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The Hashtag Health Revolution: A Bibliometric Study of Social Media in Health Literacy

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Abstract

This comprehensive study examines the burgeoning role of social media in public health literacy, utilizing Scopus as the primary database due to its extensive journal coverage. The study follows a PRISMA flow diagram to identify, screen meticulously, and include relevant papers in the bibliometric analysis. Using CiteSpace and Bibloshiny software, this study analyzes annual scientific production, identifies the most relevant sources and authors, and pinpoints the most globally cited documents. It explores trend topics, thematic maps, keyword co-occurrence, network analysis of cited journals, and timelines view of cited references and country collaboration. The findings highlight social media's critical role in disseminating health-related news, research updates, and personal experiences, especially during health crises like the COVID-19 pandemic. Health organizations and professionals are noted for utilizing social media to educate younger, digitally-savvy audiences about diseases, prevention, and healthy lifestyles. This research tries to analyse the prominence of social media in nurturing community sustenance and peer interaction, which is very significant for emotional welfare. Additionally, the study recognizes gaps in present literature and hands-on inferences for imminent studies, requiring more dedicated demographic research and the incorporation of progressive tools in health literacy.

Keywords: Health Literacy, Digital Health, Online Health Information, Social Media, Bibliometric, Biblioshiny, Citespace.

1. Introduction

Social media has arisen as an essential podium for the propagation and interchange of health information, intensely persuading community health literacy [1], [2]. It serves as a swift channel for partaking in health-related updates; research apprises, and individual health involvements, which showed its invaluableness during the world epidemic crisis like COVID-19. Medical professionals and health-related establishments use this kind of platform for health instruction, endorsing consciousness about ailments, precautionary health procedures, and fruitful choices in lifestyle, successfully appealing to an audience you are young

and tech-friendly [3], [4]. Moreover, social media nurtures community sustenance and peer collaboration, consenting individuals with related health distress to join, share understandings, and propose conjoint support, which can be vital for emotional and mental well-being.

Nevertheless, the frequency of misrepresentation and disinformation on social media permeates a noteworthy challenge, regularly leading to public misunderstanding and possibly harmful health characteristics [5]. Misrepresentation and spread of fabricated or misleading health facts will result in undermining the belief in medical authorities. Nevertheless, the frequency of misrepresentation and disinformation on social media permeates a noteworthy challenge, regularly leading to public misunderstanding and possibly harmful health characteristics [5]. Misrepresentation and spread of fabricated or misleading health facts will result in undermining the belief in medical authorities. The importance of health literacy enters the scene amid these initiatives from state and local public health authorities. The variability in health literacy skills includes access, appraisal, and applying health information from the internet and is likely to vary across the population [6]. This is where the issue of digital divide rears its ugly head. The digital divide may seriously affect access to reliable health information and further perpetuate existing health inequalities. In such a complex setting, the role of social media in transmitting health literacy is twofold: very vast in terms of potential to boost general health awareness among people and sources of risk related to the credibility and quality of the information received [7]. Appreciation of the role of these platforms in shaping health literacy matters considerably in an age where information flows through social media and other outlets [8], [9]. Health literacy, as GlobalHealth.gov notes, is the capacity "to obtain, process, and understand basic health information and services needed to make appropriate health decisions." It has significant implications for public health outcomes [10], [11]. The overarching impact of social media could well serve to enhance comprehension, provided the information is accurate and of high quality.

While eHealth literacy and social media health literacy share some similarities in the skills of accessing processes for information and its understanding regarding health, they differ in their focus and context. eHealth literacy is defined as the ability to locate, process, understand, and apply electronic health information searching for various digital health resources such as websites, online databases, and mobile apps. It represents a much larger environment of digital tools for health beyond social media. On the other hand, health literacy on social media zeroes in on the special dynamics of social media platforms, wherein information usually spreads fast and gets influenced by social interactions and user-generated content, and also on the 'viral' nature of posts in social media. This surely requires more than simple or basic health literacy skills and includes an ability that comes from critical judgment about assessing source credibility and information accuracy within a social media-based context. Comprehending this difference is critical in tailoring health literacy initiatives to this particular field of digital environments, making sure that the strengths are effectively harnessed and challenges adequately addressed.

This bibliometric enquiry tries to chart the scenario of research in this field, contributing insights into what kind of enquiry has gone into the media background of social being used in the backdrop of health literacy [12]**.** This research plans to acknowledge important research contributions, content themes and emerging trends along with potential gaps in the literature by assessing patterns in publications, content themes and citation networks. Moreover, it intends to discover the methodological methods used in these researches, giving a critical valuation of the methods and tools used to enquire about this multifaceted top. The end product of this study is aimed to help prospective research directions, apprise policy and practice, and to come up with a more profound grasp of how social media platforms can be used to enhance health literacy outcomes in varied populations.

Bibliometric study is a calculable method to analyse the effect and trends within a particular field of literature, applying statistical tools to assess patterns in citations, authorship, publication and content themes [13], [14], [15]. This procedure aids in plotting the academic scenario of a research field, showing important contributors, significant papers, and developing

research areas [16], [17]. We have utilized two significant tools that are BiblioShiny and CiteSpace for this bibliometric analysis and conceptualization [18]. These tools which offers very unique characteristics and proficiencies which supplement each other, provides a better comprehension of the research scenario in this particular field. By incorporating tools like these, we could conduct a detailed and multi-faceted bibliometric analysis, contributing a significant and thorough comprehension of the present state and development of research in the connection between health literacy and social media.

Biblioshiny which provides a more collaborative and user-friendly interface for doing bibliometric analyses is an innovative platform for R package 'bibliometrix' [19], [20], [21]. A researcher void of in-depth knowledge in programming can use this software to identify trends, perform in-depth analysis and to visualize data [22], [23]. CiteSpace, which focuses on understanding valuable points in the evolvement of a research area, is based on Java software and is used for synthesizing and picturing patterns and trends in scientific literature [24], [25]. This particular application is very much appreciated for its capability to disclose evolving trends, essential publications, and significant authors, majorly by way of clustering techniques and co-citation analysis

2. Literature Review

The online environment offers unparalleled opportunities for health-related messages and literacy, predominantly through social media. The juncture where social media and health literacy conjoins has developed into a vibrant area of research, as demonstrated by recent study discovering how these arenas support dissemination of health information and its management.

George et al. (2023) gave a significant explanation into the patterns of social media usage among black women usually at the time of pregnancy, seeking information regarding the same. The study found out that majority of their participants had great insights on health literacy and used social media to enhance their decisions regarding pregnancy. This would go on to suggest that there is a solid correlation between the productive use of social media for health-related information and eHealth literacy. The research highlights the idea that social media can be a great instrument for moderating health disparities, especially among people that face greater maternity mortality rates [26].

Loos (2013) appraised the usefulness of a social media program run by a health literacy organization. The research's reflective analysis shows that even though many benchmarks were attained on social media engagement as compared to other NGOs by Health Literacy Missouri, there are some areas where they could improve. The study shows that involving social media in health literacy initiatives sets a good example for other organizations in the health sector [27].

Kim and Utz's (2019) arbitrarily controlled trial measured the helpfulness of a social media-based mediation intended at self-management of diabetes. Their effort highlighted how accommodating involvement to the health literacy levels of patients can expressively improve self-care characteristics. Particularly, the study revealed that social media intercessions could alleviate the encounters faced by persons with little health literacy, thus augmenting patient activation [28].

Rivera-Romero et al. (2022) probed into the ethical reflections and the effect of digital health literacy on health equity in social media mediations. Their literature appraisal recognised key issues such as acceptability, principles, and digital health literacy as essential in endorsing health equity by way of social media. The writers disputed for the addition of participatory design ideologies to guarantee that digital health involvements do not broaden existing health inequalities [11].

The junction of social media and health literacy has been a 'hot' spot for a lot of research. Many bibliometric analyses outlined some trends and impacts of this junction. For example, it has been found out that the most extensively studied platforms are Twitter, YouTube, and

Facebook, uncovering completely different themes in health communication: cyberchondria, tobacco smoking, and anti-vaccination movements accordingly. Academics use social media for the dissemination of health research, which enhances visibility and accelerates citation rates. However, conclusive evidence remains indecisive. One critical issue identified across the reviewed platforms was misinformation. The COVID-19 pandemic brings the need for effective information dissemination strategies to the forefront of attention [29]. Moreover, research into mental health shows that while social media can be supportive and a source of annoyance, machine learning approaches provide key insights relating to trends in mental health [30]. The highest number of research output in relation to the association of social media and health literacy originates in the United States of America, with high contributions by the University of Pittsburgh School of Medicine and Florida State University [31]. The current literature extensively explores key themes such as literacy, digital transformation, and the impact of COVID-19 on various sectors. Scholars highlight the role of digital technologies in shaping health and education systems, emphasizing the implications of these advancements [32]. Several studies examine the evolving landscape of AI-driven analysis and its influence on public health and social dynamics, particularly in the context of post-pandemic recovery. Furthermore, research underscores the intersection between digital literacy and socio-economic factors, highlighting emerging trends in data-driven decision-making [33]. These findings contribute to an ongoing scholarly discussion on the challenges and opportunities presented by technological adaptation in contemporary research. Thus, overall, social media will be a player in health literacy through both diffusion and misinformation. Future directions should be needs-based, platform-specific strategies that include the international and non-English-speaking communities to better health communication.

3. Materials and Methods

Scopus was chosen as this study's primary bibliographical data source because it covers a broader range of quality journals compared to other databases [34], [35], [36]. The publications were retrieved using the keywords "health literacy," "digital health," "online health information," and "social media." Specific terms such as "eHealth literature," "messengers," and "forums" were not included in the search query. The primary focus of this study was on mainstream social media platforms like Facebook, Twitter, and Instagram due to their extensive user base and significant impact on health information dissemination. Including broader terms might have diluted the focus of our analysis. However, future studies could consider incorporating these terms to provide a more comprehensive overview of digital health literacy across various online platforms. There were no language restrictions; only journal articles, conference papers, and book chapters were considered. One thousand three hundred fifty-seven documents were collected from 664 different sources from 2010 to 2024. In this bibliometric analysis, choices of the approaches to selecting pertinent papers have been based on citation analysis, co-citation analysis, bibliographic coupling, and systematic review methods. Each forms with its strengths, like influential works or similar research clusters. We chose to apply PRISMA since it is a rigorous and transparent approach. Figure 1 illustrates the PRISMA approach to selecting papers for bibliometric analysis. It is a three-phase procedure in which we identify and extract the data for analysis initially from the databases. PRISMA allows this study to ensure that the selection process is as broad and unbiased as possible, enhancing reproducibility and reliability [37]. This systematic approach benefits in particular bibliometric studies in which literature shall be included cautiously and structured. By having decided to use PRISMA, it guided to its increase in acceptance and effectiveness during systematic reviews, providing a solid framework for our analysis. We excluded Reviews, Editorials, Books, Short Notes, and Surveys in the second phase. Documents included are Articles, Conference papers, and Book chapters. The findings were stored as "CSV" and RIS files, and bibliometric analysis was performed on the data using CiteSpace version 6.2.R3 (Advanced) and Bibloshiny software. The main aspects of this investigation are summarized in Table 1.

Choice of Tools for Bibliometric Analysis: In this paper, the choice of the two major tools in conducting the bibliometric analysis is based on their strengths, which complement each other in both visualizing and making sense of complex bibliometric data. CiteSpace has its own strengths in clustering and timeline analysis, burst detection, co-citation analysis, and co-occurrence analysis; all these give insight into the evolution of research topics and trending emerging lines of inquiry. Biblioshiny is a web interface to the R package 'bibliometrix.' It allows users to make all kinds of analyses, from descriptive statistics to citation analysis and co-word analysis, in a very user-friendly way without demanding any programming skills from them. Besides, it is interactive in its visualization and integrates with R, thus making it easy to use and flexible for different categories of users. In turn, VOSviewer is good at visualizing and clustering networks but misses some advanced temporal analysis features available in CiteSpace. Such tool integration—the use of CiteSpace and Biblioshiny—will allow spelling out both the temporal and structural dimensions of the landscape of research on the subject under study, setting a more detailed understanding of the roles social media could play with regard to health literacy. The strategy using these two tools will be key to a solid and nuanced analysis describing emerging trends and the intellectual structure of the field.

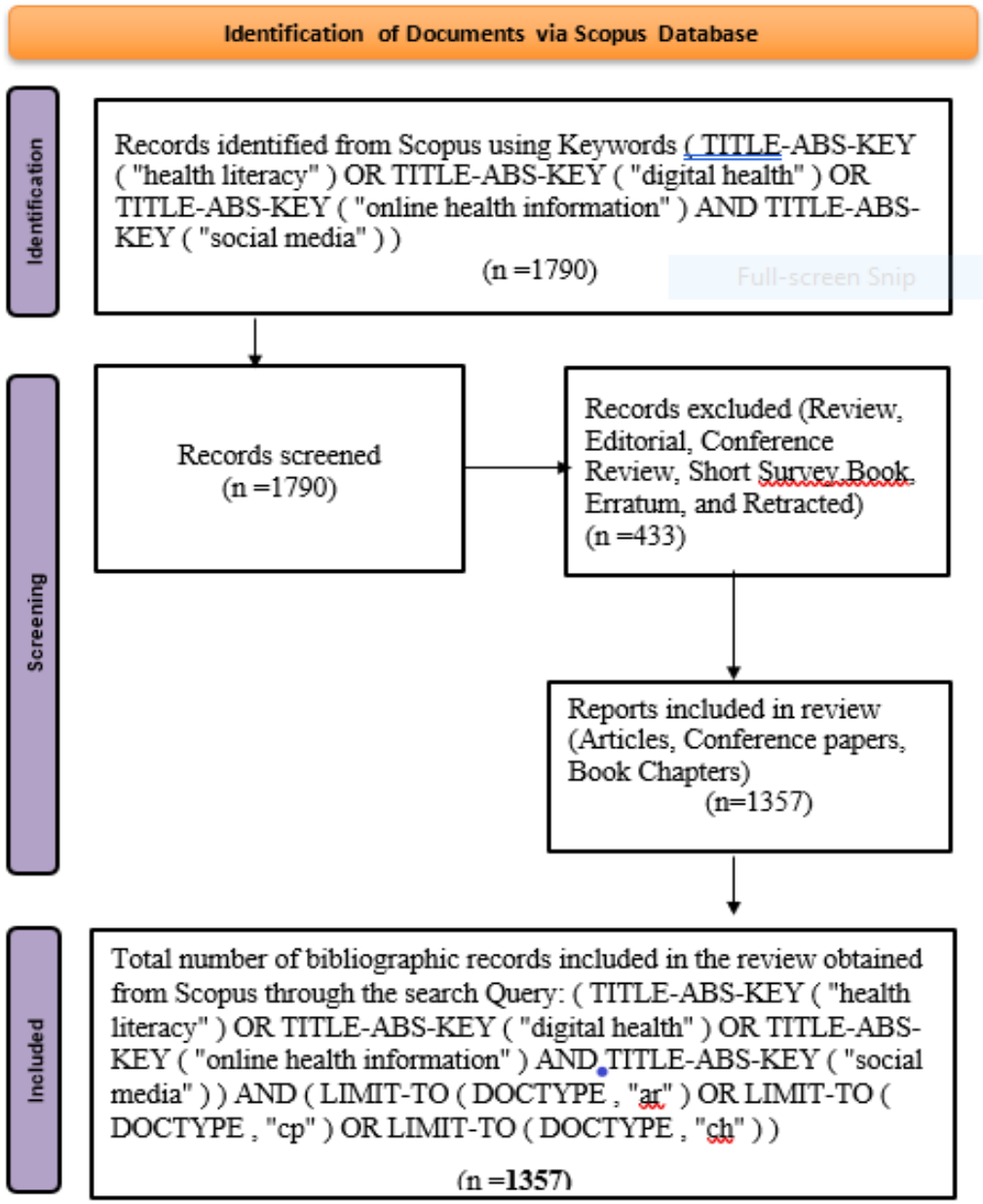


Figure 1. PRISMA Flow diagram used to Identify, Screen, and Include papers in the Bibliometric Analysis.

Table 1. Critical aspects of the investigation

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2010:2024
Sources (Journals, Books, etc)	664
Documents	1357
Annual Growth Rate %	0
Document Average Age	3.46
Average citations per doc	12.47
References	54605
DOCUMENT CONTENTS	
Keywords Plus (ID)	4838
Author's Keywords (DE)	3298
AUTHORS	
Authors	6550
Authors of single-authored docs	99
AUTHORS COLLABORATION	
Single-authored docs	106
Co-Authors per Doc	5.62
International co-authorships %	23.14
DOCUMENT TYPES	
article	1240
book chapter	44
conference paper	73

4. Findings

4.1. Annual Scientific Production

Figure 2 is the annual scientific production on social media and health literacy. It reveals several key trends and insights. Initially, from 2010 to 2014, the field was in its nascent stages, evidenced by an average of 10.4 articles published per year. This period represents the early exploration and interest in the intersection of these two domains. Though, a noteworthy shift is detected in the subsequent years, with an average of 130.5 research papers issued annually from 2015 to 2023. This obvious increase replicates the escalating interest and acknowledgement of the acute role of social media in health literacy. Notably, there are years, such as 2013 and 2021, where the year-on-year growth in publications is remarkably high, signifying periods of strengthened research and scholarly consideration.

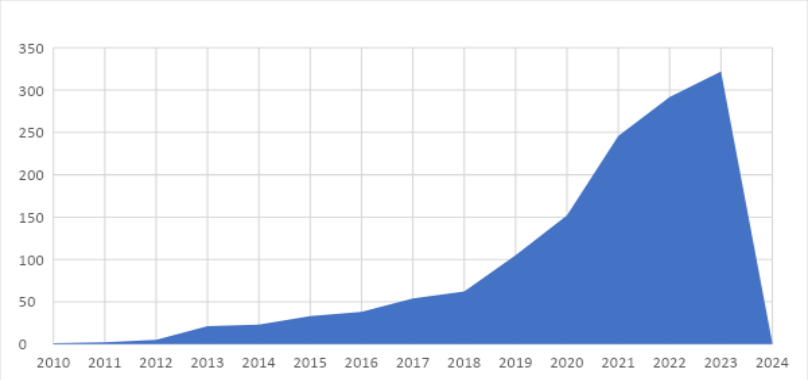


Figure 2. Annual Scientific production

4.2. Most Relevant Sources

Figure 3 reveals a pure representation of the spreading of technical documents among various publications and journals. The "Journal of Medical Internet Research" is the most productive journal, with a significant number of 110 documents, emphasizing its fundamental role in publicizing research in this field. Following the leader is the "International Journal of Environmental Research and Public Health," with 66 documents, contemplating its noteworthy contribution and possibly demonstrating a concern in the environmental features of health literacy predisposed by social media. Additional striking contributors include "JMIR Formative Research," "Studies in Health Technology and Informatics," and "BMJ Open," with 38, 24, and 22 documents respectively, showing the varied range of platforms appealing with this topic. These diverse sources highlight the interdisciplinary method within the research society, incorporating technology, public health, and wider medical research. This suggests an inclusive field where the influence of readings on social media on health literacy is not limited to a single outlook but is discovered through manifold scholarly lenses.

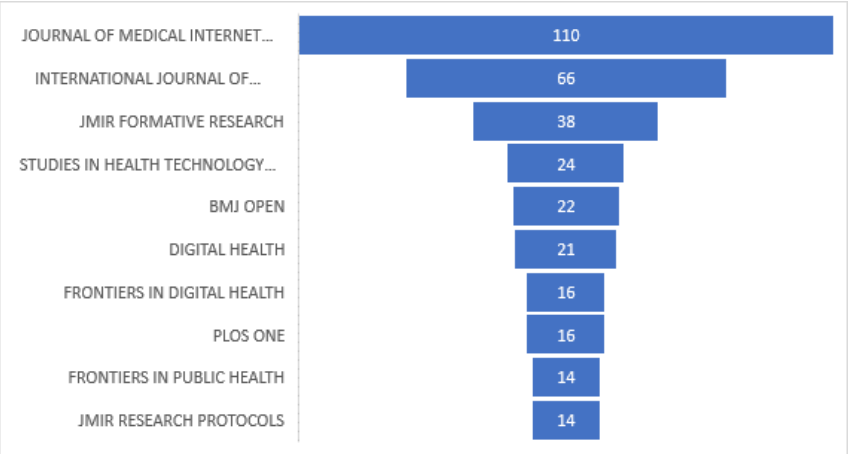


Figure 3. Most Relevant Sources

Figure 5 illustrates a significant upward trend in research publications from 2010 to 2024. Starting with modest activity, there is a noticeable acceleration post-2018, reflecting growing scholarly interest. Leading sources such as "Journal of Medical Internet Research," "Digital Health," and "BMJ Open" show marked increases in their publication volumes, particularly in recent years. Emerging journals like "Frontiers in Digital Health" and "Frontiers in Public Health" also demonstrate substantial growth, highlighting their rising influence in this research area. Overall, the graph underscores the expanding body of literature and the multidisciplinary engagement in exploring the intersection of social media and health literacy.

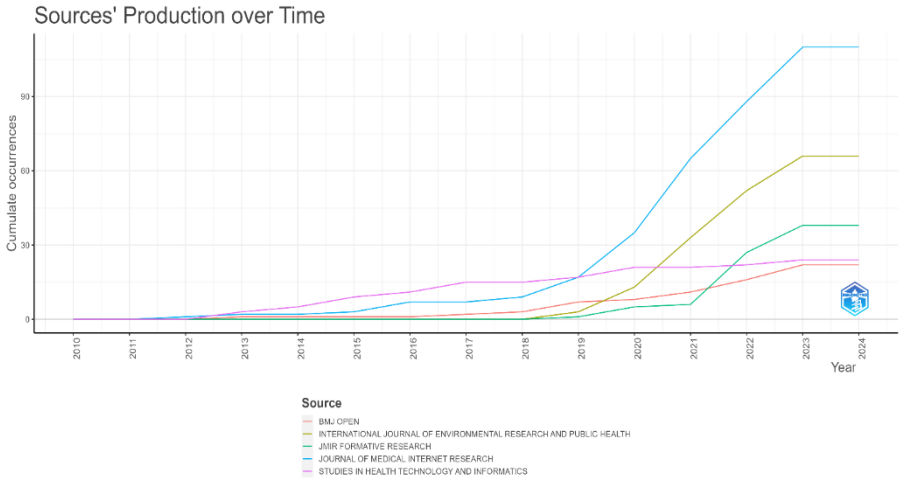


Figure 4. Sources' Production over Time

4.3. Most Relevant Authors

Figure 5 portrays the most fruitful authors within the territory of social media and health literacy enquiry. It reveals LI Y is the chief contributor with 11 documents. This figure marginally surpasses that of R.G. Langham, who has contributed 10 documents, suggesting that both authors are likely central figures in the scholarly dialogue on this topic. There is also a notable group of researchers, including A. Balducci, A. Bonner, L-L. Hsiao, K. Kalantar-Zadeh, L.A. Kumaraswami, P. Laffin, V. Liakopoulos, and S-F. Lui, each is responsible for 9 documents.

Figure 5. Most Relevant Authors

4.4. Most Global Cited Documents

Table 2 showcasing the Most Global Cited Documents in Social Media and Health Literacy reveals that the paper by Fitzpatrick KK, with its 913 total citations and impressive annual citation rate, stands as a foundational work within the field, indicative of its significant and sustained impact on scholarly discourse since its publication in 2017. Not far behind is the 2020 paper by Puri N, which has quickly established itself as critical literature, amassing an even higher annual citation rate, suggesting immediate recognition and influence**.** Prominent works, such as those by Tennant B and Swan M, also sustain strong citation records, replicating their ongoing significance. The addition of normalised citation metrics expedites a standardised valuation of impact, extenuating discrepancies in citation frequencies across diverse fields, thus portraying an all-inclusive picture of persuasive research and its essential role in the developing discourse around social media's part in health literacy.

Table 2. Most Globally Cited Documents

Paper	DOI	Total Citations	TC per Year	Normalized TC
"Delivering Cognitive Behavior Therapy to Young Adults With Symptoms of Depression and Anxiety Using a Fully Automated Conversational Agent (Woebot): A Randomized Controlled Trial" Fitzpatrick Kk, 2017, Jmir Ment Heal	10.2196/mental.7785	913	130.43	24.42
"Social media and vaccine hesitancy: new updates for the era of COVID-19 and globalized	10.1080/21645515.2020.1780846	626	156.5	32.02

infectious diseases” Puri N, 2020, Hum Vaccines Immunother				
“eHealth Literacy and Web 2.0 Health Information Seeking Behaviors Among Baby Boomers and Older Adults” Tennant B, 2015, J Med Internet Res	10.2196/jmir.3992	442	49.11	13.09
“Health 2050: The Realization of Personalized Medicine through Crowdsourcing, the Quantified Self, and the Participatory Biocitizen” Swan M, 2012, J Pers Med	10.3390/jpm2030093	295	24.58	2.5
“The growing field of digital psychiatry: current evidence and the future of apps, social media, chatbots, and virtual reality” Torous J, 2021, World Psychiatry	10.1002/wps.20883	222	74	18.34
“How the public uses social media wechat to obtain health information in china: a survey study” Zhang X, 2017, BMC Med Informatics Decis Mak	10.1186/s12911-017-0470-0	211	30.14	5.64
“Social media use among patients and caregivers” Hamm Mp, 2013, BMJ Open	10.1136/bmjopen-2013-002819	203	18.45	5.64
“Teens, Health and Technology: A National Survey” Wartella E, 2016, Media Commun	10.17645/mac.v4i3.515	183	22.88	6.31
“Health Literacy and Use and Trust in Health Information” Chen X, 2018, J Health Commun	10.1080/10810730.2018.1511658	172	28.67	7.31
“Social Media Use, eHealth Literacy, Disease Knowledge, and Preventive Behaviors in the COVID-19 Pandemic: Cross-Sectional Study on Chinese Netizens” Li X, 2020, J Med Internet Res	10.2196/19684	151	37.75	7.72

4.5. Trend Topics

Trend topics in figure 6 exemplify a scene of developing interests and research foci over the course of time. Markedly, the term "COVID-19" swells in frequency, imitating the pandemic's effect on health data dissemination by use of social media. Relentless themes such as "social

media," "internet," and "digital health" continue predominant, emphasising their continuing importance in health literacy deliberations. The advent of terms like "natural language processing systems" and "computer-assisted instruction" shows the growing incorporation of progressive technologies and educational approaches in the field. Furthermore, the regular mention of topics associated with health information designates a focused apprehension on the propagation and public understanding of health content via social media platforms**.** Additionally, the addition of demographic-specific terms like "young adult," "middle aged," and "female" proposes that research is giving close consideration to how diverse population sections involve with and are affected by health literacy in the background of social media. This picturing summarizes the dynamic and approachable nature of research as it familiarizes to global health proceedings, technological advancement, and demographic dynamics.

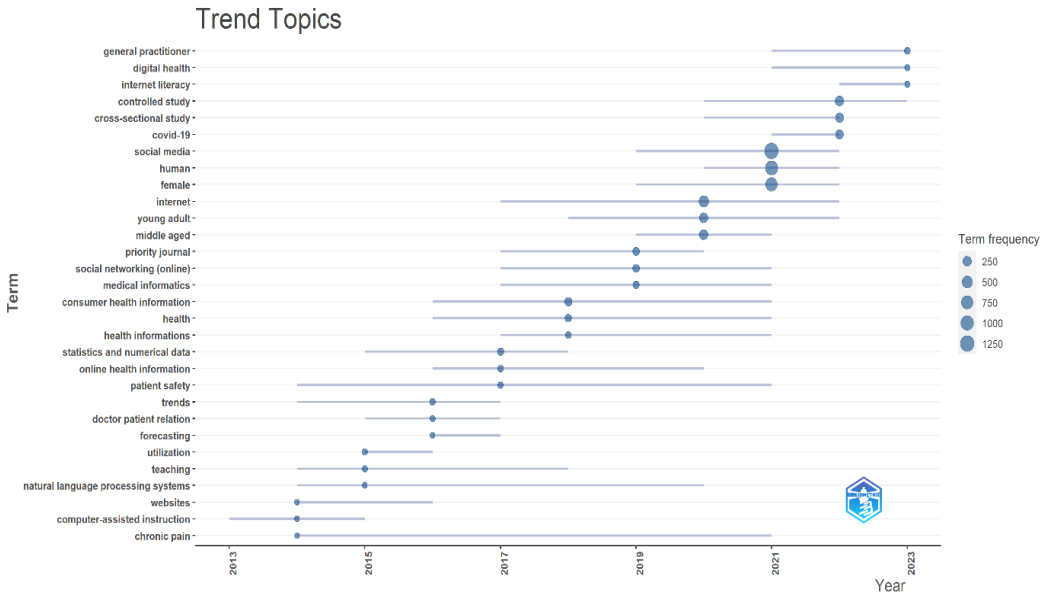


Figure 6. A visual indicating the popularity of topics

4.6. Thematic map

The thematic map (Figure 7) portrays the current scenario of research on social media and health literacy. It catalogues themes into four discrete divisions based on their expansion and significance to the field. Comfortable themes, such as those associated with the COVID-19 epidemic, are highly advanced but uphold an inferior centrality, representing a rich body of work with a dedicated focus. Motor themes, recognized here by demographic tags such as "female," "adult," and "male," indicate deep-rooted and significant areas that are motivating research forward. These themes are crucial and may change future research guidelines. Basic themes, comprising "human" and "social media," are essential to the field but are not yet compactly developed, suggestive of potential for progress and beckoning introductory areas for new research. In conclusion, deteriorating themes like "social networking (online)" and "health" have low expansion and centrality, probably directing to a shift away from these topics in researches of recent times. This map aids as a perceptive tool for researchers and specialists, helping them identify topics at the centre of current research and recognizing developing trends and fading interests within the field.

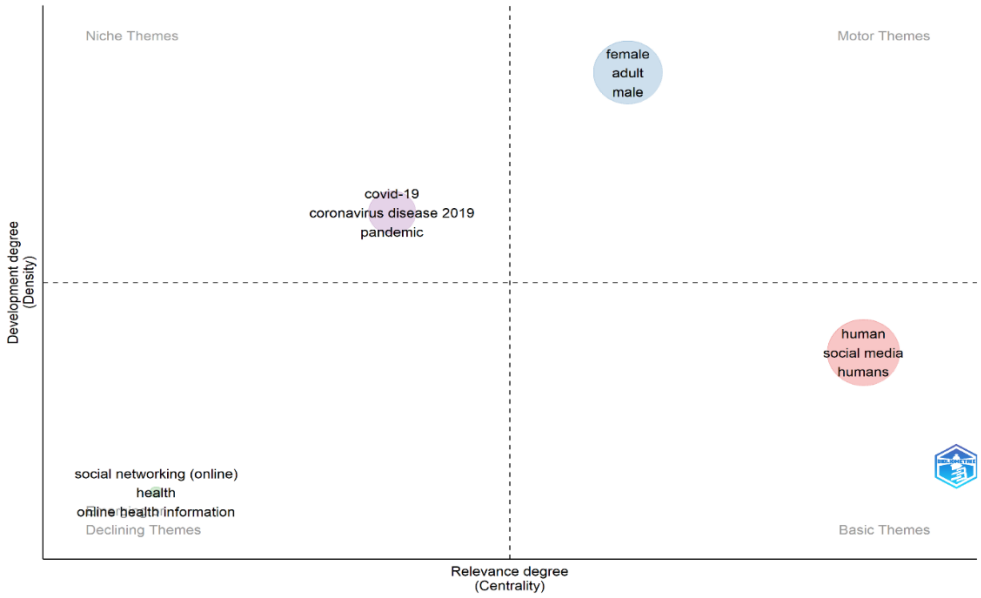


Figure 7. Thematic representation of all keywords

4.7. Co-occurrence of all keywords

Co-occurrence network in Figure 8 indicates the frequently used and highly connected terms or words found in publications related to a specific field of research. This network visualization reveals, that the keywords in health literacy and social media research encompasses a network of 16 clusters, each representing a distinct research domain. The co-occurrence network visualization displays a multicolored square, area, and clear enough text to demarcate different clusters of research. Each square represents one keyword; the size of it is determined by how often the keyword has appeared in the research publications. Colors distinguish the 16 identified clusters and thus show specific realms of research. Proximity and connectivity express the relation and co-occurrence patterns between the keywords. Additionally, areas enclosed by the same color outline represent the thematic concentration within each cluster. This multicolored and interconnected visual representation underlines, more than anything else, the fact that health literacy and social media research is complex and varied, thus showing the breadth and depth of topics covered within it. The largest cluster, Cluster #0, focuses on controlled trials related to severe mental health problems as highlighted in social media, with moderate thematic cohesion. Cluster #1 examines cross-sectional studies and boasts a high silhouette value, indicating well-defined research on social media's impact on human behavior and attitudes towards health. Cluster #2's digital health interventions are moderately cohesive, emphasizing the role of mobile phones in healthcare delivery and awareness. Mental health literacy forms the core of Cluster #3, which presents a moderately cohesive exploration of mental health in healthcare settings. Cluster #4 delves into the quality and reliability of health information, with a strong internal consistency indicated by the silhouette value. University students' health education, particularly their engagement with social media, is the focus of Cluster #5, reflecting strong thematic concentration. Cancer screening strategies and communication, studied within Cluster #6, show good thematic cohesion, while COVID-19 vaccine hesitancy, in Cluster #7, reveals moderate cohesion but a highly relevant focus given the recent global health crisis. Obesity management during the COVID-19 pandemic is detailed in Cluster #8, with a high silhouette value indicating a sharply focused research interest. Kidney health, explored in Cluster #9, also shows strong cohesion, suggesting a concentrated research effort in this niche. Cluster #10's investigation of post-traumatic stress disorder in relation to Facebook use suggests an intimate look at social media's role in supporting mental health, underscored by a high silhouette value. The tightly knit Cluster #11 concentrates on randomized controlled trials within digital health, particularly persuasive

communication in health contexts. Cluster #12's perfect silhouette value suggests a highly specialized focus on user reviews, deep neural networks, and medical concept normalization. Opportunities for nurses to increase health literacy, the theme of Cluster #13, also shows a high level of focus, as indicated by the perfect silhouette value.

The sole member of Cluster #14 investigates HIV-related messaging on social media, while Cluster #15, also with a single study, looks at big data's role in COVID-19 pandemic crisis management. Both clusters have a silhouette value of 0, which may suggest either a nascent research area or one that is highly diverse. Overall, the network reveals the breadth of research on health literacy and social media, ranging from individual health conditions to broad public health strategies, with varying degrees of internal consistency and focus. This speaks to the complex and evolving nature of how health information is communicated, understood, and acted upon in the age of social media.

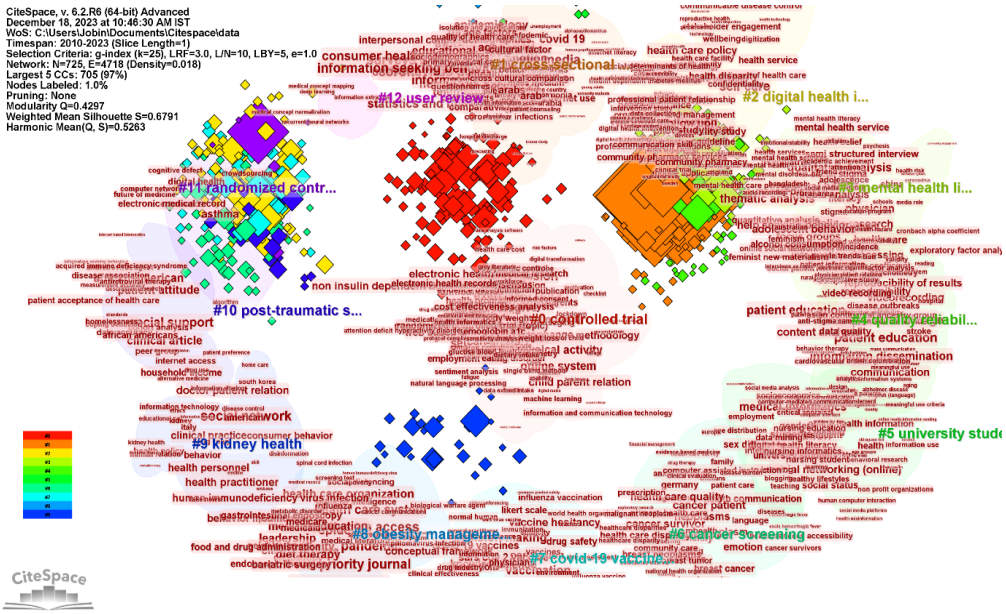
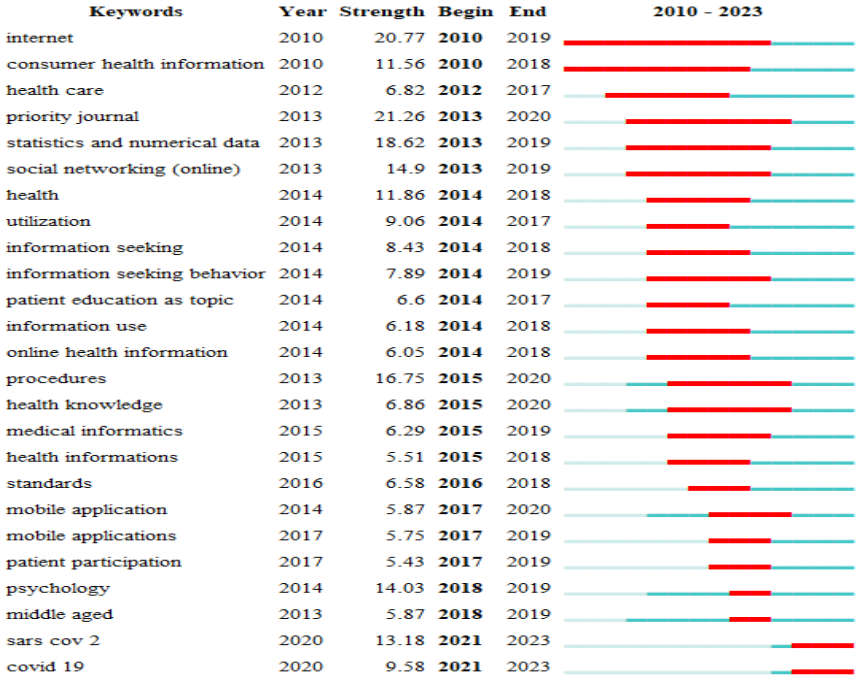


Figure 8. Co-occurrences of all Keywords

4.8. Keywords with the Strongest Citation Bursts

The study reveals the dynamic evolution of research interests and priorities, as evidenced by the strongest citation bursts indicated in Figure 9. Early in the decade, 'internet' emerged as a foundational theme, indicating a burgeoning interest in the digital landscape's role in health, which maintained prominence until 2019. During the same initial period, 'consumer health information' surged, reflecting the increasing reliance on the internet for health-related purposes. The focus then shifted towards integrating social media within 'health care' delivery from 2012 to 2017, signaling a period of exploration into digital health solutions. Notably, 'priority journal' peaked from 2013 to 2020, suggesting an era where disseminating health research through reputable sources became particularly crucial, a trend that may have been propelled by the emergent needs of the COVID-19 pandemic. Concurrently, 'statistics and numerical data' and 'social networking (online)' experienced significant bursts, indicative of methodological advances and the growing ubiquity of social media platforms. Between 2014 and 2018, 'health' as a keyword received a consistent uptick in citations, alongside 'utilization,' 'information seeking,' and 'information seeking behavior,' emphasizing a collective endeavor to understand how consumers' health information is sourced and employed. During this time, 'patient education as topic' and 'online health information' also saw heightened activity, highlighting concerns about the quality and reliability of digital health content.

As the analysis moves into the latter half of the decade, 'procedures' and 'health knowledge' from 2015 to 2020 reflect an investigative period into the dissemination of health knowledge. The rise of 'medical informatics' from 2015 to 2019 underlines the increased interest in the management of medical data. Meanwhile, 'standards' in health information suggest a push for benchmarking quality and accuracy in health communication. The advent of mobile technology in health is marked by bursts in 'mobile application' and 'patient participation' from 2017 to 2020, pointing to the rise of mHealth and participatory healthcare models. The psychological impact of social media on health, particularly among 'middle aged' demographics, gained brief but intense attention in 2018 and 2019, possibly in response to the mental health implications of social media use. The most recent and substantial citation bursts for 'SARS-CoV-2' and 'COVID-19' from 2021 to 2023 underscore the pandemic's profound effect on health literacy research, driven by the urgent need to understand, manage, and communicate about the health crisis. These bursts reflect the rapid mobilization of the research community in response to the global health emergency, marking a significant pivot in the research landscape where health literacy and social media intersect.



Keywords	Year	Strength	Begin	End	2010 - 2023
internet	2010	20.77	2010	2019	
consumer health information	2010	11.56	2010	2018	
health care	2012	6.82	2012	2017	
priority journal	2013	21.26	2013	2020	
statistics and numerical data	2013	18.62	2013	2019	
social networking (online)	2013	14.9	2013	2019	
health	2014	11.86	2014	2018	
utilization	2014	9.06	2014	2017	
information seeking	2014	8.43	2014	2018	
information seeking behavior	2014	7.89	2014	2019	
patient education as topic	2014	6.6	2014	2017	
information use	2014	6.18	2014	2018	
online health information	2014	6.05	2014	2018	
procedures	2013	16.75	2015	2020	
health knowledge	2013	6.86	2015	2020	
medical informatics	2015	6.29	2015	2019	
health informations	2015	5.51	2015	2018	
standards	2016	6.58	2016	2018	
mobile application	2014	5.87	2017	2020	
mobile applications	2017	5.75	2017	2019	
patient participation	2017	5.43	2017	2019	
psychology	2014	14.03	2018	2019	
middle aged	2013	5.87	2018	2019	
sars cov 2	2020	13.18	2021	2023	
covid 19	2020	9.58	2021	2023	

Figure 9. Keywords with strongest citation bursts

4.9. Network visualization of Cited Journals

Network visualization of Cited Journals (Figure 10) representing various academic journals connected by lines, with each node representing a journal and the connections indicating citations. The size of the nodes varies according to the number of citations each journal has received. The figure illustrates major eight iclusters. Cluster #0, the most widespread with 130 associates, focusses on mixed-methods scrutiny in social media investigation, emphasising the usefulness of these methods. The Journal of the Association for Information Systems stands tall with its 2023 articles on online health public engagement, while the Journal of Medical Internet Research, PLOS ONE, and an undetermined journal branded as '18' harvested the maximum citation counts, demonstrating their reputation in this domain.

Cluster #1 orbits around obesity supervision, with the European Journal of Preventive Cardiology bestowing a remarkable clinical accord declaration. Influential journals such as LANCET, JAMA, and the Journal of Health Communication are the most cited, illustrating an interdisciplinary focus that spans clinical insights, public health initiatives, and communica-

tion strategies. The third cluster delves into COVID-19 vaccine hesitancy, underscored by the Encyclopedia of Child and Adolescent Health, which suggests an emphasis on the impact of media on youth health. International Journal of Environmental Research and Public Health, JMIR Public Health and Surveillance, and Health Communication emerge as key journals, reflecting their role in addressing public health challenges during the pandemic. Information credibility is the central theme of Cluster #3, with JMIR Formative Research leading discussions on public health opinion and mandatory vaccination. JMIR MHealth and UHealth, an unspecified journal ('71'), and Nature are the most referenced, pointing to the significance of information validation in the health domain. Media use and its health implications form the core of Cluster #4, with the Journal of Behavioral Medicine examining digital health's evolution. This cluster's leading journals—Journal of Medical Internet Research, Computers in Human Behavior, and Journal of Health Communication—signal the intersection of health, behavior, and media studies. Cluster #5, though smaller, is dedicated to kidney health, with Nephrology (Saint-Petersburg) discussing kidney health education. This cluster's literature is diverse, with citations to 'ET AL', Social Science & Medicine, and another source labeled '75'. Cluster #6, identified as Torbat Heydarieh, may represent a region-specific study connected to health disparities, with the Journal of Health Communication from 2011 cited for its work on the potential of Web 2.0 in this area. The last highlighted cluster, #7, focuses on young men's health promotion, integrating social media and information communication technologies, and is led by Health Promotion International. This area appears to be more specialized, reflected in the fewer, but highly specific, citations.

The citation counts within these clusters, particularly for the Journal of Medical Internet Research and PLOS ONE in Cluster #0, underscore the journals' central roles in disseminating influential research on health literacy and social media. The silhouette values provide insight into the cohesion of topics within clusters, indicating a well-defined research structure in some clusters, while others suggest emerging or niche areas of study.

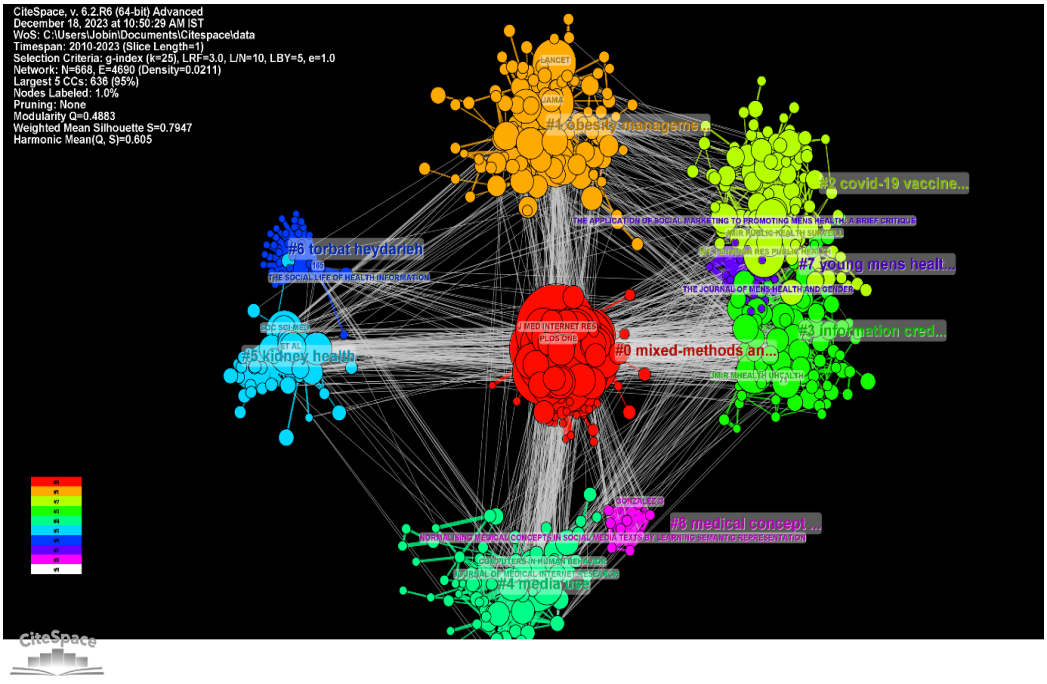


Figure 10. Cluster View of Network Visualization of Cited Journals

4.10. Timeline view of cited references

Delving into the timeline view of cited references in social media and health literacy is like traversing a dynamic landscape of knowledge. The timeline view in Figure 11 presents a comprehensive visual representation of cited references in social media and health literacy re-

search, spanning from 2008 to 2023. This figure is divided into eight clusters, each indicated by different colored lines and circles. The colored circles represent individual studies, with their size indicating the citation count, and circles consisting of two colors signifying interdisciplinary research relevant to two clusters. The arcs illustrate citation links between studies over time, highlighting the evolution and interconnectedness of research ideas. The set of circles in the upper right corner represents highly cited works or recent influential studies, indicating a concentration of impactful research in recent years. The silhouette values, indicated in the cluster descriptions, reflect thematic cohesion within each cluster, with higher values suggesting more focused research areas. Clusters #5 and #6 are not present in the visualization, due to their lower thematic presence or citation frequency. This detailed legend and explanation aim to clarify the complex visual elements of Figure 11, providing a clearer understanding of the research trends and relationships within the field of social media and health literacy. Cluster #0, the largest, focuses on online health information, highlighting the impact of the COVID-19 pandemic and obesity management. The pivotal study in this cluster by Li P (2022) examines the verification of COVID-19 information on social media. Cluster #1 emphasizes crowdsourcing in health, predicting the evolution of personalized medicine, with a key article by Swan M (2012). Cluster #2 explores health disparities in the context of Web 2.0 technologies, spearheaded by Gibbons Mc's 2011 study. General health concerns, with an emphasis on social media safety, are addressed in Cluster #3, with Lau Ay's 2012 paper discussing these concerns. Obesity management policies, mainly endoscopic treatments, form the bottom of Cluster #4, with Ryou M's 2017 enquiry leading the dialogue. Online health literacy, particularly among university scholars during the epidemic, is the emphasis of Cluster #7, as demonstrated by Zakar R's 2021 review. Cluster #8 lights light on the perilous issue of health information found online and medical misrepresentation, with a 2023 study undertaken by Mitsutake S being the most prominent. Lastly, Cluster #10 offers population-based enquiry on eHealth literacy and use of internet, with Wynn R's 2020 research being fundamental. The inclusive network is manifested by its temporal spread and the scope of the clusters representing major research facades, while extraordinary silhouette values within clusters propose thematic cohesion. The maximum cited work by Vosoughi S (2018) highlights the importance of understanding the extent of information received online. This thorough network scrutiny specifies the criticality of the COVID-19 epidemic in current research and points to possible gaps for impending investigation, predominantly in less represented areas. It replicates the field's historical progress and current research routes, emphasizing health communication, misrepresentation, and the digital rift as crucial areas of attention.

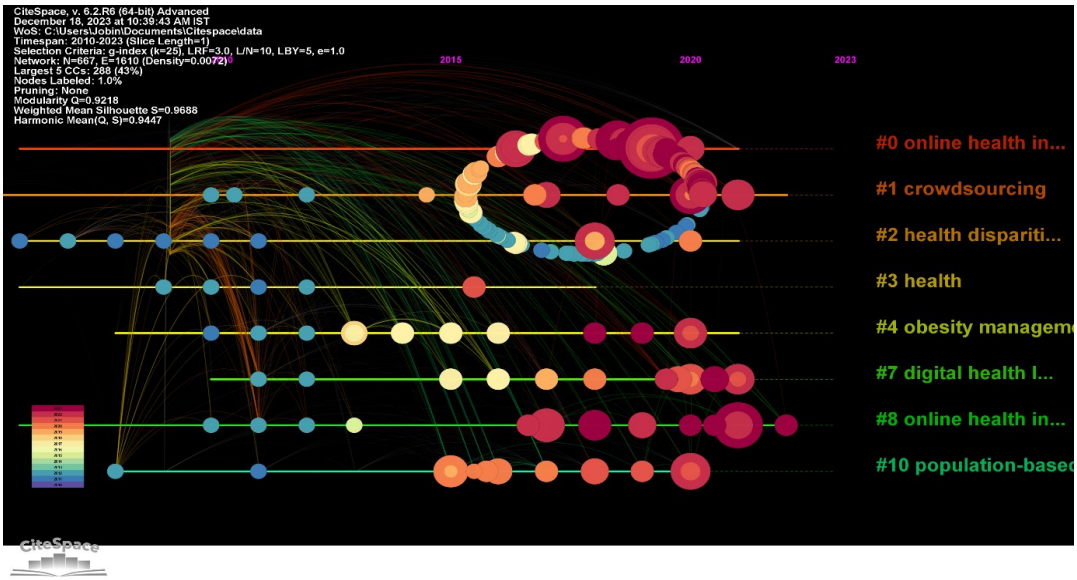


Figure 11. Timeline View of Network Visualization of Cited References

4.11. Timezone Network Visualization of Co-citation of Authors

Figure 12 presents a detailed timezone network visualization of co-citation among authors from 2010 to 2023, organized into 12 distinct clusters. The largest cluster (#0), labeled as "preventive measure," contains 92 members and a silhouette value of 0.637. This cluster is prominently cited by Cheng, Jw (2022), focusing on the role of health literacy in combating the COVID-19 infodemic in Japan. Key contributors include ZAROCOSTAS J, PAAKKARI L, and OKAN O. The second largest cluster (#1), "mental health literacy," with 88 members and a silhouette value of 0.764, is significantly influenced by Ihler, F (2019), who examined the internet's role in providing ENT-specific health information. Important contributors in this cluster include BRAUN V, MOORHEAD SA, and JORM AF. Cluster #2, "COVID-19 vaccination," includes 80 members with a silhouette value of 0.85 and is also significantly cited by Cheng, Jw (2022). Major contributors here are ZHANG Y, WANG Y, and ZHANG X. Cluster #3, labeled "YouTube video," consists of 75 members with a silhouette value of 0.839. This cluster primarily focuses on research investigating the role of YouTube as a platform for health communication and information dissemination. A key study within this cluster is by Kim, S (2015), which explores the behavior of inactive health information seekers who rely on online videos for knowledge acquisition. Significant contributors to this cluster include Norman CD, Bandura A, and Stellefson M, whose works examine the effectiveness, credibility, and reach of YouTube videos in delivering health-related content. Despite the label, the cluster is not about individual YouTube videos per se but rather about scientific studies analyzing how YouTube is used as an educational and informational tool in healthcare communication.

The network further reveals clusters like #4 "to-peer health communication," which includes 74 members and is cited by Gibbons, Mc (2011), exploring web 2.0's potential to address health disparities, featuring FOX S and CHOU WS as key members. Cluster #5, "literacy-neutral spinal cord injury information," with 58 members, highlights research by Schladen, Mm (2011) on literacy-neutral health information, with KIM Y and LEE K as prominent contributors. Cluster #6, "population-based questionnaire study," includes 51 members and highlights work by Wynn, R (2020), focusing on electronic health use in Norway, with key contributors like EYSENBACH G and GABARRON E. Clusters #7 to #11 cover diverse topics like young men's health promotion, kidney health, medical concept normalization, obesity management, and new kinds of (ab)normal, each with significant contributors and high silhouette values, indicating well-defined and cohesive research themes. These clusters collectively underscore the multidisciplinary nature of research in social media and health literacy, reflecting a broad and evolving scholarly interest in how digital platforms impact health communication and education.

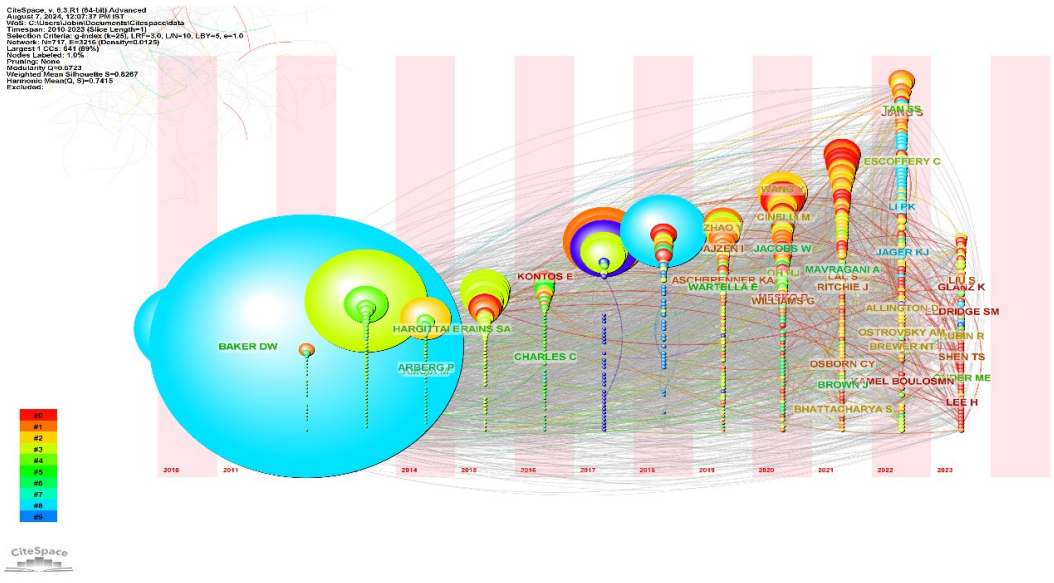


Figure 12. Timezone Network Visualization of Co-citation of Authors

4.12. Timeline View of Country Collaboration

Figure 13 is the timeline view of country collaborations in the bibliometric exploration of health literacy and social media which exhibits a varied and globally interrelated research setting, as showed by nine major clusters. Each cluster is represented by different colored lines and circles, indicating the collaborative research efforts of various countries over time. The colored circles represent individual studies or papers, with the size of each circle indicating the impact or citation count of the study. Multicolored circles signify interdisciplinary research relevant to multiple clusters. The arcs illustrate citation links between studies over time, showing the evolution and interconnectedness of research ideas. Some arcs end outside the clusters, representing the citation of works that are relevant but not confined to a single cluster. The position of country names along the timeline reflects their active years in research contributions, with prominent countries like the United Kingdom, United States, Australia, Canada, and China demonstrating significant involvement in specific research areas.

The major cluster, Digital Health Literacy, is headed by the United Kingdom, Switzerland and Germany, highlighting their noteworthy roles in progressing research on online health literacy with a precise interest in eye care inequalities. This cluster, with a reasonable silhouette value, replicates a concentrated research struggle, as demonstrated by the foremost citing article by Kletecka-Pulker, which converses the effects of a biomedical hashtag-based Twitter operation on online health and patient protection. In the second cluster, Twitter Poll Enquiry, India, Hong Kong and South Korea arise as vital contributors, signifying their active participation in leveraging Twitter for public health engagement and research, predominantly in hyper-connected surroundings. The attention in this cluster, which partake the chief citing article with the first cluster, proposes a collective thematic thread through clusters in consuming social media for information regarding health broadcasting and campaigns. The third and fourth clusters, both focused on Kidney Health but with possible differences in subtopics or procedures, establish various global connections. The United States, with the maximum citation count, primes in the third cluster, followed by Brazil and Ireland, emphasising a robust attention on kidney health study in these nations. The chief citing article by Drenkard points out online educational plans for Latin Americans active with lupus, supporting the cluster's subject of online health literacy and educating the patients. In the fourth cluster, Australia, Canada, and China are prominent, suggesting their significant engagement in kidney health education, potentially from varied perspectives or using different approaches. The major citing article by De Oliveira Figueiredo, discussing the use of instant messaging in clinical practice, underscores the interest in digital communication tools in healthcare. The fifth largest cluster, Stakeholder Perspective, with a high silhouette value, is dominated by Italy, Spain, and Israel. This cluster's focus during the COVID-19 pandemic, particularly on online health services, indicates a strong European and Mediterranean interest in stakeholder engagement in health literacy through digital platforms. The major citing article by Talutis, discussing stakeholder education in aortic dissection, reveals an interest in specialized health literacy.

The citation counts reveal the leading roles of different countries in each cluster. The United States stands out with the highest citation count, particularly in kidney health research, underscoring its prominent role in this domain. The United Kingdom follows, with significant contributions in digital health literacy. Other countries like Australia, Canada, and China also demonstrate substantial involvement in specific research areas, reflecting the global nature of the field.

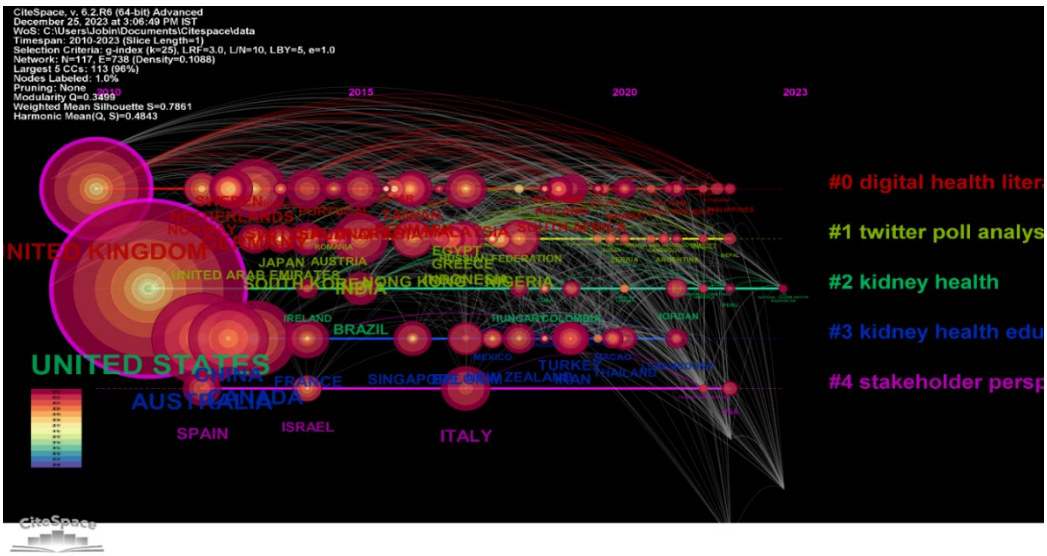


Figure 13. Timeline View of Network Visualization of Countries' Collaborations

5. Discussions

Using Scopus as the chosen database for this study allowed for the collection of a broad array of scholarly documents on health literacy and digital health, a total of 1,357 publications from a diverse set of 664 sources spanning 2010 to 2024. The analysis indicates a significant surge in research on social media and health literacy, evolving from an early average of 10.4 articles per year during 2010-2014 to 130.5 articles annually from 2015-2023, with years like 2013 and 2021 highlighting peak scholarly activity and interest in the field. Maximum Pertinent Sources reveals "Journal of Medical Internet Research" as the principal publisher with claims of over 110 social media and health literacy documents, trailed by periodicals that highlight the field's interdisciplinary feature and expansive research attention across skill, public health, and medical domains. Most Relevant Authors outlines L.Y. as the most abundant author in social media and health literacy investigation with over 11 publications, narrowly followed by R.G. Langham and a group of other vigorous researchers, demonstrating a dynamic and cooperative academic milieu within this focussed field. The analysis of global citations within social media and health literacy research positions Fitzpatrick KK's 2017 publication as a cornerstone of the field, with Puri N's 2020 paper rapidly gaining influence, highlighting key works that shape the academic discourse, as normalized metrics provide a balanced view of their impact. The trend topics timeline indicates a dynamic research landscape in social media and health literacy, where the prominence of "COVID-19" shows the pandemic's influence, and the rise of advanced technologies and demographic-specific research illustrates the field's adaptability to global events and technological advancements. The thematic map serves as a comprehensive guide for navigating the evolving research landscape in social media and health literacy, effectively categorizing themes into niche, motor, basic, and declining categories, thereby highlighting areas of current focus, potential growth, and diminishing interest.

Co-occurrence network visualization reveals a multifaceted research network consisting of 16 clusters, each highlighting a unique aspect of the interplay between these fields. Controlled trials of mental health, the effect of social media on health behaviors, digital health interventions, and health information quality are notable as major focus areas of this research, varying considerably with respect to thematic cohesion and specialization. These areas reflect the evolving complexity of health communication in the digital Era. The Keywords with the Strongest Citation Bursts offer considerable insight into the dynamic shift in the research focus of health literacy and social media research over the past decade. Early in the decade, 'Internet' and 'consumer health information' were dominating themes of research, indicative of a growing reliance on digital platforms for health information. As the decade progressed,

there is an observable shift towards incorporating social media within the delivery of health care, the exploration of digital health solutions, and an intentional focus on the dissemination of credible health research and the evolving role of social media platforms. By the latter half of the decade, the dichotomous focus of medical informatics—such as the proliferation of mobile health applications—and the psychological impacts of social media stand in stark contrast, punctuated by a significant pivot towards COVID-19 research by the year 2021, emblematic of the critical impact that the pandemic has had in the field. A network analysis of cited journals in social media and health literacy research further underscore the complexity and multi-disciplinary nature of the research, revealing a landscape with 14 clusters. Key journals such as the Journal of Medical Internet Research and PLOS ONE dominate the clustering for clusters focused on mixed-methods analysis and digital health, while others like the European Journal of Preventive Cardiology and the Journal of Health Communication illustrate the multi-disciplinary approach spanning clinical, public health, and communication research. This research not only classifies important journals in several subfields but also exemplifies the thematic unity and variety within the research network. The timeline view of cited references in social media and health literacy investigation from 2008 to 2023 discloses a dynamic development of focus areas, obvious by eight clusters stretching from digital health information to online health literacy and eHealth. Dominant themes comprise the impact of the COVID-19 epidemic, the part of social media in health communication and misrepresentation, and budding strategies in obesity administration and health inequalities, with the research of Vosoughi S (2018) being remarkably significant in accepting online information spread. This analysis highlights the epidemic's substantial influence on recent study and highlights areas for prospect examination in this ever-evolving field. The timeline view of country associations in health literacy and social media research demarcates a global network separated into nine clusters, with the United Kingdom, Switzerland and Germany prominent in online health literacy, and other nations like the United States, South Korea, Hong Kong and India actively contributes to varied research spheres such as kidney health and Twitter poll analysis. This study underscores a broad international contribution, with the United States remarkably prominent in kidney health study, and countries like Australia, China and Canada meaningfully engaging in various particular domains, highlighting the field's global and interdisciplinary feature.

6. Research gaps

A significant research gap recognized in the bibliometric analysis of social media and health literacy is found in the proportional exploration of how numerous demographic divisions, including lesser represented sets, relate with and take advantage from social media in the framework of health literacy. While demographic-particular terms such as "young adult," "middle-aged," and "female" are stated, there seems to be inadequate research showing a nuanced comprehension of these differences. Additionally, in spite of the emerging attention in advanced technologies such as natural language processing systems and computer-assisted instruction, there is a prominent shortage in research that probe into their applied application and usefulness across assorted populations. Additionally, the consequences of deteriorating themes such as "social networking and "health" need additional investigation to comprehend how these changes affect overall health literacy policies. The study also highlights a gap in longitudinal research examining the enduring effects of the COVID-19 pandemic on health literacy, particularly in relation to information dissemination and public perception.

7. Practical implications

From a practical stance, these recognized research gaps propose several consequences. Firstly, analyzing the gaps in demographic-specific research can lead to the development of more targeted and operative health literacy involvements, guaranteeing inclusivity and relevance. This is predominantly crucial for addressing the wants of assorted population seg-

ments. Secondly, perceptions into the incorporation and usefulness of emerging technologies can support in the formation of cultured health literacy tools that are both available and extensive. Distinguishing the changing trends and deteriorating themes in social media and health literacy study can help practitioners acclimatize their approaches, ensuring they remain pertinent in the ever-evolving digital scenario. Furthermore, accepting the enduring impacts of the COVID-19 contagion can notify policy progress and public health approaches, augmenting the flexibility of health literacy in prospective global health disasters. Lastly, admitting the necessity for an all-inclusive evaluation of health literacy propagation tools on social media can lead to the advance of more vigorous calculation methods, thereby refining the efficacy and spread of forthcoming health literacy initiatives.

8. Conclusion

The study overwhelmingly validates the vital role of social media in improving public health literacy and information propagation. It discloses a noteworthy increase in related intellectual activity, demonstrating the mounting position of social media in the health segment. Key conclusions include the acknowledgement of predominant themes and persuasive authors and sources, as well as the appreciation of social media as an essential tool for health education and community support. The research gaps recognized, such as the need for extra demographic-specific enquiries and the amalgamation of evolving technologies, provide a course for further research. Additionally, the practical consequences of this study accentuate the requirement for health professionals and establishments to acclimatize and augment their use of social media for public health dissemination. Overall, the study emphasizes social media's transformative influence on health literacy, encouraging for its sustained utilization and study in the developing scenario of digital health communication.

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