4B. Saseen JJ (Saseenet al., 2017) absorbed the most attention, with 26 citations in total, followed by Carter BL (Carter, 2016), Chisholm-Burns MA (Chisholm-Burns *et al.,* 2010), Kaboli PJ (Kaboli al., 2006) and Ravn-Nielsen LV (Ravn-Nielsen *et al.,* 2018), with roughly 20 citations each. In addition, documents with high betweenness centralities also deserved attention. These documents with betweenness centrality values ranked top ten were listed in Figure 4B, including authors Holland R (Holland *et al.,* 2008), Carter BL (Carter *et al.,* 2009), Kaboli PJ (Kaboli *et al.,* 2006), Kripalani S (Kripalani *et al.,* 2012) and Bond CA (Bond & Raehl, 2004). Based on that, the published articles with high co-cited numbers can be regarded as the academic development key points in the field of CPE.



Top 10 most cited document

Cited documents	Count	Centrality
Saseen JJ, 2017, PHARMACOTHERAPY	26	0.01
Carter BL, 2016, DRUG AGING	21	0.06
Chisholm-Burns MA, 2010, MED CARE	19	0
Kaboli PJ, 2006, ARCH INTERN MED	18	0.63
Ravn-Nielsen LV, 2018, JAMA INTERN MED	18	0.29
Lee H, 2019, CRIT CARE MED	17	0.06
Dalton K, 2017, INTEGR PHARM RES PRA	17	0
Davey P, 2017, COCHRANE DB SYST REV	13	0.3
Badreldin HA, 2020, J AM COLL CLIN PHARM	13	0.01
Fick DM, 2019, J AM GERIATR SOC	13	0.05

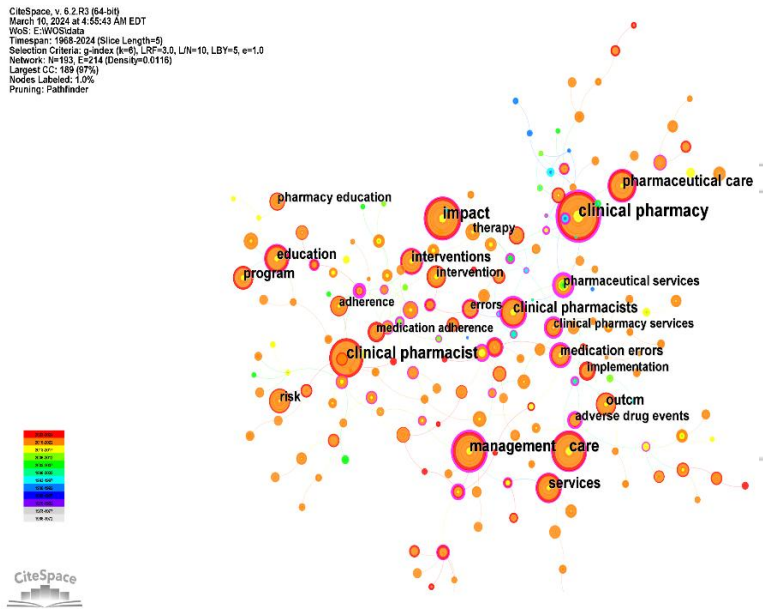
Cited document sorted by centrality

Cited documents	Count	Centrality
Holland R, 2008, BRIT J CLIN PHARMACO	4	0.67
Carter BL, 2009, ARCH INTERN MED	11	0.66
Kaboli PJ, 2006, ARCH INTERN MED	18	0.63
Kripalani S, 2012, ANN INTERN MED	4	0.6
Bond CA, 2004, PHARMACOTHERAPY	3	0.49
OMahony D, 2015, AGE AGEING	13	0.45
Kaushal R, 2001, JAMA-J AM MED ASSOC	7	0.45
Bond CA, 2001, PHARMACOTHERAPY	2	0.45
Hassan Y, 2009, ANN PHARMACOTHER	4	0.37
Bond CA, 1999, PHARMACOTHERAPY	6	0.34

Figure 6: Document co-cited network

Keywords co-occurring network, clustering and burst analysis

Figure 7 shows a keyword co-occurring network with 193 nodes and 214 links. The time slice length was five. The selection criteria included g-index (k = 6), LRF = 3.0, L/*N* = 10, LBY = 5, and e = 1.0. The most frequent keywords included clinical pharmacy (frequency = 398), impact (frequency = 285), and care (frequency = 267), with a total of 12 keywords with frequencies exceeding 100 occurrences.

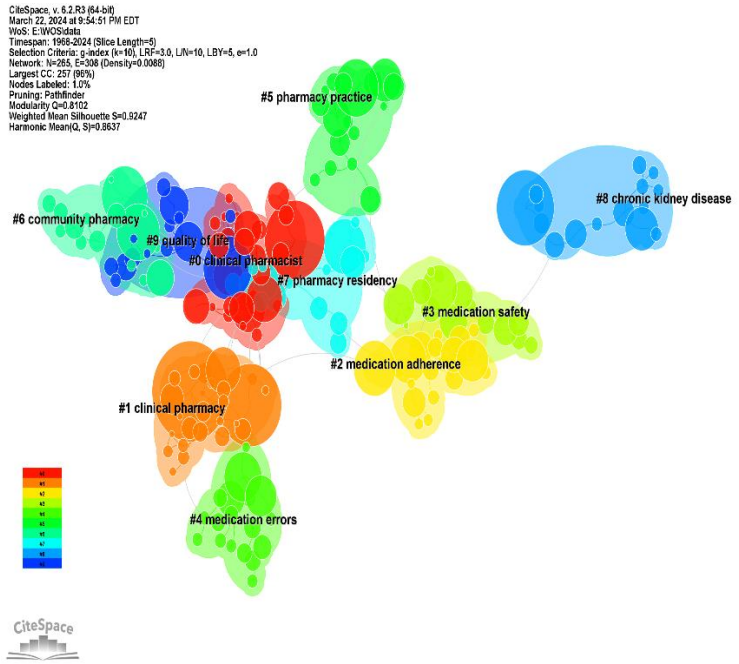


Top 10 most popular keywords

Keywords	Count	Centrality	Starting Year
clinical pharmacy	398	0.24	1991
impact	285	0.14	1993
care	267	0.11	1991
clinical pharmacist	245	0.06	2003
management	220	0.35	2001
pharmaceutical care	193	0.14	1992
clinical pharmacists	156	0.29	1991
services	139	0.16	1991
education	128	0.17	2004
program	127	0	1996

Figure 7: Keyword co-occurring network

Figure 8 presented 10 key clusters identified using the log-likelihood ratio (LLR) algorithm, and the best keyword cluster labels in terms of uniqueness and coverage were selected (Zhao, 2017). The largest cluster, "*clinical pharmacist*" (28 members), contrasted with the smallest cluster "*quality of life*" (15 members). Most clusters were formed by papers published after 2000.



Cluster ID	Size	Silhouette	Mean (Year)	Label (LLR)
0	28	0.879	2001	clinical pharmacist; medication error; clinical pharmacy services; drug therapy; diabetes mellitus
1	26	0.888	1995	clinical pharmacy; pharmaceutical services; pharmacy - institutional - hospital ; data collection; education - pharmaceutical
2	20	0.922	2008	medication adherence; outcm; pharmacy education; blood pressure; pharmaceutical services
3	18	0.959	2008	medication safety; medication reconciliation; reconciliation; errors; discrepancy
4	18	0.957	2013	medication errors; prescribing errors; infectious diseases; drug interactions; iran
5	17	0.836	2010	pharmacy practice; professional development; saudi arabia; critical care; mentorship
6	16	0.886	2003	community pharmacy; services ; primary health care; cost effectiveness; surgery
7	16	0.874	2009	pharmacy residency; cardiovascular disease; primary care; atrial fibrillation; heart failure
8	15	0.944	2014	chronic kidney disease; risk; potentially inappropriate medication; prescription evaluation; pharmaceutical services
9	15	0.983	2007	quality of life; systematic review; general practice; randomized controlled trial; pharmacy service

Figure 8: Cluster map of keywords

Based on the method algorithm developed by Kleinberg (Kleinberg, 2003), the top 20 keywords with the strongest citation burst were selected and shown in Figure 9 Pharmaceutical services (1991–2012) acquired the strongest attention, with a citation burst strength of 18.39, followed by data collection (burst

strength = 10.57, 1991–2007), pharmacists-hospital (burst strength = 9.95, 1991–1997), education-pharmaceutical (burst strength = 7.52, 1992–2012) and clinical pharmacists (burst strength = 6.71, 1991–1997). During the study period from 2018 to 2024, some keywords, such as "*validation*" and "*saudi arabia", in the field of CPE, headed a new trend recently, while the Saudi Arabia region has made* great efforts to CPE-associated studies since 2018. From the perspective of CPE projects, the concerns of drug-related topics had garnered tremendous attention before 2018. Other subjects related to CPE, such as patients, disease management, and quality assurance, have also been analysed recently.

Figure 9: Top 20 keywords with the strongest citation burst

Discussion

The review of the history and development of clinical pharmacy education or training is considered to be quite extensive; therefore, here, this study focused on a few key points that may help understand the trend of CPE over the past six decades. Based on the results of the bibliometrics analysis of CPE, several notable features were revealed. Firstly, the reports on the field of CPE emerged in the 1990s and prevailed after 2019 with a sharp rise in published literature numbers. Secondly, the United States has played a dominant role in the establishment and promotion of CPE. With the emergence of CPE, countries such as France, Brazil, Japan and India have gradually incorporated CPE into their pharmacy education systems since the early 2000s, and the CPE development in the Saudi Arabia area has also been noticed since 1978, which extended and deepened the CPE globalisation. Thirdly, the highlights of CPE over the past 58 years have shifted from the concerns of drug administration to the methodology of CPE, which is dedicated to promoting the clinical patient care service.

Based on our observations, CPE-related research has been sporadic since the 1960s, with a notable increase in the 1990s, following a nearly 30-year time lag (Carter, 2016). As clinical demands increase and the population ages, pharmacists' involvement in patient care expands, improving the quality of pharmacy service gradually (Elenbaas & Worthen, 2009). The early 1970s displayed a shift in USA federal funding, which led to the expansion of clinical pharmacy faculty and infrastructures. The American Association of Colleges of Pharmacy (AACP) drove the CPE development, and the "*Millis Commission*" report chaired by Dr John Millis recommended training pharmacists for direct patient care to improve public health. Consequently, in 1992, the AACP House approved the Pharm.D. degree as the only pharmacy professional degree (Buttaro, 1992). While the Pharm.D. programme integrates comprehensive academic training, clinical practice, and patient care skills, it differs from Clinical Pharmacy

Education (CPE), which is an ongoing professional development process. The observed increase in CPE hours reflects the broader trend towards a more clinical and patient-centred focus in pharmacy practice.

In comparison, the UK developed its clinical pharmacy practice later (Calder & Barnett, 1967). The first CPE programme was launched in Manchester in 1978, followed by others in Bradford and London (Anonymous, 1978). Pharmacy departments worked closely with medical faculty to train pharmacists with courses provided part-time and in hospital settings. After stagnation, a 1994 survey confirmed the evolving role and diversity of pharmacy practice in the UK (Cotte*et et al.*, 1994). The Nuffield Foundation advocated for patient-focused clinical pharmacy practice in 1986 (Nuffield Foundation, 1986).

Pharmaceutical care, as defined by Hepler and Strand, was a broader concept that goes beyond CPE (Hepler & Strand, 1990). While both aimed to improve patient outcomes, pharmaceutical care focused on pharmacists' clinical responsibility in medication management, whereas CPE emphasised ongoing professional development. This bibliometric study specifically includes literature on CPE. As mentioned above, the expansion of medication options and the legislation of clinical pharmacy practice in the USA increased healthcare access for a larger patient population, including the elderly and the poor. Additionally, the large number of veterans who survived World War II was speculated as in their 50's to 70's during the period between the 1990s and the 2010s (The Lancet, 2015). They began pursuing more extensive care in veteran hospitals and clinics as ageing. These healthcare changes have directly impacted the role of clinical pharmacists, driving the expansion of CPE programs. The increasing demand for specialised pharmacy services in patient care has created a clear need for professional development opportunities, thus contributing to the growth of CPE worldwide

Keywords such as drug information and medication therapy were prominent in earlier years, reflecting the traditional focus on medication management. However, more recent studies emphasised patient care and quality of life, indicating a shift toward a more patient-centred approach in pharmacy education. This shift can be attributed to changes in healthcare priorities, with greater emphasis on patient outcomes. The burst analysis also revealed growing interest in these topics in the past decade, highlighting their increasing relevance in pharmacy education. The transformation in CPE concerns had shifted from a drug-prominent approach to one focused on patient care and quality, as seen in both the rise of CPE hours and the expanding role of pharmacists in direct patient care. The evolution has been driven not only by early contributions from the USA and UK but also by emerging regions such as China and Saudi Arabia. The increasing demand for CPE, particularly in emerging regions such as China and Saudi Arabia, can be attributed to a combination of factors. In China, the rapid expansion of healthcare infrastructure, coupled with a growing demand for healthcare professionals to address complex patient needs, has spurred significant interest in CPE. In Saudi Arabia, the government's focus on improving healthcare quality and expanding pharmacy services, along with recent policy shifts and funding for CPE programs, has resulted in a surge of research and participation in CPE-related activities.

As the co-cited journal network showed, the American Journal of Health-System Pharmacy (AJHP) held the highest citation frequency, reflecting its central role in advancing pharmacy practice. Clinical pharmacy research initially focused on basic drug information and medication management, saw substantial growth in the 1980s with an increased focus on improving health outcomes. With the development of new technology and knowledge in the late 20th century (Berenguer *et al.*, 2004; Koehler *et al.*, 2009; Nkansah *et al.*, 2010; Jarab et al., 2012; Touchett *et al.*, 2014), CPE shifted towards advanced clinical pharmacy services. (Allemann *et al.*, 2014; Crews *et al.*, 2011; Sakeena *et al.*, 2018). These transformations are reflected in both the keyword networks and the global contributions from emerging regions like China and Saudi Arabia, where governmental support and policy reforms have fostered significant growth in CPE-related research. (Al-Ghananeem *et al.*, 2018; Badreldin *et al.*, 2020; Almaghaslah & Alsayari, 2021).

The surge in CPE-related research after 2019 can be attributed to several factors, including the global health crisis brought by the COVID-19 pandemic, which highlighted the essential role of pharmacists in patient care (Badreldin *et al.,* 2020; Almaghaslah & Alsayari, 2021). The pandemic accelerated the demand for clinical pharmacists and reinforced the need for professional development. Additionally, advancements in digital education platforms have made CPE more accessible, while policy shifts in regions like Saudi Arabia and China have increased government investment in healthcare and pharmacy education.

Conclusion

In conclusion, clinical pharmacy education or training programmes have been established well and improved gradually over the past six decades. This bibliometric analysis demonstrated that the expanding action of CPE

in pharmacists has been driven by the USA and UK with early contributions shaping the development of CPE, and other countries all over the world have also paid attention to CPE development recently, which is beneficial to improve and enhance pharmacy services globalisation. The focus of Clinical Pharmacy Education (CPE) has evolved from a 'drug-prominent' approach, which emphasised the management of drug therapies and dispensing, to a more 'quality-focused' approach that prioritises patient outcomes, the role of pharmacists in multidisciplinary health teams, and the improvement of overall healthcare quality.

This study has certain limitations. Firstly, this study relies solely on the Web of Science (WoS) core collection database, which may result in the omission of relevant literature that is indexed in other databases such as Scopus, PubMed, or regional databases. Additionally, the use of WoS may underrepresent certain research fields and open-access publications, potentially limiting the generalisability of the findings. These factors should be considered when interpreting the results of this study. Second, while this bibliometric study provides valuable insights into trends in CPE, it primarily focuses on the number of publications and does not explore the content and quality of the studies in detail. The qualitative analyses of CPE programmes in different countries by meta or systemic review could provide deeper insights into the evolving nature of pharmacy education worldwide. Despite these limitations, the study provides valuable insights into the trends and developments in CPE, highlighting the growing importance of CPE in shaping the future of pharmacy practice and education worldwide.

Conflict of interest

The authors declare no conflict of interest.

Source of funding

This work was supported by China Medical Board Grant Funds (21-398) (B.Z.).

Author contribution

L.Q.: conceptualisation, data curation, formal analysis, software, investigation, methodology, writing-original draft. H.L.: formal analysis & editing. K.Y.: writing-review & editing. B.Z.: conceptualization, supervision, funding acquisition, writing-review & editing. X.R.: supervision, writing-review & editing; all authors reviewed the manuscript.

Data accessibility

The authors collected and had complete access to study data.

Data availability

Data are open access, and the details are available on request.

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