ORIGINAL ARTICLE

PHOTOVOICE METHOD TRENDS, STATUS AND POTENTIAL FOR FUTURE PARTICIPATORY RESEARCH APPROACH

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ABSTRACT

In the last decade researchers from around the world have shown deep interest in using photovoice as a method of analysis in scientific research. This might be due to participatory strength of the method that act as a bridge to connect researcher and community by balancing scientific research and mitigating action. The purpose of this research is to synthesize the available research of photovoice method using Scientometric method. This article explores the research landscape, key topics, and developments of photovoice method based on the 1252 document data retrieved from Web of Science Core Collection dated from 1997 to 2019. The results show that the interest of using this method is significantly high in United States, Canada, and United Kingdom as they are the major leaders in publication contributions. A Scientometric analysis for Document co-citation analysis were applied and 15 research clusters were identified. This paper reviews the main characteristics of 6 most important clusters and their contribution to the photovoice method. The outcome of this study contributes to academia, industry practitioners and policy makers by providing an understanding in overall trends, status, and potential research questions of study in this domain.

Keywords: *CiteSpace, Document Co-citation, keyword analysis, knowledge map, scientometric study, visualization analysis*

INTRODUCTION

Photovoice concept was developed by Caroline C. Wang and Mary Ann Burris to enable Chinese village women to photograph their daily lives focusing on health and livelihood (1,2). It is defined as "a process by which people can identify, represent, and enhance their community through a specific photographic technique(3,4). The core idea of this method is to initiate change from the grassroots by documenting realities and daily challenges (5–7)

Over the last few years, there has seen a surge of interest in using photovoice as a method of analysis in scientific research. This may be explained by the participatory strength of the method that act as a bridge to connect researcher and community by balancing scientific research and mitigating action (4,8). Past research in photovoice domain has been focusing on health-related multidisciplinary issues such as key determinants of the local food environment influencing residents diets (9), perceived health and well-being effects of access to urban natural areas (10) and opportunity for empowering women in low-income area at developing country (11).

In addition, several reviews have synthesized photovoice research in various field such as health (1), community empowerment and therapy (3,7,11). While such review of literature is valuable by providing clear description of research using photovoice method, it is subject to numerous limitations. Such limitation for this type of review is its narrow focus where most of it emphasize on one issue or discipline. This

happened due to time-consuming and laborious use of capital to read large amount of publication, identify key ideas and links and draw conclusions (12).

By understanding the domain in bird's eye view, the information can improve photovoice method by discussing: (i) the intellectual turning points of the method, (ii) the links between different discipline that use this method and (iii) the progress of knowledge over time (12,13). None of the previous work in photovoice method, to the knowledge of the authors, has focused on the mapping of general research indices, prevalent themes of research, research hotspots and influential stakeholders such as authors, organization and contributing countries. This study set out to map photovoice method using scientometric analysis, defined as the "quantitative study of science, communication in science and science policy" (12,13). Scientometric can identify influential research studies and the evolution of specific field of science (12,13). It has been widely applied in various research areas and method including eye tracking technology (14), creativity research in business economics (15), and status of advancement of nuclear power (16).

Scientometric study involves numerous quantitative approaches from descriptive statistics and data visualization to advanced econometric methods such as network science, machine-learning algorithms, mathematical analysis and computer simulation (12,13). This method has been chosen due to (i) availability of large bibliographic corpora for example; Web of Science, Scopus and Pubmed, and (2) availability of visualization and text-mining software packages such as CiteSpace (12–14).

Therefore, the purpose of this study is to synthesize the available research of photovoice method from the year 1997 to 2019 using scientometric method. This study presents a scientometric analysis using CiteSpace as well as an analysis of research time intervals using the Web of Science database. The specific objectives are to (1) determine the research landscape of photovoice method in terms of the year, journals, authors, countries, institutions, keywords, and references; (2) and explore the key topics and developments of the photovoice method.

METHODS

This review study employed scientometric method to examine the journal articles published between the years 1997 to 2019 which used photovoice as a research method.

Database Searches

Document information was collected from the Web of Science (WoS) core collection database by Clarivate Analytics. WoS database has been extensively applied in review articles such as scientometric as it is most reputed and has a very comprehensive database, covering most areas of knowledge. Furthermore, WoS database was chosen because it ranks top countries, journals, scientists, papers, and institutions by field of research. It indexes more than 6,650 major journals across 150 scientific disciplines and includes all cited references captured from indexed articles (17,18).

The search in WoS was made using keyword (search code) with asterick"*" used at the end of the search code to identify variations, thereby broadening the search. WoS searches the title of the manuscript, its abstract, keywords, author, and Keywords Plus as the search option when the field "TS" is checked (17–19). To complete this study, the final search code used was TS = (photovoice*).

The search code is adapted from Catalani & Minkler (4) in their systematic review study on the use of photovoice in public health. The search was restricted to articles published between 1997 to 2019 that was when photovoice was first introduced. Publication types are restricted to only original research articles while commentaries, short communications of findings, books and book chapters, protocol papers, theory/discussion papers and editorials were excluded. All research designs (quantitative, qualitative, and mixed-methods studies) are included. The search was conducted on 10th November 2020.

Data Analysis

Descriptive Analysis

Descriptive analysis was performed on number of papers that were published annually, the names of the journals wherein the papers were published, and the names of the most productive authors, universities/institutes, and countries wherein the authors were residing when the papers were published.

Scientometric Analysis

CiteSpace V version 5.2.R 2.3.26.2018 for 64-bit Windows was used to conduct visualization and knowledge graph analysis in this study. CiteSpace offers the most comprehensive suite of tools for generating multiple bibliometric networks and conducting multiple methods of analysis (12,13). The dual-map overlay categorized the literature into two groups: (1) cited journals and (2) citing journals (i.e., the latter cited its references from the former). The strength of connections between these groups were visually represented and measured (12,13).

Different types of bibliometric networks can be constructed in CiteSpace and two analyses were used in this study: (i) Document Co-citation Analysis (DCA) where a co-citation instance occurs when two sources are cited together in one paper; and (ii) keyword analysis, where instances of two keywords appearing together are analyzed. The Document Co-citation analyses were performed to get the cluster of co-citing journals (12,13).

The input data for CiteSpace were retrieved from WoS as mentioned previously. In order to generate an individual network, threshold settings are required to enable article selection. The Top N per slice procedure are used in this study, which selects the most cited items from each slice to form a network, according to the input value and node type determined by the user. The value of 50 and multiple node types are chosen for this study, so the top 50 most cited items were displayed and ranked accordingly. The "Time Slicing" is set to 1990-2019 and "Years per slice" at one year. In addition, the generated network is pruned and to do that the "Pruning" parameter is selected. All term sources, including title, abstract, author keywords and keywords plus were chosen in the text processing.

A multidimensional clustering method were used for identification of cluster. Log-likelihood ratio (LLR) were used to automatically extract the cluster label. This method was found to provide the best results in terms of uniqueness and coverage. To visualize the shape and form of the network, a timeline and cluster view of Document Co-citation Analyses are used in the study. Timeline view consisted of a range of vertical lines that represent time zones chronologically, arranged from left to right. The cluster of DCA view produced spatial network representations that were color-coded and automatically labeled in a landscape format.

Quality control and impact

The qualities and the homogeneity of the analysis and detected clusters were measured using the modularity Q index, the average silhouette metric and betweenness centrality. The modularity Q index ranges between 0 and 1, with larger indices indicating higher reliability. The average silhouette metric ranges between -1 and 1, where values above 0 indicate better homogeneity. Betweenness is a measure of influence that shows the degree to which publications or journals stand between each other. Publications with higher betweenness would have a higher influence on the network because they connect more publications or journals and, accordingly, more information and paths pass through them (12,13).

The most influential publication is based on its centrality scores retrieved from scientometric analysis. Publication with value of centrality more than 1 is considered as "central" publication, where it becomes a bridge for other publication citation in photovoice method network. A publication with high centrality would have a higher influence on the network because it has connected more publications and lead to more information and paths pass through it. The scientific novelty publication is based on sigma result where publication with sigma score more than 1 is considered as high novelty. Sigma is the combination of betweenness centrality and burstness. This metric (ranged from 0 to 1) was used to identify and measure novel ideas presented in scientific publications, with highest value are associated with high value research. In addition, influential publications and top keywords were also determined by computing citation burstness. Burst detection is a sudden surge of citations for a specific article and is indicated by a red ring around the node (12,13)

RESULTS

Descriptive Analysis

Evolution of Published Studies

Overall, there are 1,252 publications with a h-index of 50 retrieved by employing the search strategy mention in the methodology section. These publications cumulated 16,666 sums of times cited (11,453 without self-citation) with an average citation per article of 13.31. Figure 1 shows the trend of photovoice research between year 1997 to 2019. The growth of publication using photovoice in Figure 1 forecasts the continuous development of this method in the upcoming years. Prior to 2007, the numbers of annual publications were less than 10. However, a rapid growth of publication number can be seen in the year of 2009, with a total of 26 publications. Since then, the annual publications increased sharply, with a figure as high as 225 in the year 2019 (Figure 1)

The top ten countries in terms of total publications, number of cited publications, total citations, and h-index are illustrated in Figure 2. In total, 75 countries published their work employing the photovoice method with the top three being the United Stated of America, Canada and United Kingdom. The United States of America is the epicenter of this method accounting 48.80% of total publications. Canada ranks second with 272 articles, representing 21.72% of the total publications and the third most productive countries is United Kingdom with 104 publications and amounting to 8.31% of the total publications.

Top Productive Organization

Based on the data, articles using photovoice method was published by 1,215 organization shows by the top contributing organizations in

this field (Figure 3). The most active organization in this field are The University of British Columbia with 40 articles, followed by University of Alberta with 36 articles and University of Manitoba and The University of North Carolina at Chapel Hill each with 30 articles. Most of the publications came from organizations from the North American region such as Canada and The United States of America. These two countries recorded the highest contribution of publications. It is also interesting to note that an organization from South Africa that is University of KwaZulu-Natal produced a significant number of publications and many of the samples were drawn from the Asian countries. This indicates a progressive use of the photovoice method worldwide.

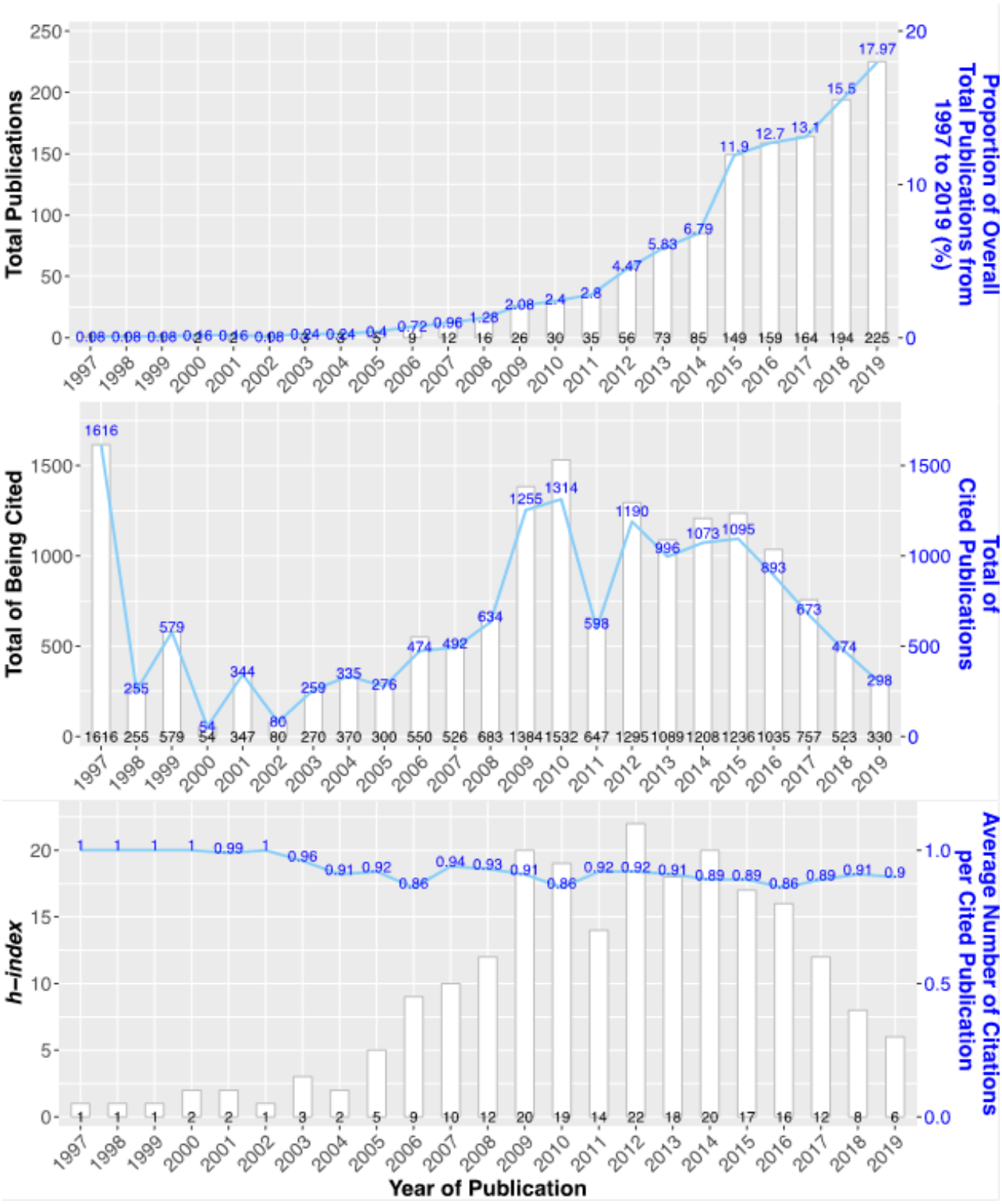

Figure 1: Publication and Citation of Photovoice between Year 1997 to 2019

Top Productive Countries

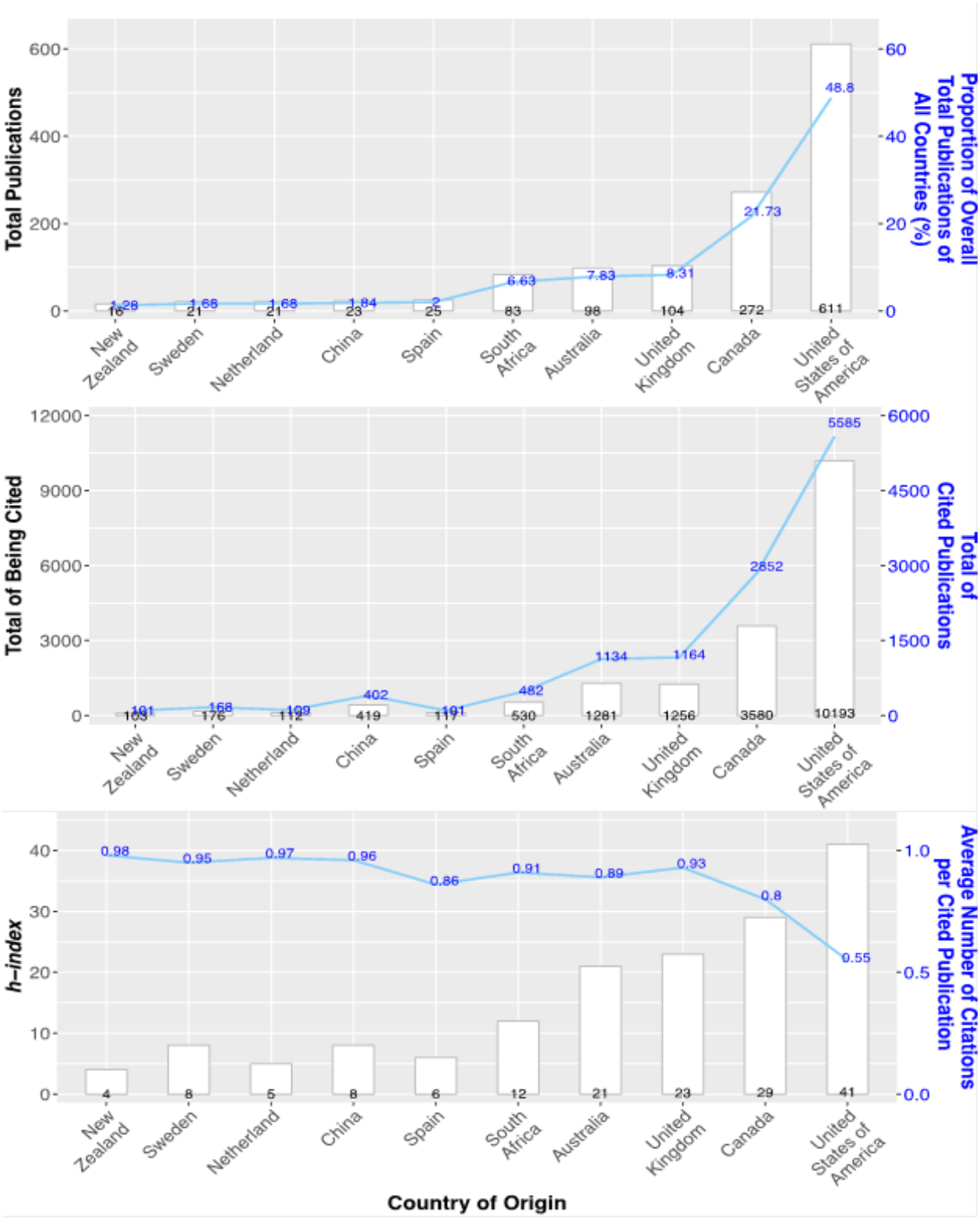

Figure 2: Top Ten Countries' Distribution of Publication

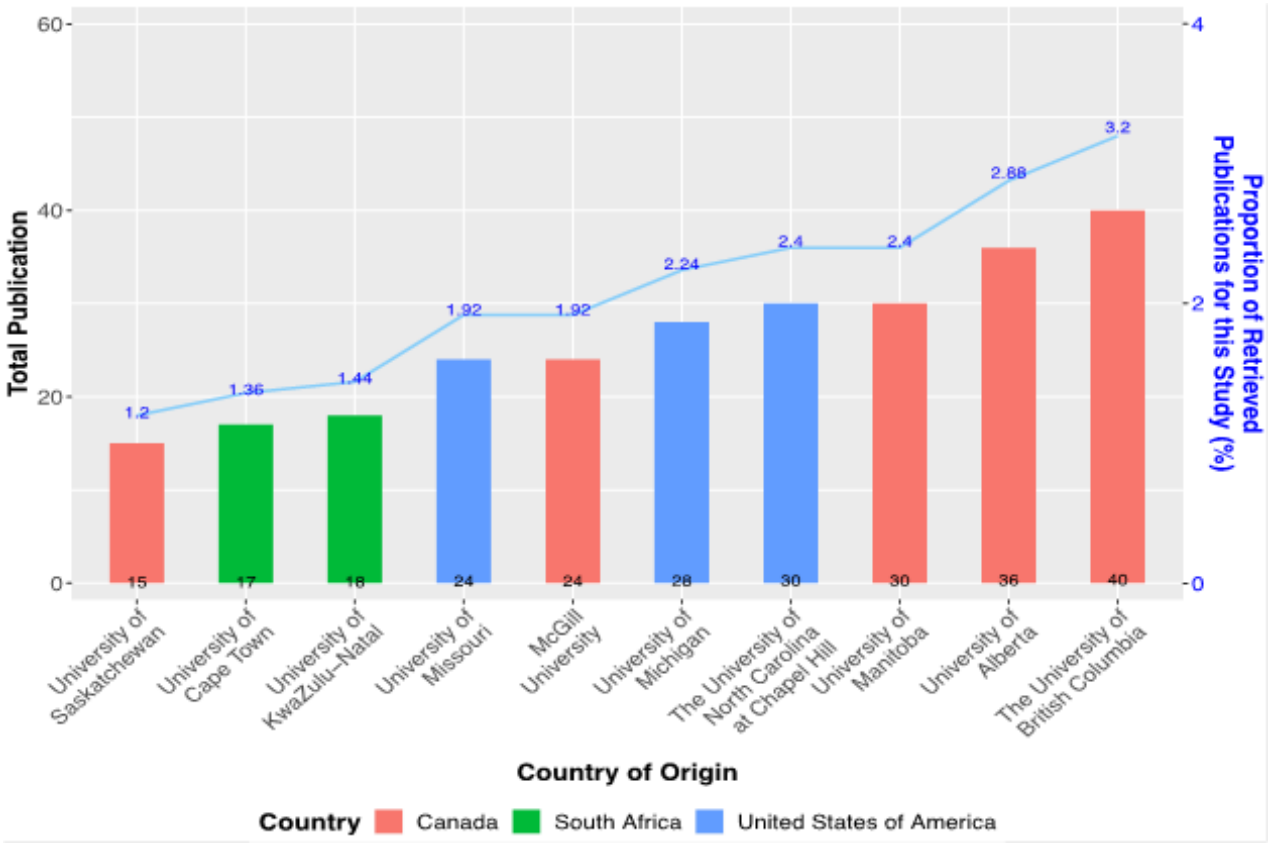

Figure 3: Top Ten Organization Distribution of Publications

Top Productive Journal

The 1,252 articles were published in 655 journals, where 446 of the journals published only one article throughout the research period. The top ten most productive journals, accounting for 15.27% of the total publications shows in Figure 4 Qualitative Health Research is the most productive journal with 46 articles representing 3.67% of total publications. International Journal of Qualitative Methods ranks second with 25 articles, for the sum of 1.6% of the total publications. The third most productive journal is Progress in Community Health Partnerships Research Education and Action with 20 publications and accounting for 1.60% of the total publications. Majority of the top ten journals are from Public, Environmental & Occupational Health. Based on the Impact factor, this method has received a considerable amount of attention from some of the best journals in the field of social health.

Top Productive First Authors

Overall, 3,449 authors published articles implementing photovoice as research method. However, 84.61% of the authors only contributed one article, indicating that only a few researchers used this method as the focus of their research. The top ten most productive first authors are shown in Figure 5. There are three first authors who have published more than ten articles. John L. Oliffe was the most productive author with 19 published articles. Meanwhile, Michelle Teti ranked second with 16 articles published and Roberta Lynn Woodgate ranked third with 12 articles. Caroline C. Wang is the author with highest total citation as she is the pioneer of photovoice method.

Highly Cited Publications

Figure 6depicts the top ten highly cited publications with year of publication, total citations and average citation per year. The top three publications are (1,2,4)with total citations of 1,616, 579 and 438 respectively.

The article with the highest number of citations is the pioneering study which introduced the basic concept and process of photovoice method (2) . It is developed to enable Chinese village women to photograph their everyday health and work realities. As reported in 2019, this article was still highly cited with an average of 67.33 citations per year. Article by (1), titled "Photovoice: A Participatory Action Research Strategy Applied to Women's Health", is ranked second with 579 total citation. This article is also the 4th highest in terms of average citation per year. This article focuses on the implementation of photovoice method in understanding women's health and suggests the potential of photovoice method to further understand the lives of women in terms of health, education, childcare, violence prevention, and access to quality care.

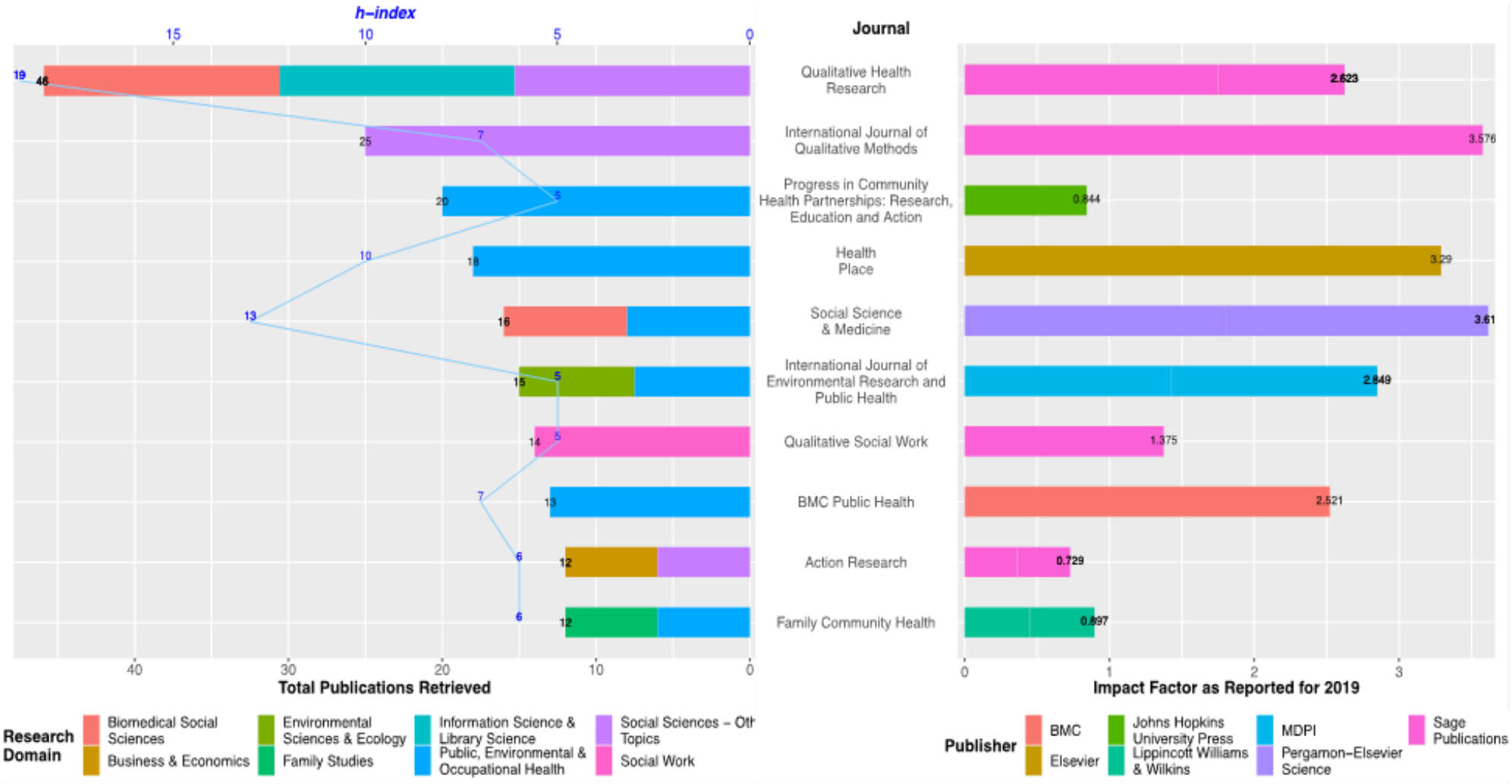

Figure 4: Top Ten Productive Journals

The third article with highest citation is "Photovoice: A review of the literature in Health and Public Health"(4). It is the first systematic review publication of photovoice with a focus on health. This review found several limitations of past studies which used the method such as vague descriptions of project evaluation practices and lack of consistent reporting precluded hard conclusion. Nevertheless, the articles echoed the potential of photovoice as a participatory tool for engaging communities as partners in a community-based participatory research.

Scientometric

Scientometic results showed the intellectual structure of photovoice method by analyzing a network for a series of publication from year 1997 to 2019. A dual-map overlay, document co-citation analysis (DCA) and keyword analysis that mapped a specialty domain "in terms of a time series of networks" were performed (12,13). Dual-map overlay detects the most productive discipline that conducting photovoice method and the intellectual basic of this domain. Document co-citation analysis detected impactful documents and publications clusters while keyword analysis was used to identify the keyword "burst" of the focusing articles.

A dual map overlay analysis was applied to identify the highly productive and highly cited discipline and journals in photovoice method areas (Figure 7). Dual-map overlay analysis shows the journals of specific dataset and its place on the global landscape. The analysis traces the cited journals in the reference list of those journals, puts those on another journal overlay map, and links both maps. The ovals in the map indicated the clusters of highly active citing and cited journals. The size of the ovals was proportionate to the number of publications for the citing journals on the left and to the number of citations received on the right. Hence, the left side of the map is the distribution of journal that use photovoice as its method on the global landscape while the right side is the distribution of cited journals. The line bridging between cited and citing map is the frequency of citation, where a thicker line (Adjusting with z-score) indicates high frequency of citing between disciplines.

The dual-map overlay indicated that photovoice articles were mainly published in "Psychology, Education, Health" discipline. The cited journals, which can be considered to constitute the intellectual basis of the research domain, are primarily clustered in the "Psychology, Education, Social" and "Health, Nursing and medicines" disciplines. This result implied that the majority of photovoice method was highly nested within specific scientific sub-domains and were less interdisciplinary. Articles in this domain are often cited by articles from their own discipline. However, activities from other disciplines indicated by the line bridge between both cited and citing articles can be seen on the map. This indicates that photovoice method is emerging slowly into more interdisciplinary research.

Document Co-citation Analysis

Cluster Network

The modularity Q index and the average silhouette metric for DCA network for this study are 0.6138 and 0.4424 respectively, suggesting an acceptable level of reliability and homogeneity for the network. A total of 15 co-citation clusters emerged from the analysis. The top seven clusters in the data on a horizontal line with the cluster label appearing on the right side (Figure 9) and the network of the whole articles (Figure 9). The clusters were numbered and ranked in terms of its size, indicated by #0 as the largest cluster. The circle shows the magnitude of the publications influence whereby a large circle equal means a high citation for the publication. The red rings outside the circle indicate the burses of the articles. They reveal where the articles start to "burst" and how big is the "burst" strength. The purple rings indicate the centrality of the articles, whilst a high centrality articles indicate a strategic positions and ability to bridge between different articles in the DCA networks. The yellow line in each line represents the lifetime of the cluster. The top ten articles with highest citation are shown in Figure 9.

Cluster label were generated by text mining and keyword analysis algorithm in CiteSpace software. These clusters are named according to four methods: (i) Latent Semantic Indexing (LSI), Term Frequency * Inverted Document Frequency (TF*IDF), loglikelihood ratio (LLR), and, Mutual Information (MI). This paper reports the cluster based on loglikelihood ratio (LLR) as the outputs of each method are not always sensical (12,13).

Cluster Characteristics

The top five major clusters emerged from DCA analysis. Each cluster represents a research topic in the photovoice domain (Table 1). The size of cluster equals to the number of publications it has. All six clusters have more than twenty publications with cluster #0 as the highest number of publications. The silhouette score for each cluster ranges from 0.502 to 0.707. This indicates a good homogeneity of publication within each cluster (silhouette score ranges from -1 to 1, with score higher than 0 seen as homogenous). Cluster #0 "mental mapping" has 60 publications and is the largest clusters. These 103 publications were placed in this cluster because all of them are cited by similar group of publication, thus representing a co-citation relationship. The content and scope of each

cluster are further discussed in the "Discussion" section.

Document Burst

The top 10 publications with highest citation burst strength and their duration is available on the right column shows in Table 2. The burst analysis was performed to identify the publication in the domain that had drawn researchers' attention. The burst analysis detect 56 publications with a burst and the strongest burst publication. The results suggest that it took two to six years for a publication to become a focal point and achieve citation bursts.

Keyword Burst

The top ten keyword bursts computed via keyword analysis is shows in Table 3. Burst keywords can reflect the emergence of certain keyword in a short time. It can be used to detect an emerging trends and hotspots. The Modularity Q score is 0.4684 and the mean silhouette is 0.652. These scores suggested that network boundaries are not clear, but the heterogeneity is respectable. A total of 18 burst items were identified where a blue line depicts the time interval (1997 – 2019) and the burst period depicts as a red line. Keyword with largest magnitude is "Health" (strength = 10.9997), with the longest burst span of 8 years. Next keyword is "family" (strength = 5.572, 2008 – 2011) and followed by "South Africa" (strength 5.5187, 2017 – 2019). Based on the finding, the livelihood and wellbeing associated keywords (health, family, behavior, resilience, and neighborhood) are the hot topics, suggesting that the photovoice practitioner focused more on the community wellbeing issues.

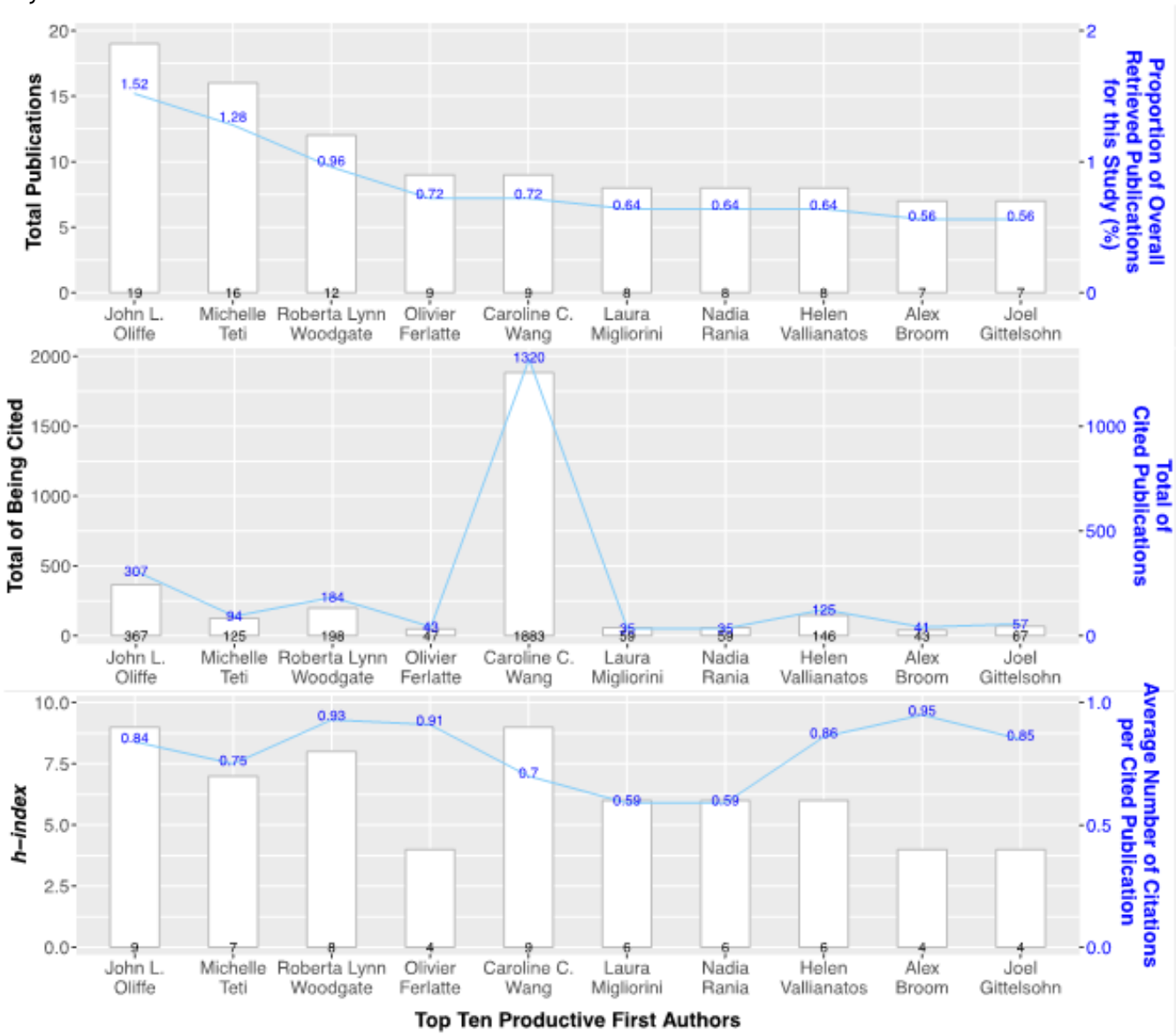

Figure 5: Top Ten Most Productive Authors

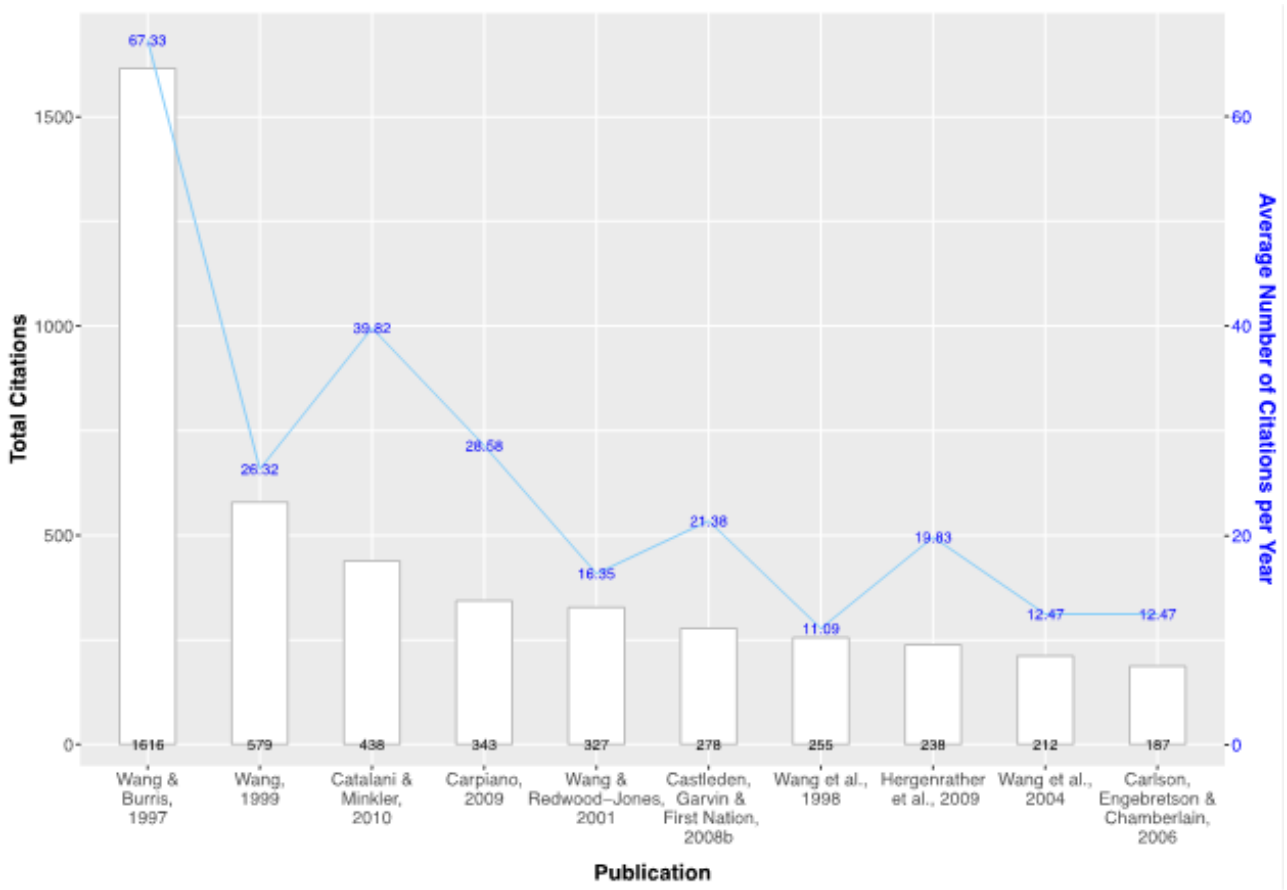

Figure 6: Top Ten Highly Cited Publications

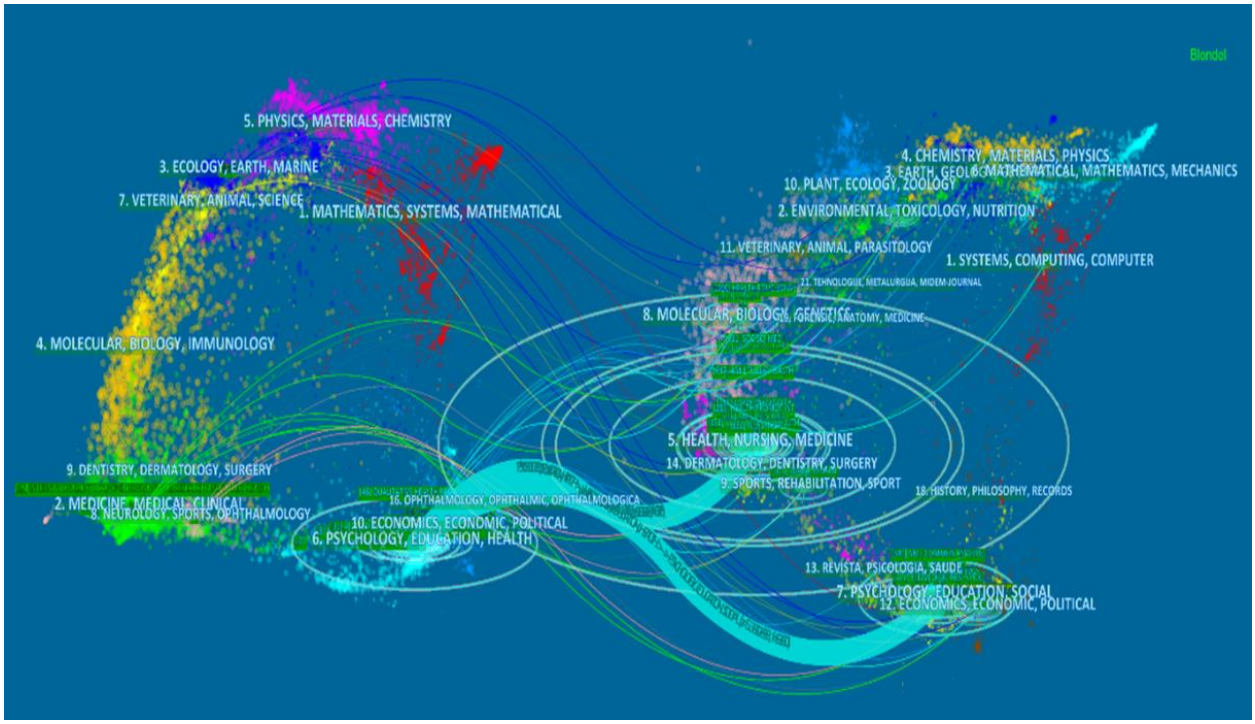

Figure 7: Dual-map Overlay on Photovoice Research

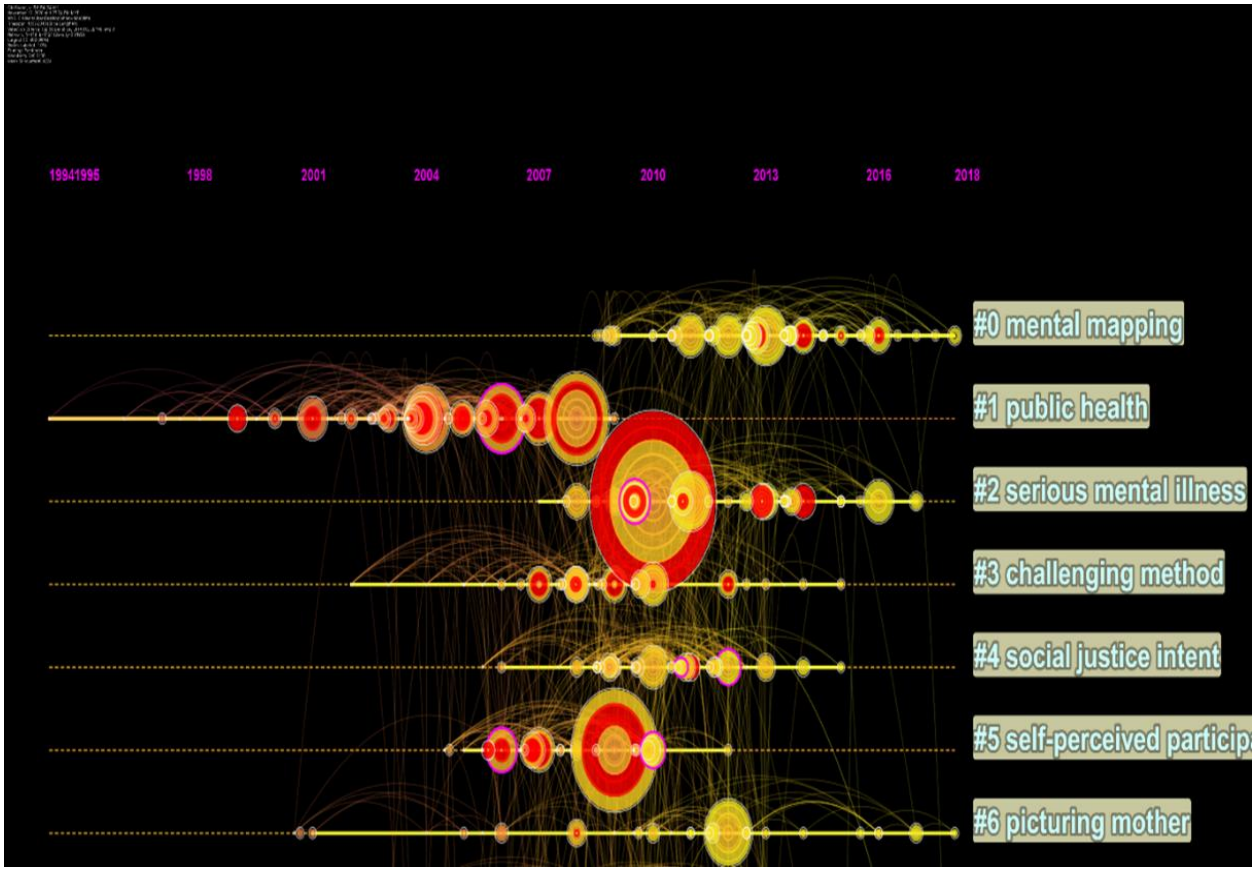

Figure 8: Timeline View of the Document Co-citation Network

Figure 9: Cluster View of Document Co-citation Network (Top Ten Articles with Highest Citation Shown)

Table 1: Top Six Clusters

Cluster ID	Size	Silhouette	Mean Year	Cluster Label
0	60	0.502	2013	Mental Mapping
1	54	0.707	2003	Public Health
2	38	0.567	2012	Serious Mental Illness
3	36	0.629	2008	Challenging Method
4	36	0.661	2010	Social Justice Intent

Table 2: Top Ten References with Strongest Citation Burst

References	Strength	Begin	End	1997 - 2019
(20)	17.8145	2006	2012	
(4)	16.5844	2017	2019	
(21)	15.4918	2006	2012	
(22)	14.5478	2006	2011	
(23)	13.8211	2008	2014	
(24)	12.2575	2015	2017	
(25)	11.8067	2006	2009	
(1)	9.3701	2003	2007	
(26)	9.1204	2009	2014	
(3)	9.0853	2004	2008	

Table 3: Top 10 Keywords with Strongest Citation Burst

Keywords	Strength	Begin	End	1997 - 2019
Health	5.7532	2003	2011	
Family	5.572	2008	2011	
South Africa	5.5187	2017	2019	
Behavior	5.2036	2017	2019	
Resilience	5.1934	2016	2019	
Issue	4.8802	2009	2013	
Model	4.7274	2017	2019	
Neighborhood	4.7028	2009	2014	
Challenge	4.6522	2017	2019	
Voice	4.4746	2015	2016	

DISCUSSION

In recent years, photovoice method have attracted increasing attention from researchers around the world. Figure 1 shows the overall development trend of related publications in photovoice domain. The figure shows an upward trend of publication since 1997. 1997 is the year when the "photovoice method" was first published. The article was published in Health Education & Behaviour, with a title of "Photovoice: Concept, methodology and use for participatory needs assessment" and written by its developers Caroline C. Wang and Mary Ann Burris. The article explains photovoice technique and its three main goals: (i) to enable people to record and reflect their community's strengths and concerns, (2) to promote critical dialogue and knowledge about important issues through large and small group discussion of photographs, and (3) to reach policymaker (2). The article receives the highest citation in terms of all photovoice method articles with 1,616 total citations (Figure 6).

It is interesting to note that 70.53% of total publications are from two countries, the United States of America and Canada, accounting for 48.80% and 21.73% respectively (Figure 2). While third most productive country is United Kingdom with 8.31% publications. This result is consistent with other studies in other fields indicating that United States of America is the largest contributor (Igoumenou et al. 2014; Gao et al. 2019). The performance of these three countries in terms of publication outputs might be due to the country's expenditure on research and development activities. Majority of the countries are in the top fifteen countries with the highest expenditure in research and development. In return, this gives them positive encouragement to perform excellently at the international level and receive high academic reputation and accolades.

In terms of organization comparison, universities originated from the United States of America and Canada again hold eight of the top ten institutions with highest publications. Interestingly, two of the remaining universities originate from South Africa, showcasing that this method is gaining interest in developing country (Figure 3). This result is in line with the country's publications and as prove on the importance of government's aids and funding for research and development activities. As a result, universities with more research grants and research platforms could encourage their researchers and students to publish more. They could also hire outstanding academicians to provide guidance to other staff members and students. For instance, The University of British Columbia is the most productive university to date, likely because it has more visiting scholars and international students to conduct research. Furthermore, The University of North Carolina at Chapel Hill, a famous university in the United States of America, are able to conduct more international academic research with sufficient funding projects.

Photovoice-related research were published in 1,252 articles and the top ten journals published 15.27% of publications in this area (Figure 4). Among the ten most productive journals, six are in the research domain of "Public, Environmental & Occupational Health". The distribution of these publications followed Bradford's law or also called Pareto distribution, indicating that most of the publications on specialized topics were actually published by a limited subset of specialized journals and in this case "Public, Environmental & Occupational Health". This result indicates that the domain of "Public, Environmental & Occupational Health" is the core journals in using photovoice.

Strengths, Limitations, and future work

There are several strengths and limitations to this study. This study interprets the data based on the structural and temporal patterns from retrieved publications. As this study only uses WoS databases, other databases such as Scopus, PubMed and EmBase are not included, and this might lead to publication bias. However, WoS is deemed better to achieve the study objectives as its database is geared towards hard science and social sciences with its wider databases and scope compared to other available datasets (17,18). WoS also is the most used database in scientometric analysis (12,13). Comparing other sets of databases with WoS for mapping photovoice method research around the world can be done for future research.

Another restriction is the use of software to mine the publication. The datasets were identified using CiteSpace and WoS, rather than being collected manually. The datasets might be subject to bias due to the chance of irrelevant subjects being unintentionally included. The decision to balance between stringent criteria and over-excluding certain studies is a challenge. Future research aiming for high precision can consider using more stringent keyword searches to reduce the likelihood of irrelevant studies. Lastly, only the names of the principal (first) authors were used in the co-citation analyses performed in this study. Databases of cited publications downloaded from WoS did not include the names of other contributing authors even though citing publications did not possess such restriction. If additional author names were made available by these databases, the co-citation analysis may yield different results.

Despite these limitations, this study provides a comprehensive perspective on photovoice

publication between year 1997 to 2019. This paper facilitates other researchers on several issues such as: (i) the most productive countries in photovoice research were mainly developed countries (United States, Canada and United Kingdom). Hence, revealing the need for more collaboration between developing, less developed and develop countries in research activities focusing on this method to help strengthen world research capacity; (ii) Majority of research focuses on Public, Environmental & Occupational Health discipline, however, with increasing interest in social science, clearly there is a need for multidisciplinary research which serves as crucial platform for publication and exchange of research findings. Studies on disciplines other than health such as economic impact, environmental impact, intervention success and geology should be further encouraged in the future.

CONCLUSION

This study synthesizes the research of photovoice method from the year 1990 to 2019. It reveals the research landscape of photovoice in terms of the year, journals, co-cited journals, authors, countries, institutions, keywords, and references. The scientometric approach used in this study contributes to the body of knowledge by presenting a holistic perspective of photovoice research. This study benefits academia, industry practitioners and policy makers by providing an understanding of overall trends, status and potential research questions of study in this domain.

Conflict of interest

The authors declare no potential conflict of interest.

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