Health journalism: a bibliometric analysis of research themes and future directions

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The body of health journalism research literature remains scattered across various disciplines and requires comprehensive understanding. This study aims to enhance researchers' comprehension of the field, by presenting a systematic review of SSCI-indexed articles. Findings reveal two peaks in health journalism research from 1994 to 2023: during the 2009 H1N1 influenza and the COVID-19 outbreak. Using bibliographic coupling analysis, it was possible to define 10 major research themes from the review. They were: How health stories are framed in the news; How audiences engage with health information online; How constructive journalism can improve the news reporting of public health crisis; How fact-checking can improve the news reporting of public health crisis; How health stories are framed from science journalism perspective; Why citizen journalism is significant in health news reporting; How health journalists perceive their journalistic role; Who serves as the news source for health news reporting; How health professionals impact health news reporting; and How peace journalism can be used for health news reporting on vulnerable populations. This research provides insights into the current state of health journalism research and outlines potential areas for further exploration in health journalism, spanning topics such as women and other marginalized communities in health reporting.

KEYWORDS

health journalism, science journalism, bibliometric analysis, citation analysis, bibliographic coupling, systematic literature review

Introduction

The rising significance of health journalism is accompanied by growing challenges. While it has the potential to shape public health policy and influence people's understanding, attitudes, and behavior towards health, it contends with diminishing resources in the evolving media landscape (Bonfiglioli and Cullen, 2017). Reflecting on the history of health journalism, particularly well-documented in Western societies, the early 1980s marked the onset of growing interest in the health-related content of news, advertising, and entertainment media (Kline, 2006). French scholars Patrick Champagne and Dominique Marchetti, research associates of Pierre Bourdieu, observed this trend and characterized the development of health journalism as a subfield situated between the journalism and medical domains during periods of commercialization and politicization in both fields (Champagne and Marchetti, 1999, as cited in Benson, 1999). In other words, health journalism can be seen as the co-production between health and media professionals (Stroobant et al., 2019).

However, only a limited number of research endeavors have undertaken a review of the research themes in health journalism and delved into the evolution of this research field. Moreover, the difficulty of doing so lies in the complex nature of research on health news. Journalism serves as a research object across multiple disciplines—sociology, political economy, cultural studies, health sciences, environmental sciences, etc.—(Nash, 2013). The term health news encompasses an extensive and diverse range of stories and topics, spanning health policy, medical research, and personal lifestyle, which extends beyond scientific and medical news, and often overlaps with political and cultural subjects (Furlan, 2016). Similarly, the term health reporting can sometimes refer to health news (e.g., Briggs and Hallin, 2010), but it is frequently understood as information regarding the population's health sourced from the public health system (e.g., Broome et al., 2003; Bartig et al., 2019). Moreover, the term health journalism encompasses not only health news coverage and stories but also includes the study of health journalists, newsrooms, and the broader news media industries, constituting a distinct discipline (e.g., Keshvari et al., 2018; Molyneux and Holton, 2015; Schwitzer, 2010). Within the communication discipline, health news occupies the intersection of health communication, scientific communication, and even political communication, given its impact on broader ideologies and social structures (Briggs and Hallin, 2010). Moreover, in journalism studies, health news can be classified as both soft news and hard news because it covers a broader range of topics. The broad spectrum includes hard news topics like new scientific findings in medical research, general public health, health education, and health policy (Mohammadi et al., 2021), as well as soft news stories related to healthy lifestyles (Kristensen and From, 2015). Therefore, the related literature is dispersed and demands thorough comprehension. Earlier efforts by Kline (2006) identified "Challenges to Bodily Health" (p. 46) and "Politics and Sociocultural Context: Public Policy, Controversies, Health Scares, and Ideologies" (p. 49) as two primary topics derived from research on health media content through narrative literature review, covering the late 1990s to the early 2000s. Consequently, there exists a knowledge gap regarding the development of health journalism research in the current century.

To evaluate knowledge development of an academic field, bibliometrics, defined as "the application of mathematics and statistical methods to books and other media of communication," has been used across various disciplines (Pritchard and Wittig, 1981, p. 3) Research articles published in academic journals constitute a crucial component of the academic knowledge development process, serving as a primary indicator of research impact (Garfield, 2006). As Price (1965) described, the growth of academic knowledge often can be seen as structuring the research front, in which researchers pay attention to a small select part of the most recent literature as expressed by their references. Thus, the cluster of co-cited documents among academic papers indicates a relationship pattern among the influential concepts represented by these frequently cited documents in a given field and specialty (Small, 1973). Small and Crane (1979) highlighted the dynamic nature of scientific specialties, suggesting that applying the co-citation technique in these dynamic fields can help identify active areas deserving of in-depth analysis by other methods. The term specialty is used here in the colloquial sense to denote an area of study, encompassing both large and small domains, rather than strictly adhering to its narrow technical definition as a minimal cohesive research community (Morris and Van Der Veer Martens, 2008). In

some cases, different clusters may identify the same specialty, which will be necessary to analyse different structural aspects of publications in combination in a quantitative fashion instead of the exclusive use of single aspects, like, for instance, combining co-citation mapping, and co-word mapping (Braam et al., 1991). Borgman and Furner (2002) investigated earlier validation studies of co-citation results, demonstrating that citation analysis offers statistical validity and high reliability.

This study conducted a systematic literature review of current research in health journalism, guided by the question: What are the current research themes in health journalism? To address this query, I systematically examined research articles from communication journals listed in the Social Sciences Citation Index (SSCI), covering the years 1994 to 2023. The study employed bibliometric methods to map the current intellectual landscape. In the pursuit of contributing to future research, it also proposed a direction for advancing the field.

Methodology

The present study employed a systematic review approach to examine health journalism literature through a bibliometric analysis. To be systematic, the researcher used systematic searching guided by a predefined set of selection criteria to avoid potential bias in the author's interpretations (Pae, 2015). Furthermore, incorporating bibliometric analysis into a systematic review enhances its impact by facilitating objective literature assessment, bolstering rigour, and mitigating researcher bias (Zupic and Čater, 2015). In this study, the researcher formulated three stages for the systematic review, summarizing the steps taken for data collection and subsequent analysis to fulfil the study's objectives. These stages are depicted in the flowchart (Figure 1), and the succeeding sections provide detailed descriptions of each stage.

Stage 1 data collection

Data collection took place on November 29, 2023 (see Table 1). A total of 238 research articles, along with their bibliographic metadata (including publication years, authors, titles, journals, cited references, etc.), were gathered from communication journals listed in the Social Sciences Citation Index (SSCI), spanning the years 1994 to 2023. I focused on communication journals whereas scholars may prefer to publish in medical journals. Defining the search string is the first step in most bibliometric studies to gather representative academic work from a set of highly cited journals, reflecting the most active and productive segments within a field (Zhao, 2009). Through testing, the searching term "health journalism" retrieved focused outcomes to represent the research field of journalism within communication discipline rather than as a research object served for studies from other disciplines, which is suitable for the focus of this study.

Furthermore, Social Sciences Citation Index (SSCI) was chosen for the composition of high-ranking and high-quality publications (Ho, 2014; Huh, 2017). To select a database with high-quality bibliographic metadata, three prominent databases—Social Sciences Citation Index (SSCI) of Thomson Reuters' Web of Science (WoS), Scopus, and Dimensions—were tested to assess the completeness of exported bibliographic metadata. The testing acknowledged, as

FIGURE 1
Flow chart of the bibliometric review method.
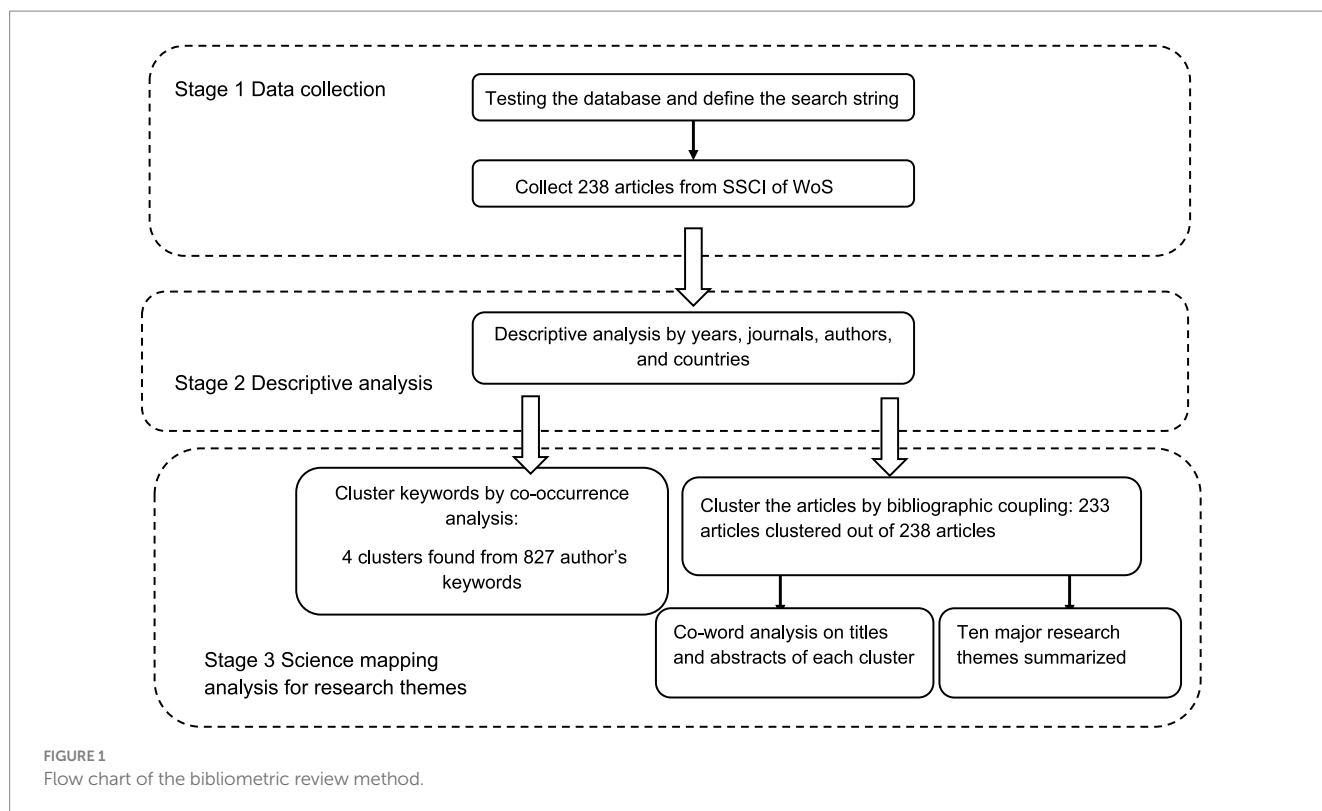
suggested by previous studies, the WoS as a credible and reliable source of bibliographic data (e.g., Birkle et al., 2020; Pranckutė, 2021), although Scopus, and Dimensions have higher coverage than Web of Science (e.g., Guerrero-Bote et al., 2021; Martín-Martín et al., 2021). This evaluation was conducted using the R-package of Bibliometrix, a bibliographic analysis program developed by the University of Naples Federico II (Aria and Cuccurullo, 2017; Derviş, 2020). Additionally, considering the types of articles can influence the results of citation analysis (Braam et al., 1991), review articles were excluded from the data collection for this study because their wider coverage often results in a higher citation impact as they tend to be more relevant to a greater number of articles than those reporting individual studies (Zhao and Strotmann, 2015, p. 16).

Stage 2 descriptive analysis

The bibliographic metadata acquired from Stage 1 was imported into the R-package Bibliometrix for conducting descriptive analysis, unveiling productive sources, authors, and countries. Descriptive statistics include the number and frequency of literature geographically, authors, journals, years of publication and areas, etc., which focus on the production of a body of literature (Potter, 1988, as cited in Manganello, 2017). Potter (1988, as cited in Manganello, 2017) emphasises that descriptive studies predominantly centre on citation patterns or distributions, specifically two key laws: Lotka's Law of Productivity, beneficial for testing extensive literature across a broad period, and Bradford's Law of Scatter, which suggests that a small number of core journals publish approximately one-third of the literature in any given field. The H-index, proposed by Hirsch (2005), serves as a citation impact measure within bibliometrics. It was

employed to assess the scientific output of both researchers and journals (Bornmann and Daniel, 2007). Overall, Lotka's Law, Bradford's Law, and H-index were used in this current study for measuring the scientific contribution.

Stage 3 science mapping analysis based on co-word and bibliographic coupling

To examine the research themes within the body of literature, co-word and co-citation approaches were employed. The bibliographic metadata obtained from Stage 1 was imported into the R-package Bibliometrix to perform the visualisation of keywords co-occurrence mapping (Guo et al., 2019; Xu et al., 2022). It was performed based on the keywords visualised by Louvain algorithm (De Meo et al., 2011), which is common in keyword network clustering analysis (Wang et al., 2022).

For clustering a body of literature by research themes, co-citation analysis and bibliographic coupling are widely employed in citation network analysis. Small (1973) is widely credited with introducing co-citation analysis, particularly the concept of document co-citation where a pair of articles is linked if both are cited by a third article. Conversely, bibliographic coupling, introduced by Kessler (1963), involves two documents linked by their shared citations to a third article. Co-citation analysis has a weakness in detecting emerging research fronts due to a time lag of articles from getting published to getting cited, unlike bibliographic coupling analysis, which does not have this time delay (Shibata et al., 2009). This notable distinction stems from their respective focuses: Bibliographic coupling analysis centres on recent research by currently active scholars within a field, whereas co-citation analysis unveils the structure of influences on the

TABLE 1 Search strings and results of research articles on health journalism.

Data base	Search string	Number of articles	Annual growth rate	Timeframe*	Number of journals	Number of authors	Number of single-authored articles	Data Completeness (number and proportion of missing contents)						
								Publication Year	Author	Corresponding Author	Abstract	Keywords	Cited References	DOI
The Social Science Citation Index-Web of Science (WoS)	(TS = (health journalism)) AND (DT==("ARTICLE") AND TASCA==("COMMUNICATION") AND EDN==("WOS.SSCI") AND LA==("ENGLISH"))	238	13.47%	1994–2023	40	544	58	0	0	4/1.68	0	23/9.66	1/0.42	9/3.78
Scopus	(TITLE-ABS-KEY (health AND journalism)) AND (LIMIT-TO (SRCTYPE, "j")) AND (LIMIT-TO (SUBJAREA, "SOCI")) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (LANGUAGE, "English"))	616	**6.84%**	1957–2023	254	1,352	194	0	1/0.16	146/ 23.7	0	155/25.16	39/ 6.33	57/9.25
Dimensions	Health AND journalism, 4,701 Communication and Media Studies, Article	476	5.62%	1947–2023	229	1,018	192	7/ 1.47	9/1.89	289/60.71	1/0.21	391/82.14	476/ 100	12/2.52

*Dates taken from start of database.

field, encompassing sources from outside the field or from founding figures who are no longer active (Zhao and Strotmann, 2008). Moreover, bibliographic coupling exhibits greater accuracy when compared to co-citation analysis (Boyack and Klavans, 2010). Kleminski et al. (2022) have consistently highlighted that bibliographic coupling tends to obtain more meaningful insights compared to co-citation. Hence, this present study employed bibliographic coupling to cluster the body of health journalism literature obtained from stage 1.

The most used items for cluster analysis in bibliographic coupling are documents, authors, and journals (Jarneving, 2005). While author-based analysis often generates clearer visual maps of citation networks due to the fewer items required when most authors contribute multiple documents (Zhao and Strotmann, 2015, p. 26), it is not suitable for the dataset of current studies, where most authors only contributed single articles. The bibliographic coupling performed in this study was based on document, conducted using the software package VOS Viewer (Van Eck and Waltman, 2010). Furthermore, co-word analyses were conducted for the high-frequency words and their linkage in each cluster based on the article abstracts, using the web-based text analysis software Voyant Tools (Sampsel, 2018).

Results and discussion

Distribution of major health journalism literature

Distribution by year

Figure 2 presents the yearly progression of the number of publications from 1994 to 2023. The initial upward trend reflects a growing interest among scholars in health journalism, particularly since 2011. A significant 44% of the total research articles (105 out of 238) were published in the last decade, spanning from 2011 to 2020. It's noteworthy that the second peak indicates the publication of 183 research articles related to health journalism in the past 3 years since

2021, comprising 47% of the total research articles (112 out of 238). Based on our results, two peaks in health journalism research appear to align with two global pandemics: the 2009 H1N1 influenza virus (previously known as swine flu; Al Hajjar and McIntosh, 2010) and the COVID-19 outbreak in December 2019 (Peng, 2020).

Distribution by authors

According to the current dataset, 544 authors have contributed to 238 research articles on health journalism. Assessing author productivity through Lotka's Law, 491 authors (90.3%) have each published one article. It indicates that health journalism research has been considered one of their areas of interest, contributing only a smaller portion to their academic endeavors throughout their careers. There are 32 authors who have published two articles (5.9%), and 16 authors who have published three articles, accounting for 2.9%. Additionally, three authors have each published four articles, representing 0.6%. Notable contributors in this category include Avery E. Holton from the University of Utah, María E. Len-Ríos from the University of Missouri, and Karin Raeymaeckers from Ghent University. Two authors have each published six articles, accounting for 0.4%. The highest contributing authors within our dataset are Amanda Hinnant from the University of Missouri and Daniel Jackson from Bournemouth University.

Distribution by journals

Out of the 238 research articles selected for analysis, 40 journals have contributed. Table 2 presents the top 10 journals in health journalism research, ranked by H-index, which collectively account for 69.7% (166 out of 238 articles) of the current dataset. The table indicates that the area of study is multi-disciplinary, with contributions from the disciplines of journalism, media studies, science communication, and health communication. According to our results, *Journalism Practice* has been the most active journal in this field, holding a 13.45% share of the articles published in health journalism, followed by *Journalism Studies* (12.18%) and *Journalism* (10.92%). The contribution of *Journalism*
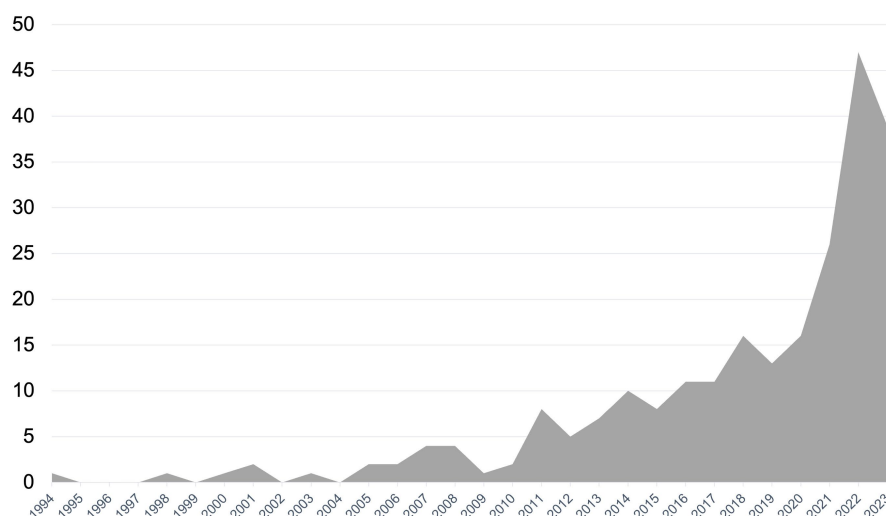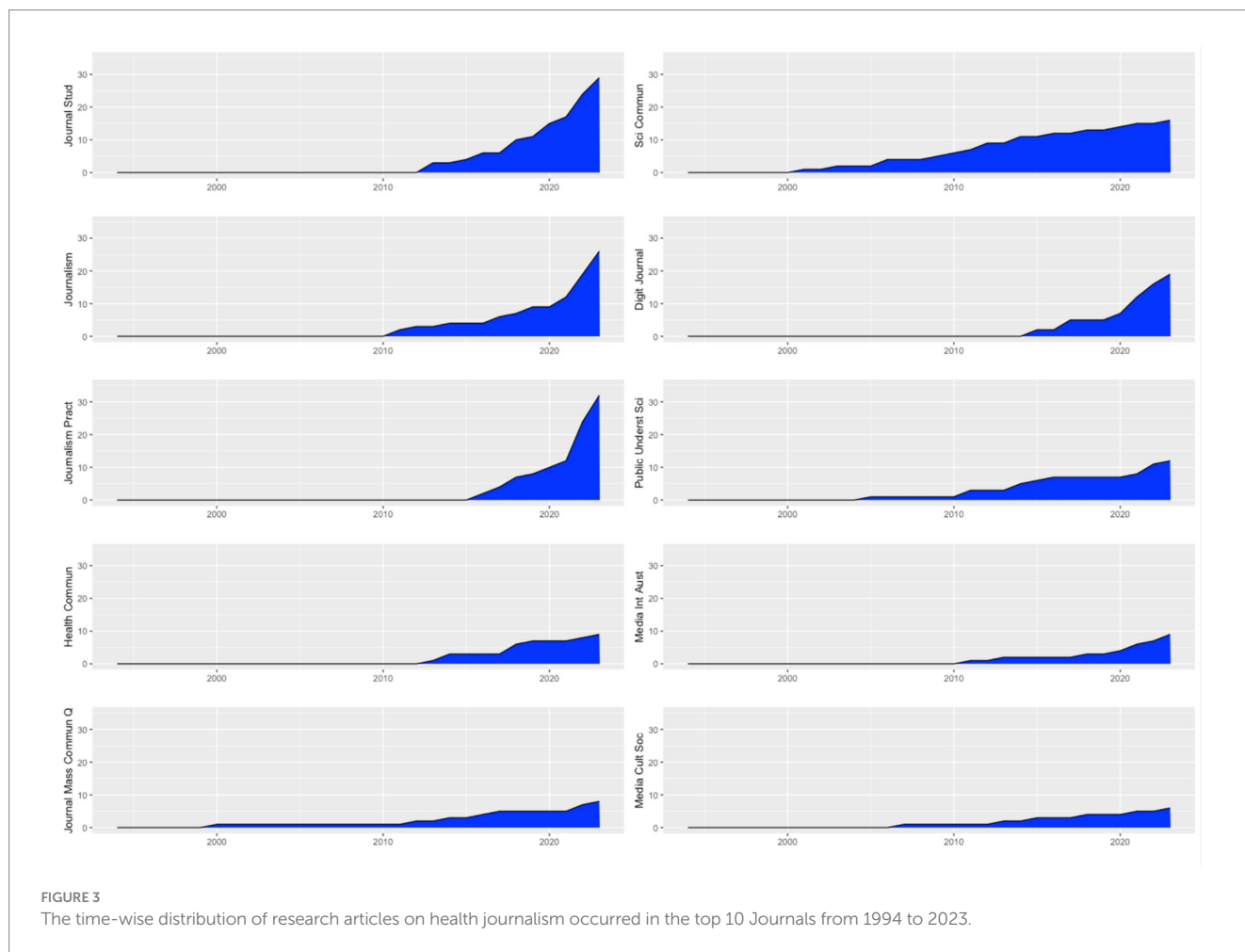

FIGURE 2
The annual production of health journalism research from 1994 to 2023.

TABLE 2 Top 10 journals by the H-index of research articles on health journalism.

Name of the Journal	Number of articles	Total citations	H-index
Journalism Studies	29	418	11
Science Communication	16	289	10
Journalism	26	274	8
Digital Journalism	19	288	8
Journalism Practice	32	203	7
Public Understanding of Science	12	151	7
Health Communication	9	226	6
Media International Australia	9	86	5
Journalism and Mass Communication Quarterly	8	69	5
Media Culture and Society	6	104	5

FIGURE 3
The time-wise distribution of research articles on health journalism occurred in the top 10 Journals from 1994 to 2023.

Studies is also noteworthy, particularly in relation to its highest h-index. As shown in Figure 3, research in health journalism emerged in the *Journalism and Mass Communication Quarterly*, *Science Communication*, and *Public Understanding of Science* during the first decade of the 21st century. In contrast, other journals began publishing research related to health journalism after 2010.

Distribution by countries

Table 3 shows the top 10 countries ranked by their corresponding author's productivity in health journalism research. The United States emerges as the leading country, having 93 corresponding authors who received a total of 2,909 citations. Notably, Spain, Australia, and the United Kingdom, and Singapore have also demonstrated significant productivity, with 13, 19, 21 corresponding authors, respectively. Scientific

TABLE 3 Countries with most citations of research articles on health journalism.

Country	Total citations	Number of articles from the corresponding Author's Country*
USA	1,600	93
Spain	333	13
Australia	237	19
United Kingdom	183	21
Singapore	160	4
Sweden	125	6
Belgium	99	7
Canada	78	7
Germany	62	8
Finland	45	2

*Includes multiple country publications.

FIGURE 4
Collaboration network among countries.
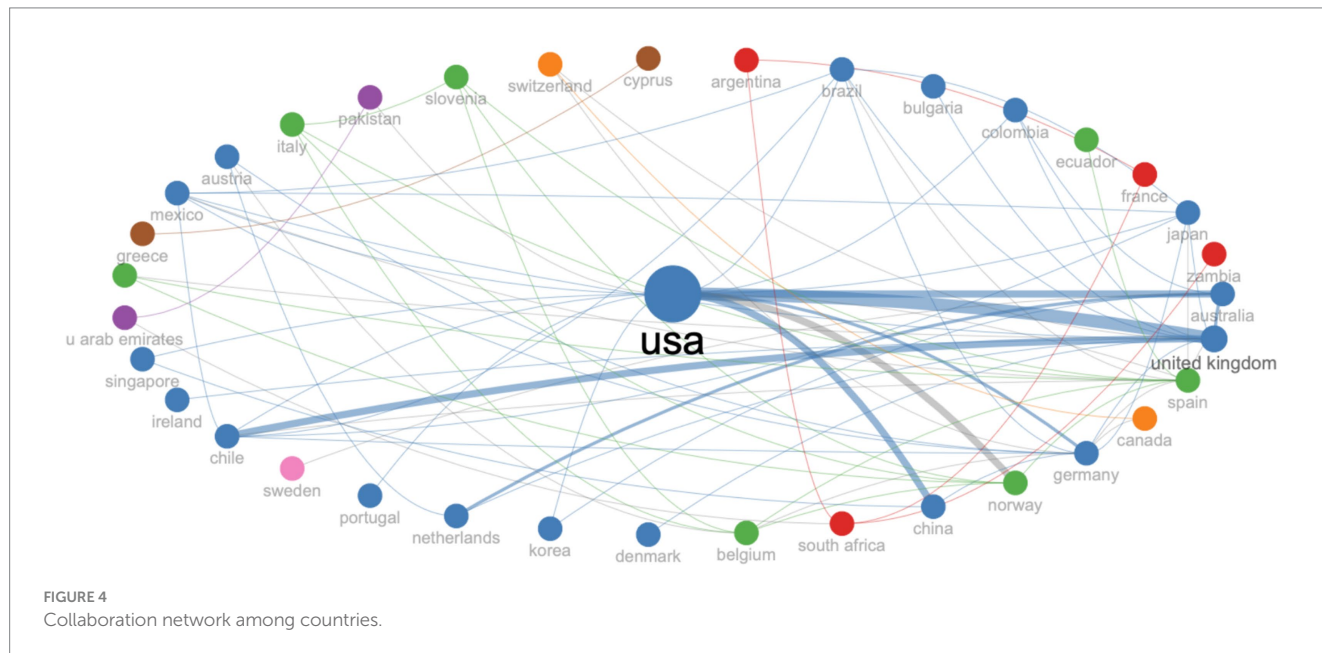
collaboration analysis considers that if multiple authors are present in an article at the same time, these authors are regarded as collaborators. If these authors are from different countries, a collaborative network among these countries is formed. Figure 4 illustrates that American scholars are at the centre of the global network of health journalism research. The figure gives an extensive global network, with notable collaborations among scholars from the US, the UK, Chile, and China.

Major research themes of health journalism literature

The co-occurrence network of keywords

Thirty-four of the most frequently used author's keywords were identified, labelled, and organised into four groups from a pool of 827 keywords found in the 238 research articles selected for this study. This network classification is illustrated in Figure 5. The first group encompasses keywords such as journalism, framing, newspapers, health, public health, media, mental health, ethics, news media, political communication, sources, comparative research, science, democracy, disinformation, gender, and trauma. These are represented as nodes in red in Figure 5. This group of keywords is centred around the keyword 'journalism', related to the common research approach, such as framing and comparative research. The second group consists of nodes in blue in Figure 5 labelled as follows: covid-19, coronavirus, pandemic, constructive journalism, news consumption, solutions journalism, and uncertainty. It indicates the significance of constructive journalism or solutions journalism highlighted by the COVID-19 outbreak. The third group is represented by nodes in green in Figure 5, labelled as follows: science journalism, health communication, public understanding of science, and science communication. This group shows health journalism understood as a type of science journalism from health and scientific communication perspectives. The last group includes nodes coloured in purple in Figure 5 labelled as follows: content analysis, social media, health journalism, news, Facebook, Twitter. It highlights the use of content analysis in researching health news on social media.

FIGURE 5
The co-occurrence network of author's keywords from the health journalism literature.
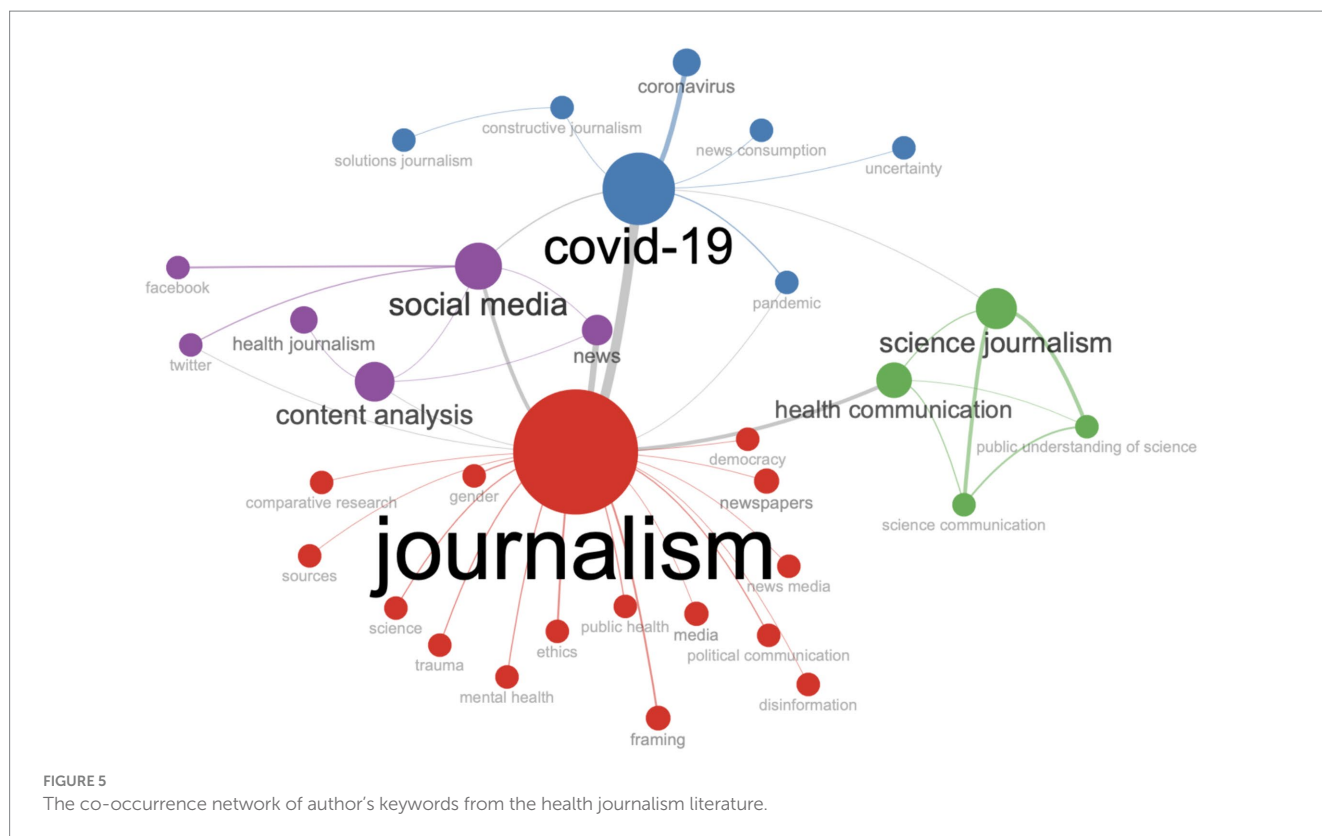
These highlighted keywords provide a brief snapshot of the conceptual structure of health journalism but cannot directly structure and organise the articles using this method. Therefore, bibliographic coupling analysis was used to structure the articles, and its results are discussed below.

Ten clusters found by bibliographic coupling analysis

Without restrictions on the minimum number of citations, 233 articles were clustered out of a total of 238 research articles to explore the premise and emerging research specialties in health journalism using bibliographic coupling. As shown in Table 5, 10 clusters are organised, and the articles belonging to the same cluster have cited the same references in higher amounts, indicating a higher probability of advancing similar research themes or employing the same methodical approach. In addition, within the same cluster, the top 10 words with the highest frequency from titles and abstracts, along with their co-words in these clusters, are listed by co-word analysis (see Table 4). The results from the automatic approach of co-word analysis could help avoid potential bias in the author's interpretations when summarising the research themes. The research themes below were summarised by closely reading each article in the same cluster.

Cluster 1: how health stories are framed in the news

Most articles in the first cluster focused on the representation of health-related issues in journalism, employing framing analysis. The cluster comprises 42 articles, dating back to 2005 at the earliest (Miah,

2005). Most early research primarily shed light on framing new technology and innovations in the news, such as the ethical issues of gene-edited reproductive technology (e.g., González Santos et al., 2018; Michelle, 2007; Miah, 2005) and radiation in health usage (Candela and Pasquarè Mariotto, 2016).

Later, the major body of literature in this cluster focused on how public health crises are framed in the news, such as Covid-19 (Bednarek and Carr, 2021; Bernadas and Ilagan, 2020; Bosch and Wasserman, 2023; Hamusokwe et al., 2022; Meyer and Van Schalkwyk, 2023; Milutinović, 2021; Sadri et al., 2022; Wollnik, 2021; Zhao et al., 2023), 2009 H1N1, also named swine flu (Holland et al., 2014; Holland and Blood, 2013), and the life crisis in East Africa (Conrad, 2015). Comparative analysis was employed by Suran et al. (2014) to make a comparison among public health topics in the news, by Edwards (2022) to compare the framing of Covid-19 and the 1918 flu in Spine news coverage, and by Perko et al. (2019) to compare news coverage of nuclear accidents between Fukushima and Chernobyl. Alternatively, mediation analysis is systematically reviewed in the research of health news by Chan et al. (2022) and employed by Maier et al. (2017) to examine news frames and emotional response to genocide and mass violence.

Framing public health issues in the news was also explored across various domains, including mental health (Holland, 2018; Slopen et al., 2007; Zhang et al., 2016), HIV (Grimm and Schwartz, 2021; Owen, 2018; Ren and Dan, 2022), cancer (Kim et al., 2017), food (Brüggemann et al., 2022), alcohol (Carah and Van Horen, 2011), obesity (Sandberg, 2007), and gaming disorder (Schatto-Eckrodt et al., 2020).

In addition, framing of gender health was also highlighted, for example, the framing of brain injuries among American

TABLE 4 Identified high frequency words and their co-words from titles and abstracts of 10 clusters by bibliographic coupling.

Cluster	Article count	Highest frequency words (count)	Co-words
1	42	health (112), news (82), media (69), public (46), coverage (44), analysis (41), study (40), reporting (40), journalists (33), journalism (33)	framing, issues, pandemic, articles, communication, journalistic, role, perception, daily, covid, research, political, content, examines, interviews, responses, use, swine, professional, sources
2	32	news (109), media (59), health (45), local (37), journalism (35), study (33), content (25), analysis (24), social (23), research (21)	exposure, objectives, medical, findings, related, capital, examines, quality, community, uses, use, shape
3	29	news (84), media (67), journalism (56), health (56), covid (46), public (38), pandemic (36), constructive (36), social (30), study (29)	professionals, overload, participants, trust, reporting, systems. Discuss, explored, information, effects, avoidance, approach, fact, positive, funding, model
4	27	journalists (109), news (38), health (33), study (30), fact (29), work (26), journalism (26), emotional (25), social (24), pandemic (24)	literacy, crisis, covid, virus, exposure, related, role, protests, websites, interviews, support, net, labour (labor), information, production, television, routines, coverage, mental, public, press, practices, organizations
5	26	science (71), health (48), news (42), journalist (35), media (34), coverage (24), scientific (23), study (21), journalism (21), information (20)	evidence, depth, risks, times, press, research, reporting, sources, public, uncertainty, vaccination, vaccine, training, literacy, content, types, quality, peer
6	24	media (46), news (43), journalism (43), journalists (36), health (33), research (31), indigenous (16), study (15), citizen (15), content (14)	personal, community, margins, workers, voices, uncertainty, analysis, findings, representations, brandings, crowd, public, values, users, role, share, agenda, intervention, language, Africa, communication, sharing, issues, sharing, newsrooms, political, trust
7	22	journalists (85), health (79), news (58), media (30), study (20), sourcing (19), sources (19), role (17), practices (17), journalism (16)	social, flux, twitter, journalistic, multi, press, private, mentioned, conceptions, public, native, magazines, reporting, networks, Australian, professional
8	17	media (53), news (45), health (30), coverage (27), journalists (24), sources (23), social (23), suicide (18), reporting (18), public (17)	sourcing, mainstream, study, based, crisis, textbooks, rrs[#], protests, research, debate, analysis, struggle, open, guidelines, themes, posts, relationship, Tanzania, evidence, related science
9	10	news (38), health (34), media (23), expertise (16), coverage (14), journalism (11), interest (11), scientific (10), stories (9), analysis (9)	sources, systems, journalistic, used (using), treat, research, study, qualitative, narratives, terms, based, participation, online, popular, understanding, favor, experts, trajectories, compared, covid, issue, ways, told, German, judgement, human, previous
10	4	journalism (20), peace (14), covid (9), media (7), news (6), local (6), subframe (5), solutions (5), pandemic (5), immigration (5)	portrayed, representations, repatriation, unprecedented, pj[##], traditional, theory, stricken, principles, model, positive, stories, study, new, time, posed, using, residents, stigmatized, scholarship, suggests, covering, coverage, values, referring, untied, proposing, analyzing, approach, project, closer

[#]RRS is short for "responsible reporting on suicide."
[##]PJ is short for "peace journalism."

female athletes (Grubic, 2023), the framing of breastfeeding in public (Bock et al., 2019), and the framing of maternal mortality among African American women (Walker and Boling, 2023), stereotyping of the female body (Tinga et al., 2023). Critical discourse analysis was employed to examine the gendered framing (Bock et al., 2019; Hamusokwe et al., 2022; Tinga et al., 2023). In addition, community health issues were discussed, such as the framing of Indigenous health (LaPoe et al., 2022), health podcasts in the UAE and Pakistan (Raza et al., 2023), and the news portrayal of elderly people mistreated in private health care (Djerf-Pierre et al., 2013). From a methodological perspective, content analysis is closely associated with and widely employed in a larger body of research articles that conduct framing analysis, with further advancements noted in some studies (e.g., Bednarek and Carr, 2021; Kruvand, 2012; Riesch, 2011).

Cluster 2: how audiences engage with health information online

The second cluster explores the impact of online media on audiences, examining how audience interaction influences journalistic practices, the mediation of health messages, and the online debate on public policy. This cluster comprises 32 articles, with the earliest dating back to 2008 (McMillan et al., 2008). McMillan et al. (2008) examined the mediation of health messages from the public's interaction with online health website. A similar approach was later undertaken by Hurley et al. (2014) and Moon (2015), who specifically focused on online health news.

With the continued growth of social media, more studies have investigated such online interactivity. This includes health information on Facebook (Mathieu, 2016), online news articles

about mental health (Adamson et al., 2017) or Ice Bucket Challenge (Brown et al., 2020), how user comments influence audience perceptions of health news stories (Hinnant et al., 2023), and the prevalence of health misinformation in social media groups (Zimdars et al., 2023).

Constantly, some studies have explored the impact of the audience's online engagement on traditional journalism of health reporting, for example, how social media metrics shaped journalistic practices (Mukerjee et al., 2023). According to Hallin and Briggs (2015), the role of health journalists in mediation is not only influenced by the field of medicine and science but also shaped by changing media logic. Moreover, some research articles on online health information fall within the overlap of political communication and health communication, highlighting the complex nature of health journalism. For instance, public debates surrounding health-related policy decisions were employed as their cases to examine the roles played by traditional journalists and audience's online engagement on social media. Their results reaffirmed the essential role of traditional journalists in promoting public deliberation based on facts (Lawrence and Schafer, 2012), and the interventions of critical and investigative journalism (Fonn and Hyde-Clarke, 2023).

Cluster 3: how constructive journalism can improve the news reporting of public health crisis

Cluster 3 concentrated on examining the influence of COVID-19 on the current media system and journalistic practices, emphasizing the significance of constructive journalism, as a type of solutions-oriented journalism, encompassing the idea of incorporating positive perspectives into news reports. This cluster comprises 29 articles, with the oldest one dating back to 2020 (Casero-Ripolles, 2020). The effects of this pandemic on the media system have been examined, highlighting the resurgence of television news in re-establishing connections with audiences previously distant from information (Casero-Ripolles, 2020). For example, online news outlets tend to portray the significant rise in income inequality in the context of COVID-19 in a subdued manner (Odriozola-Chéné et al., 2020). The politicisation of COVID-19 coverage has significant implications for public health communication and, ultimately, compliance with disease-preventative measures (Wondemaghen, 2023). Nevertheless, both news outlets and social media platforms face criticism for amplifying concerns such as anxiety, racial bias, and resistance to public health recommendations amid the COVID-19 pandemic (Overgaard, 2021). Restricting the news consumption is viewed as a strategy to preserve mental well-being (Mannell and Meese, 2022).

Constructive journalism is supported for its capacity to alleviate anger and anxiety and to improve the trust and comprehension (Overgaard, 2021; Van Antwerpen et al., 2022; Van Antwerpen et al., 2023a; Van Antwerpen et al., 2023b), but its effectiveness might be challenged in less developed countries (Mututwa and Mare, 2021; Tshabangu and Salawu, 2021). The possibility of practicing constructive journalism using digital means has been explored, such as podcasts (Lindgren and Jorgensen, 2023; Sang et al., 2023). Particularly in these countries, independent news media has confronted a crisis exacerbated by the impact of COVID-19 (Trifonova Price and Antonova, 2024).

Cluster 4: how fact-checking can improve the news reporting of public health crisis

Although the majority of studies in Cluster 4 focused on the news reporting of COVID-19 as a general journalism practice, it is noteworthy that news coverage significantly shaped public understanding of COVID-19 (Strydhorst and Landrum, 2022). This cluster includes 27 articles, with the earliest one published in 2013 by Rafter and Knowlton (2013). Moreover, anxiety and concerns related to COVID-19 have led to a decrease in health fact-checking, a phenomenon largely influenced by social media information overload and social media fatigue (Jiang, 2022). Cushion et al. (2022) contend that, as audiences show a preference for rigorous journalistic scrutiny of information sources, journalists can more prominently engage in fact-checking claims and questioning dubious statements without eroding trust in journalism. Fact-checking also leans on the expertise of scientists, especially virologists, who field questions and engage in discussions among participants to debunk myths and combat fake news related to the coronavirus pandemic (Fedtke et al., 2023). The prevailing belief among most journalists is that accurate information is rooted in scientific evidence and coverage of official communication. They see the role of professional journalism as combating misinformation, pseudoscience, conspiracies, and fake news (Muresan and Salcudean, 2023). It's noteworthy to observe an emerging departure from the public reason model inherent in journalism's professional logic toward a more instrumental public health model of news work. This adaptation is particularly relevant in a digital media environment dominated by platform companies (Graves et al., 2023). Martínez-García and Ferrer (2023) highlighted journalistic collaborations with fact-checkers to fight disinformation.

Cluster 5: how health stories are framed from science journalism perspective

The fifth cluster focused on examining the representation of health issues from a science journalism perspective, assuming that health news is a subtype of scientific news. This cluster comprises 26 articles, with the earliest one published in 1998 by Culbertson et al. (1998). Differing from Cluster 1, articles in this cluster leaned towards employing the term "model," which incorporates "framing," as a competent way to characterise the news reporting on health issues. Examples include the overuse of the biomedical model of disease in health news reporting (Mercado-Martinez and Robles, 2001) and the development of criteria evaluation model for news coverage of risk (Vasterman et al., 2008). In addition, Lee and Basnyat (2013) employed framing to analyse the news coverage of the 2009 H1N1 A Influenza Pandemic within the developmental model of journalism.

Furthermore, understanding scientific evidence in health research, referred to as health literacy, is essential for enhancing information quality and developing effective sourcing strategies (e.g., Amend and Secko, 2012; Chew et al., 2006; Clarke, 2011; Hinnant and Len-Ríos, 2009; Lynch et al., 2014; Mbarga et al., 2012; Ratcliff, 2021; Stroobant et al., 2018). Many articles focused on the effective sourcing strategies of health journalism in the context of non-Western developing countries (Appiah et al., 2015; Lublinski et al., 2014) and comparisons among countries (Ren et al., 2014; Rosen et al., 2016; Vestergaard and Nielsen, 2016). The COVID-19 pandemic transformed the comprehension of scientific evidence into a data-driven journalism practice, thereby redefining the objectivity of news and public opinions (Wu, 2021).

Cluster 6: why citizen journalism is significant in health news reporting

The sixth cluster focuses on the examination of the significance of citizen journalism in health news reporting, specialised for marginalised communities. This cluster comprises 24 articles, and the earliest one was published in 2013 by Sweet et al. (2013), who suggested Indigenous citizen journalism can serve as both journalistic and public health interventions to improve the health of the Indigenous community. Citizen journalists from the Indigenous community can alleviate their marginalised and ignored situation through engagement with so-called mainstream news outlets (Tsai et al., 2022). For instance, the intersection of Indigenous-language media in Africa with gender and health communication was highlighted, such as how these media outlets cover health emergencies and portray various aspects such as politics, gender, health, sports, violence, and communication science (Tshabangu and Salawu, 2022). Furthermore, Hinnant et al. (2019) noted the Indigenous citizen journalism grappled with the tension between medical understanding of health and cultural perspectives on health. This tension contributed to the oversaturation of certain issues, such as diabetes, while other health topics were underrepresented. Therefore, as Barge (2023) suggested, health communication interventions encompass patient-based, community-based, and media-based approaches, along with critical intervention perspectives. Barge (2023) emphasises cultural interventions, adopting a culture-centred approach aimed at transforming social inequities.

Moreover, health journalism is experiencing a significant reduction in the boundary between traditional journalists working for news organizations and citizen journalists. Davis (2017) proposed refining general citizen journalism into a community health focus. This initiative led to the development of a training program for local health professionals and social workers, empowering them to use media tools for citizen journalism practices. Meanwhile, Luce et al. (2017) adopted a similar approach for disabled and elderly individuals, empowering them to take on the role of citizen journalists. The collaboration between journalists and community health experts, exemplified by co-produced podcasts, was also recommended by MacGregor and Cooper (2020).

Cluster 7: how health journalists perceive their journalistic role

The seventh cluster focuses on the examination of roles and approaches employed by journalists in reporting health news, which suggests that the practices involved in gathering health news often deviate from the typical newsgathering methods employed by general reporters. Overall, this cluster comprises 22 articles. The earliest one was published in 2007 by Gill and Babrow (2007). From their work, specific news gathering approaches were identified in the coverage of breast cancer, including the simplification of health information and the use of metaphoric expression. Additionally, the common practice in health news reporting involved the use of personal stories as examples or faces to illustrate a health issue, as noted by Hinnant et al. (2013), De Dobbelaer et al. (2018), and Wheatley (2020). Compared with general journalists, health journalists, particularly on topics such as vaccines, approached the subject from a neutral perspective, drawing on a broader array of scientific sources, notably those from professional associations and scientific journals (Catalán-Matamoros and Peñafiel-Saiz, 2019; Schultz, 2023). Given that health news often addresses politically charged topics involving corporate or state responsibility for the causes and solutions of health problems, health journalists operate on a spectrum in terms of their professional role conception, ranging from a disseminator to a facilitative role (Hinnant et al., 2016). However, the survey conducted by Gearhart et al. (2018) notes that US journalists working in Indigenous media outlets are identified as disseminators of culturally relevant health information. Journalists covering health crises often adopt a more cooperative role with authorities in their efforts to contain the crises (Klemm et al., 2019).

In addition, Twitter helped to build the identity of health journalists (Holton, 2016), and could serve as a news sourcing tool for health journalists, but they tended to use it more for monitoring and interacting with their peer journalists rather than seeking information from other sources, including health experts or the general public (Deprez and Van Leuven, 2018; Zhang and Zhu, 2022). Gender also played a role, with traditional areas of higher financial value, like politics and sports, being predominantly covered by male reporters, while fields such as arts, education, and health were primarily covered by females (Middleweek, 2022; North, 2016; Ross et al., 2018).

Cluster 8: who serves as the news source for health news reporting

Most of research articles from the eighth cluster centred on examining who are the news sourcing used by health journalists, indicating the limitations of traditional news gathering approaches and the rise of social media activism as a response to public health issues. This cluster comprises 17 articles. The earliest one was published by Viswanath et al. (2008). They conducted a national survey of U.S. health journalists and found that 93% of respondents were Caucasian, with their primary news sources being press conferences or press releases. Additionally, in developing countries, it is notable to highlight the potentially problematic role of non-governmental organisations (NGOs) in intensifying promotional and advocacy-driven health reporting (Kothari, 2018). Throughout the COVID-19 pandemic, mainstream news organisations continued to exhibit a robust elite orientation, relying heavily on sources from the state and biomedical authorities (Matar and Taha, 2023; Matthews et al., 2024; Mellado et al., 2021). In addition, Garnier et al. (2022) conducted a study on the news coverage of Avian Influenza in the UK and discovered that the coverage did not seem to promote an open, constructive, and informed public debate.

Cluster 9: how health professionals impact health news reporting

The ninth cluster continued to explore the tension between journalism objectivity and advocacy, particularly evident in the relationship between health and media professionals. This cluster comprises 10 articles, and the earliest one was published by Canary et al. (2018). They examined the news coverage of a specific type of genetic test and found that most news articles relied exclusively on press releases distributed by for-profit laboratory companies.

Furthermore, Stroobant et al. (2019) argued that the production of health news is a co-production within the biomedical sector, intricately interwoven within academic, industrial, state, and media

structures since the 1980s. This integration is suggested to worsen the existing health inequalities. As science and media become more closely connected, it is essential to understand the role of media in contributing to medicalization, characterised by the inclination to depict and address an increasing array of human conditions and experiences using medical terminology (Hallin et al., 2021; Ross Arguedas, 2020). Therefore, the role of the medical expertise was highlighted in health news gathering (Leidecker-Sandmann et al., 2022; Ross Arguedas, 2021). However, Saikkonen (2019) argued that it is crucial to examine how journalists themselves understand their role and practices in evaluating health expertise as a source in various socio-cultural contexts.

On the other hand, health is deemed a shared responsibility, urging for political intervention and accountability from health authorities (Leidecker-Sandmann et al., 2022). These assertions are more prominent in European health news and less common in the more commercially oriented U.S. health and media system. Moreover, to achieve a balance, Ytreberg and Thorbjørnsrud (2020) proposed including medical patients as health news sources, alongside medical professionals.

Cluster 10: how peace journalism can be used for health news reporting on vulnerable populations

Cluster 10 delved into peace journalism and solution journalism in the context of news coverage for disadvantaged people and communities during the COVID-19, encompassing four articles. Solution journalism is characterised as news actively seeking solutions for social problems (Wenzel et al., 2018), while peace journalism is defined as the media framing of open war and conflict focused on social responsibility that actively contributes to fostering peaceful resolutions of conflicts (Hanitzsch, 2004). The earliest article, authored by Wenzel et al. (2018), focused on the implementation of solution journalism in stigmatized communities across the US. Following this, Kalfeli et al. (2022) expanded the realm of peace journalism by introducing a new model tailored to scrutinize how media portrays immigration. During the COVID-19 pandemic, the peace journalism was found to cover the vulnerable populations in health news reporting (Auwal et al., 2022; Ersoy and Dambo, 2023).

Further directions

Future research directions are proposed here. The first two pertain to overlooked or problematically portrayed communities in current health news reporting, specifically focusing on gender or other marginalized social groups. Additionally, two directions highlight health topics that have been neglected, namely sustainability, as well as complementary and alternative medicines. The remaining directions delve into the digital impact on health news reporting, addressing health disinformation and medicalization, as well as the role of social media in shaping the citizen-as-source relationship in health journalism.

Women as subjects and sources of health news reporting

Several articles from Cluster 1 and Cluster 7 investigated the role of gender in health news repotting. Women's full participation in society is limited when their worth is confined to the roles their bodies play for others (Bock et al., 2019). Therefore, women as subjects and sources of health news reporting remain significant when Media coverage continues to be shaped by hegemonic masculinity (Grubic, 2023; Tinga et al., 2023). Additionally, examining how health news addresses the intersectionality of gender and queer experiences presents a fertile ground for various analyses and criticisms. This inquiry aims to illuminate how diseases, intricately linked with gender norms, are portrayed by the media and journalists (Bradshaw, 2022).

Health news with a positive impact on marginalized communities

Several articles from Cluster 8 found that so-called mainstream news outlets frequently portray protests in a negative manner, particularly when addressing issues such as discrimination against Indigenous people, racism, immigrants' rights, health, and the environment (Brown and Harlow, 2019). Compared to so-called mainstream news outlets, ethnic news press demonstrates a tradition of activism, advocating for ethnic health and freedom (Williams, 2021). Employing personal narratives on social media, which showcase dynamic and multidimensional stories, should be regarded as a strategic approach for marginalized communities (Moors, 2019).

Future studies should investigate how individuals from diverse ethnic and socioeconomic backgrounds in communities with a prolonged history of negative media portrayal respond to narratives involving nearby but distinct groups (Wenzel et al., 2018). This is particularly evident in the context of immigration issues (Kalfeli et al., 2022). Moreover, news coverage of public crises must avoid perpetuating the stigmatization or marginalization of specific racial or ethnic groups as carriers of diseases (Ersoy and Dambo, 2023). Achieving racial diversity in traditional newsrooms and incorporating the knowledge and perspectives of journalists from varied backgrounds is essential to improving public understanding of significant issues related to racial justice and exploring potential solutions (Brown and Harlow, 2019). Additionally, upcoming research could investigate the lasting effects of citizen news reporting on civic engagement, self-esteem, and psychological well-being among Indigenous community members (Tsai et al., 2022). Future research endeavors should delve into the diverse significance of different media sources within communities and explore the relationship between the sense of community and the sense of belonging (Damanhoury et al., 2022).

Health news of sustainability

Issues linked to the unsustainable nature of our consumption patterns pose a challenge as they are characterized by gradual, long-term processes rather than individual events. Recognizing that Sustainable Living has evolved into a prevalent perspective in numerous countries and newspapers is crucial, as it opens up avenues for researchers to delve deeper into and explore these sustainability issues (Brüggemann et al., 2022).

Health news of complementary and alternative medicines

A singular article within the Cluster 8 delved into the framing of Complementary and Alternative Medicines (CAM) in Spanish news. The study revealed a shift as the media increasingly reported on the legitimization of complementary and alternative medicines, the tone of its coverage underwent a shift towards a negative perspective (Lopera-Pareja and Cano-Orón, 2022). It remains crucial for health

news reporting to be guided by scientific evidence (Walker and Viaña, 2023).

However, it is worth noting that science, particularly in the form of Western medicine, is often endowed with epistemological authority, potentially overlooking the subjectivity inherent in the predominantly Western institutions that have shaped the development of this knowledge and practice (Tinga et al., 2023). The constraints of the research tradition become evident due to its confinement within Western-centric paradigms, which presuppose the universality of Western knowledge. This underscores the importance of context-driven empirical research that can both contribute to and challenge existing theories (Matar and Taha, 2023).

Health disinformation and medicalization

Although the impacts of disinformation are frequently studied in the realms of political communication and journalism, it is equally important to consider significant implications for health and science communication, as discussed in articles from Cluster 3. The intricate connections between health news and various stakeholders in the health sector, including biomedicine, industry, the state, and civil society, warrant increased scrutiny from researchers in the fields of journalism and political communication (Hallin et al., 2021). There is a need for future research to investigate whether accusations of disinformation have diverse effects on issues that are more closely tied to identity and the varying levels of trust in media structures (Egelhofer et al., 2022). As the intersection of science and media becomes more intricate, there is an increasing need to comprehend how media contributes to the process of medicalization. Medicalization is defined as the process whereby an expanding array of human conditions is defined in medical terms (Ross Arguedas, 2021). Additionally, upcoming research could explore the growing importance of scientists on the news of public health crisis in the context of the diminishing authority of politicians in Western democracies (Fedtke et al., 2023). Unlike previous pandemic discussions, the prominence of scientific experts has diminished in the news coverage of COVID-19, with a greater emphasis on individuals strategically communicating from the political executive (Leidecker-Sandmann et al., 2022). There is considerable potential for future research in developing methods and tools for journalists and readers in evaluating the strength of evidence and uncertainties in scientific studies (Løvlie et al., 2023). More research should look into whether and how the way journalists work, and the conditions they work in, might be stopping them from giving the kind of news coverage needed to tackle complex issues, including the scientific, scholarly, cultural, political, and economic conflicts connected to these issues (Garnier et al., 2022).

The role of social media in shaping the citizen-as-source relationship in health journalism

Making health news for social media is an ongoing and significant topic of interest (Matthews et al., 2024). As discussed by several articles from the Cluster 6, On Facebook, local healthcare news was extensively shared among the audience (Almgren, 2017). Though news organization tended to use the news of sports and entertainment to attract their online audience, the most audience comments and interaction were found form the news of politics and health care (Almgren and Olsson, 2015). In Australia, for example, health and education issues continue to be among the most salient topics in

policy-related news reporting (Gibbons, 2020). Allaham and Diakopoulos (2022) developed audience response models from online comments during the COVID-19 pandemic.

In addition, Twitter also granted occupational health journalist brands their own identity and influence, shifting the focus from the news organization they are affiliated with and altering the dynamics of their relationship with the audience (Molyneux and Holton, 2015). Journalists specializing in health coverage might prioritize personal branding due to the relatively specific nature of their coverage area (Holton and Molyneux, 2017). In the realms of science and health journalism, for instance, Sehat (2022) observed a lack of journalists' involvement in news distribution on digital platforms that do not identify as news publishers. During COVID-19, the comments from right-wing politicians could slightly undermine the credibility of journalism, focusing more on scientists and health authorities (Egelhofer et al., 2022).

Also discussed in several articles from Cluster 8, the potential of social media in taking citizen's voice in account of news on public health issues persisted (Len-Ríos et al., 2014). Social media activism emerged in response to a local health crisis, as citizens-initiated hashtag campaigns to construct a critique of inadequate journalistic storytelling (Moors, 2019). Several aspects of the citizen-as-source relationship warrant further exploration and play influential roles in this dynamic, for instance, examining how news reporters acquire sources through personal contacts, tip-offs, PR liaisons, sources reaching out independently to the media, or even via social media is crucial (Wheatley, 2020). Greater emphasis should be placed on non-elite sources, rather than elite entities such as governments, in the process of news gathering, ensuring equal opportunities for various segments of society to have their voices heard (Auwal et al., 2022). Moreover, including patients' perspectives in health news reporting can be advantageous, as it promotes a more comprehensive understanding of the experiences associated with illness (Ytreberg and Thorbjørnsrud, 2020).

In summary, this paper suggests potential avenues for future research. The initial two parts focus on underrepresented or inaccurately depicted communities in contemporary health news coverage, particularly emphasizing gender, or other marginalized social groups. Another set of directions draws attention to overlooked health subjects, namely sustainability and complementary and alternative medicines, which are often marginalized in mainstream medical practices and biotechnology discourse. The final paths explore the digital influence on health news reporting, examining issues such as health misinformation and medicalization, the impact of social media in news gathering of health journalism.

Conclusion

In this study, we conducted a systematic review using bibliometric analysis, focusing on SSCI-indexed journal articles in health journalism. Our analysis revealed two significant peaks in health journalism research, corresponding to the 2009 H1N1 influenza (swine flu) and the COVID-19 outbreak. The academic contribution was led by the United States, followed by Spain, Australia, the United Kingdom, and Singapore. The study identified noteworthy authors, highly cited articles, and influential journals. A bibliographic coupling analysis highlighted 10 key research themes, including: How health stories are framed in the news; How audiences engage with health information online; How constructive journalism can improve

the news reporting of public health crisis; How fact-checking can improve the news reporting of public health crisis; How health stories are framed from science journalism perspective; Why citizen journalism is significant in health news reporting; How health journalists perceive their journalistic role; Who serves as the news source for health news reporting; How health professionals impact health news reporting; and How peace journalism can be used for health news reporting on vulnerable populations. Moreover, the study proposes future research directions. These include exploring topics such as women as subjects and sources of health news, sustainability in health reporting, positive impacts of health news on marginalized communities, health news related to complementary and alternative medicines, health disinformation and medicalization, the role of social media in citizen-as-source relationship in health journalism.

This study has several limitations. First, it is imperative to acknowledge that the current research does not undertake an exhaustive examination of all existing research articles on the subject. Instead, it focuses on English research articles published from 1994 to 2023 indexed in the SSCI, a deliberate choice made to ensure the use of high-quality bibliometric data. It is essential to recognise the findings may not represent the entirety of available research on health journalism but only offer a bird's eye view and map the basic structure of health journalism scholarship. This study intentionally explores research on health news exclusively from the perspective of journalism studies. This decision is driven by the aim to maintain a clear and focused approach to mapping the intellectual structure of health journalism literature. However, it is essential to acknowledge that health news, as a subject, spans various research disciplines. This study focused on communication journals whereas scholars may prefer to publish in medical journals. Considering these limitations, future research endeavors could complement and extend the findings of this study, for instance, by adopting a scoping review approach based on the research themes identified here.

Data availability statement

The data supporting the findings of this study are available from the corresponding author, Shi Feng, upon reasonable request directed to fengshi1919@gmail.com.

Author contributions

SF: Conceptualization, Investigation, Methodology, Software, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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