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A bibliometric analysis of COVID-19 publications in the ten psychology-related Web of Science categories in the social science citation index

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Abstract

Objective: The aim of this study was to analyze the characteristics of the COVID-19 publications in the ten psychology-related Web of Science categories in the social science citation index 10-month following the COVID-19 outbreak.

Methods: Six publication indicators were examined across authors, institutions, and countries.

Results: Analyses showed that the United States has produced the highest number of empirical investigations into the psychological impact of COVID-19, and the majority of the research across all countries was in clinical and psychopathology. Distribution of journals and psychology-related Web of Science categories were analyzed. Frequently used words in article title, author keywords, and KeyWords Plus were also presented.

Conclusions: The findings suggest that there are substantial clinical implications associated with COVID-19. There are recommendations offered for future research and clinical practice.

KEYWORDS
bibliometric, coronavirus, COVID-19, psychology, social science citation index

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Institution Where Work Conducted: Trend Research Centre, Asia University

1 | INTRODUCTION

The COVID-19 pandemic has had an impact on virtually every aspect of life in every corner of the world. Before the onset of this pandemic, it was widely expected that there would be systemic impact on psychological functioning given that virus containment requires extensive disruption in daily life (Taylor, 2019). The scope of psychological impact was further delineated in Gruber et al. (2021), where the manner of disruption from childhood through older adulthood, across every major psychiatric condition was described, with differential impact on racial and ethnic minority groups, and concluded with recommendations for potential intervention culled from clinical psychological science. Much of the anticipated adverse consequences from the COVID-19 pandemic was based on research from recent prior pandemics (i.e., SARS, MERS, Avian Flu, Ebola). Each of the prior pandemics this century has had significant psychological consequences, with research documenting the nature or scope of impact. As with prior pandemics (i.e., SARS; Skowronski et al., 2005), the COVID-19 outbreak has led to high engagement among psychological researchers, who have documented a wide range of impacts. In recognition of the rapid increase in psychological research on the impact of COVID-19, numerous journals instituted expedited review and publication policies. Additionally, many journals commissioned special issues that comprised both conceptual and editorial contributions in addition to empirically-driven investigations. Further, since the start of the pandemic, scholarly productivity has increased dramatically, and across all disciplines (Palaywe et al., 2020). Finally, to foster additional more carefully controlled research, several governmental research institutes and private foundations released grant programs specifically aimed at supporting this kind of work. In light of the high rate of research engagement on the psychological impact of COVID-19, this bibliometric analysis was undertaken. The value of this analysis, conducted approximately 10 months after the first documented observation of COVID-19 in Wuhan province (discussed in Spiteri et al., 2020), is to evaluate the rates of research productivity in different subdisciplines in psychology, across individual investigators, institutions, and countries, with recommendations for where future research might be concentrated. There have been several other bibliometric analyses of psychological research conducted related to COVID-19 (Maalouf et al., 2020; Nawaz et al., 2020), but none have evaluated subdisciplines and patterns of collaborations among institutions and individuals. Accordingly, this evaluation fills a gap in understanding where research into psychological research related to COVID-19 is concentrated. As shown in prior pandemics this century, it was expected that the majority of research would be in clinical and psychopathology (discussed in Brooks et al., 2020). This review can significantly contribute to resource allocation and refine research agendas for psychological research in general, and clinical and psychopathology research in particular, associated with the COVID-19 pandemic.

2 | METHOD

Data were retrieved on November 30, 2020, from the social science citation index (SSCI) Web of Science Core Collection by Clarivate Analytics. The SSCI indexes a total of 3490 journals across 58 Web of Science categories in 2019. Ten of the 58 Web of Science categories are related to psychology: applied psychology (84 journals), biological psychology (13 journals), clinical psychology (131 journals), developmental psychology (77 journals), educational psychology (60 journals), experimental psychology (87 journals), mathematical psychology (13 journals), multidisciplinary psychology (138 journals), psychoanalysis psychology (13 journals), and social psychology (64 journals). All COVID-19 related documents in psychology-related categories in SSCI can be searched out by keywords: "COVID-19," "COVID-2019," "2019-nCoV," and "SARS-CoV-2." It has been pointed out that the "front page" including paper title, abstract, and author keywords as filter could give more accurate bibliometric results (Fu et al., 2012). These search keywords were searched with the title (*TI*), abstract (*AB*), and author keywords (*AK*) in advanced search and the ten psychology-related Web of Science categories.

The Journal Citation Reports in 2019 was used to determine the impact factor of a journal (IF_{2019}). The obtained records were reorganized, using Microsoft Excel 2016, as recommended elsewhere (Li & Ho, 2008). The SSCI database designated the corresponding author as the "reprint author" but we retained the term "corresponding author" (Chiu & Ho, 2007). Moreover, we considered, only the last corresponding author in articles having multiple corresponding authors (Ho, 2019). Addresses of the authors were used to determine the type of collaborations. Affiliations in England, Scotland, Northern Ireland, and Wales were reclassified as being from the United Kingdom (UK) (Chiu & Ho, 2005).

The data analysis and visualization were performed using VOSviewer (Van Eck & Waltman, 2010), biblioshiny (RStudio) (Aria & Cuccurullo, 2017) and BibExcel (Persson et al., 2009). The biblioshiny interface was used to identify the data to obtain co-occurrence and collaboration network. The VOSviewer software was used to visualize the keyword co-occurrence network, co-occurrence network of subject category, coauthorship network and international collaboration.

3 | RESULTS

3.1 | Document type and language of publication

A total of 1254 COVID-19 documents in the ten psychology-related Web of Science categories in SSCI from the beginning stage of the COVID-19 outbreak, December 2019 up through November 2020 were found. Early access documents that were "in press" but not yet officially published were excluded. After removing early access papers there were a total of 970 documents. These were categorized into nine document types indexed in the Web of Science (Table 1). The most frequent type of article were empirical in nature, with 674 articles (69% of 970 documents) and the average number of authors per publication (APP) of 4.4. There were a total of 191 editorial materials across 68 journals, primarily in *International Psychogeriatrics* (27 editorial materials; 14% of 191 editorial materials), *Child and Adolescent Mental Health* (16, 8.4%), *Nature Human Behaviour* (13, 6.8%), *Journal of Adolescent Health* (12, 6.3%), and *Journal of Vocational Behavior* (10, 5.2%). In March, an article entitled "Brief report: Can political orientation explain mental health in the time of a global pandemic? Voting patterns, personal and national

TABLE 1 Authors according to the document

Document type	TP	TP*	%	AU	APP
Article	674	674	69	2972	4.4
Editorial material	191	188	20	572	3.0
Letter	41	41	4.2	139	3.4
Meeting abstract	34	34	3.5	157	4.6
Review	25	25	2.6	122	4.9
Correction	3	3	0.31	11	3.7
Biographical-item	1	1	0.10	1	1.0
Data paper	1	1	0.10	28	28
News item	1	0	0.10	0	N/A

Note: APP, number of authors per publication; AU, number of authors; N/A, not available; TP, number of articles; TP*, number of articles with author imformation in SSCI.

Abbreviation: SSCI, social science citation index.

coping resources, and mental health during the coronavirus crisis" (Mana & Sagy, 2020) in *Journal of Social and Clinical Psychology* and an editorial titled "Coronaphobia: Fear and the 2019-nCoV outbreak" (Asmundson & Taylor, 2020) in *Journal of Anxiety Disorders* were the earliest publications in psychology-related journals in SSCI. The article entitled "Using social and behavioural science to support COVID-19 pandemic response" (Van Bavel et al., 2020) by 42 authors from the United States, Brazil, United Kingdom, Poland, Netherlands, China, Australia, and Canada was the only document with more 100 citations from Web of Science Core Collection. "The novel coronavirus (COVID-2019) outbreak: Amplification of public health consequences by media exposure" (Garfin et al., 2020) in *Health Psychology* was the most frequently cited editorial material.

Additional analyses of bibliometric data was restricted to empirical papers, given the novelty of findings to incrementally address unique psychological consequences of this specific pandemic, and underwent typically more rigorous review than editorials. Only 674 COVID-19 articles in the ten psychology-related Web of Science categories in SSCI were further analyzed. A total of 666 COVID-19 articles (99% of 674 articles) were published in English, six in German, and two in Spanish.

3.2 | Publication distribution

In March, one COVID-19 article in the ten psychology-related Web of Science categories was published, and the rate sharply increased to a peak of 155 articles in August (Figure 1). Beginning in August, there were a large number of articles posted that were the aforementioned "early view" or "in press," and thus the trend lines show that the
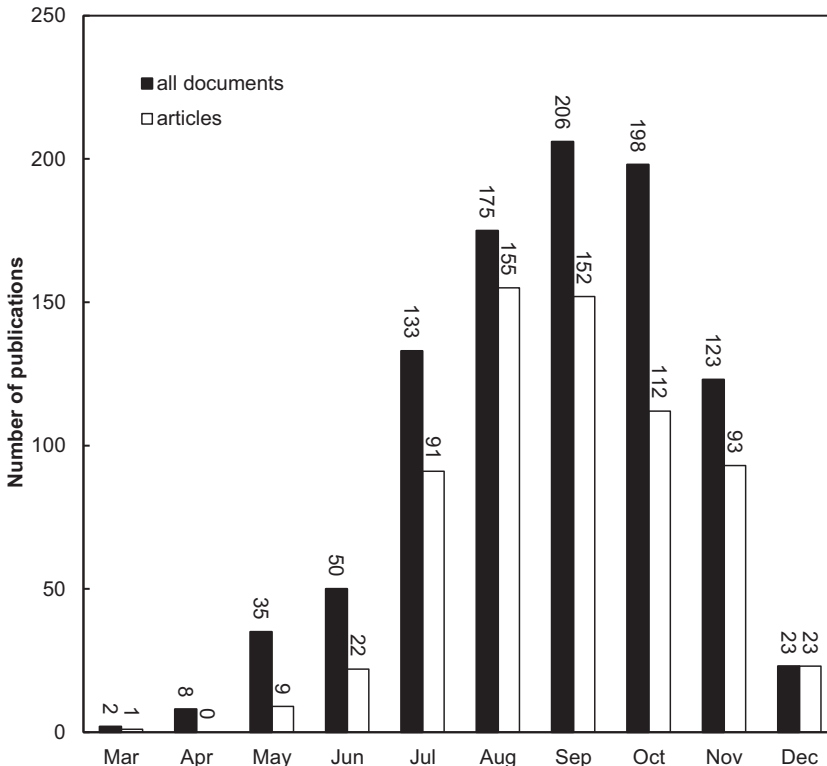

FIGURE 1 Number of COVID-19 articles in the ten psychology-related Web of Science categories by month

rate of publications are expected to continue to rise, particularly given that there continue to be additional waves of infections. Results in Figure 1 show the trendline of articles expected following August 2020 (Figure 2).

3.3 | Web of Science categories and journals

The ten psychology-related Web of Science categories were listed in Table 2. A total of 674 COVID-19 articles were published in nine of the ten categories. The highest representation of articles was clinical psychology with 318 articles (46% of 674 articles), while no COVID-19 article was published in the category of mathematical psychology. Articles published in the category of biological psychology had the highest authors per paper (*APP*) of 16. The high representation of clinical psychology in this bibliometric analysis is reasonable, considering that research from past pandemics has emphasized the high impact on psychological functioning, both in contributing to new onset of conditions and exacerbation of existing conditions (Gruber et al., 2021). The present bibliographic analyses show that while developmental and educational psychology ranked fourth and seventh respectively in the rate of publications in SSCI (see Table 2), these are also areas that deserve considerable attention. Globally, education has been disrupted due to the pandemic, through either school closings or shifting education to online platforms and home-based education. These changes have resulted in predictions of adverse developmental consequences, as well as anticipated negative effects on educational attainment (Viner et al., 2020). These educational impacts have additional impact on psychopathology and clinical psychology, and it can be expected that as educational psychology research increases, a corresponding increase in clinical should emerge as well (discussed in Jefsen et al., in press).

Table 3 shows the 10 journals that published 12 COVID-19 articles or more with journal impact factor in 2019 (IF_{2019}) and *APP*. The journal *Psychological Trauma-Theory Research Practice and Policy* ($IF_{2019} = 2.595$) in the
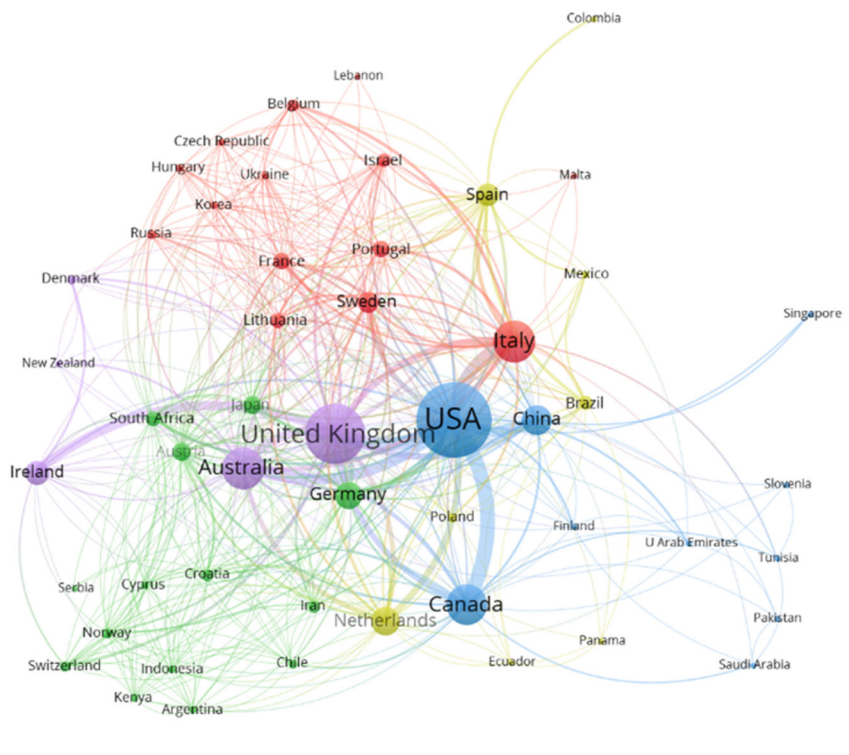
FIGURE 2 International collaboration of psychology-related COVID-19 research

TABLE 2 The ten psychology-related Web of Science categories in SSCI

Web of Science category in SSCI	TP (%)	APP	No. J
Clinical psychology	318 (46)	4.3	131
Multidisciplinary psychology	214 (28)	4.7	138
Social psychology	69 (8.9)	2.8	64
Developmental psychology	29 (7.9)	4.7	77
Applied psychology	22 (4.8)	3.6	84
Experimental psychology	22 (4.4)	12	87
Biological psychology	14 (3.2)	16	13
Educational psychology	14 (1.6)	2.1	60
Psychoanalysis psychology	10 (1.4)	2.0	13
Mathematical psychology	0 (0)	N/A	13

Abbreviations: APP, number of authors per article; N/A: not available; No. J, number of journals in a category in 2019; TP, total number of articles.

TABLE 3 The top 10 productive journals in the ten psychology-related Web of Science categories in SSCI

Journal	TP (%)	IF_{2019}	APP	Web of Science category in SSCI
Psychological Trauma-Theory Research Practice And Policy	153 (23)	2.595	3.0	clinical psychology
Frontiers in Psychology	148 (22)	2.067	4.9	multidisciplinary psychology
Journal of Adolescent Health	22 (3.3)	3.945	4.8	developmental psychology public, environmental and occupational health
Family Process	18 (2.7)	2.175	2.5	clinical psychology family studies
Journal of Loss & Trauma	18 (2.7)	0.769	2.8	social psychology
British Journal of Health Psychology	17 (2.5)	2.917	5.3	clinical psychology
Journal of Humanistic Psychology	15 (2.2)	1.902	1.7	multidisciplinary psychology
Nature Human Behaviour	13 (1.9)	12.282	17	biological psychology experimental psychology
Personality And Individual Differences	13 (1.9)	2.31	3.2	social psychology
British Journal of Social Psychology	12 (1.8)	2.736	3.5	social psychology

Note: APP, number of authors per article; IF_{2019}, journal impact factor for 2019; TP, total number of articles.
Abbreviation: SSCI, social science citation index.

categories of clinical psychology and psychiatry published the largest number of papers, with 153 articles (23% of 674 articles), followed by *Frontiers in Psychology* (IF_{2019} = 2.595) in the categories of multidisciplinary psychology with 148 articles (22%). Articles published in *Nature Human Behaviour* (IF_{2019} = 12.282) had the highest *APP* of 17. Additionally, based on journal impact factor, *Nature Human Behaviour* with 13 articles, was ranked first with the highest IF_{2019} of 12.282, followed by *Psychological Inquiry* with one article (IF_{2019} = 9.917).

3.4 | Countries, institutions, and authors

The 674 empirical COVID-19 articles in psychology-related Web of Science categories were from 73 countries. Altogether, 511 (76% of 674 articles) were single country articles from 52 different countries and 159 (24%) were internationally collaborative articles from 66 countries. The six publication indicators (Ho & Kahn, 2014; Ho et al., 2010) listed below were applied to compare publication performance: total articles (TP), single country articles (IP), internationally collaborative articles (CP), first-author articles (FP), corresponding-author articles (RP), and single-author articles (SP). Table 4 shows the 15 most productive countries published 11 COVID-19 articles or more. The United States dominated in the six publication indicators with TP of 310 articles (46% of 671 articles with author information in SSCI), IP of 238 single country articles (47% of 511 single country articles), CP of 72 articles (45% of 159 internationally collaborative articles), FP of 264 articles (39% of 671 first-author articles), RP of 269 articles (40% of 671 corresponding-author articles), and SP of 49 articles (50% of 98 single-author articles) followed distantly by other countries.

In total, 255 COVID-19 articles (38% of 671 articles) were single institute articles and 416 (62%) were inter-institutionally collaborative articles. The top 10 productive institutions with nine COVID-19 articles or more were listed in Table 5. Five of the top 10 institutions are located in the United States, two in Canada, two in Italy, and one in the United Kigdom. The Stanford University in the United States published the most 15 articles. The Stanford University and the University College London in the United Kingdom had the most collaboration partners, and with 12 collaborative articles. The University of British Columbia in Canada also published the most first-author articles, with a total of eight. Stanford University in the United States, the University of British Columbia in Canada, and the University of California-Los Angeles in the United States published the most corresponding-author articles, with six for each. Furthermore, the Columbia University in the United States published five articles and the University of Basque Country (UPV/EHU) in Spain published

TABLE 4 Fifteen productive countries published 10 COVID-19 articles or more

Country	Rank (TP)	Rank (IP)	Rank (CP)	Rank (FP)	Rank (RP)	Rank (SP)
USA	1 (310)	1 (238)	1 (72)	1 (264)	1 (269)	1 (49)
United Kingdom	2 (82)	4 (31)	2 (51)	3 (50)	3 (49)	5 (3)
Italy	3 (78)	2 (44)	3 (34)	2 (63)	2 (61)	5 (3)
China	4 (53)	5 (30)	6 (23)	5 (43)	5 (36)	3 (6)
Spain	4 (53)	3 (34)	7 (19)	4 (45)	4 (46)	2 (7)
Canada	6 (40)	7 (14)	4 (26)	7 (22)	6 (24)	12 (1)
Australia	7 (36)	8 (12)	5 (24)	8 (17)	8 (16)	7 (2)
Germany	8 (32)	6 (17)	8 (15)	6 (23)	7 (23)	4 (5)
Israel	9 (18)	9 (11)	14 (7)	9 (15)	9 (15)	7 (2)
Netherlands	10 (15)	12 (4)	9 (11)	11 (7)	10 (7)	N/A
France	11 (14)	13 (3)	9 (11)	10 (8)	10 (7)	12 (1)
Japan	12 (12)	11 (5)	14 (7)	14 (5)	14 (5)	12 (1)
Austria	13 (11)	13 (3)	13 (8)	14 (5)	18 (4)	N/A
Ireland	13 (11)	21 (2)	12 (9)	21 (3)	22 (3)	12 (1)
Sweden	13 (11)	31 (1)	11 (10)	21 (3)	22 (3)	12 (1)

Abbreviations: CP, internationally collaborative articles; FP, first-author articles; IP, single country articles; N/A, not available; RP, corresponding-author articles; SP, single-author articles; TP, total number articles.

TABLE 5 The top 10 productive institutes published nine COVID-19 articles or more

Institute	Rank (TP)	Rank (IP)	Rank (CP)	Rank (FP)	Rank (RP)	Rank (SP)
Stanford University, United States	1 (15)	3 (3)	1 (12)	3 (5)	1 (6)	N/A
Sapienza University of Rome, Italy	2 (12)	34 (1)	3 (11)	6 (4)	15 (3)	N/A
University College London (UCL), United Kingdom	2 (12)	N/A	1 (12)	6 (4)	15 (3)	N/A
University of Padua, Italy	2 (12)	34 (1)	3 (11)	6 (4)	15 (3)	N/A
Harvard Medical School, United States	5 (11)	N/A	3 (11)	16 (3)	6 (4)	N/A
University of British Columbia, Canada	6 (10)	N/A	6 (10)	1 (8)	1 (6)	N/A
Harvard University, United States	7 (9)	34 (1)	8 (8)	16 (3)	15 (3)	6 (1)
New York University (NYU), United States	7 (9)	34 (1)	8 (8)	6 (4)	15 (3)	6 (1)
University of California Los Angeles, United States	7 (9)	3 (3)	15 (6)	2 (6)	1 (6)	1 (2)
University of Regina, Canada	7 (9)	N/A	7 (9)	16 (3)	6 (4)	N/A

Abbreviations: CP, internationally collaborative articles; FP, first-author articles; IP, single country articles; N/A, not available; RP, corresponding-author articles; SP, single-author articles; TP, total number articles.

had the most single institution articles with four each. Only five institutions—Rhode Island College in the United States, the Family Institute at Northwestern in the United States, the University of California-Los Angeles in the United States, the Chicago School of Professional Psychology in the United States, and the Zhejiang University in China—had two single-author articles. The first COVID-19 article in the psychology-related category was published by Adi Mana from Peres Academic Center in Israel and Shifra Sagy from the Ben-Gurion University of the Negev in Israel.

There are 501 entries of collaborations among 72 countries worldwide maximum 17 to one collaboration. The minimum total link of strength of a country has been set to be three, and there were 51 countries to meet the thresholds. Figure 4 presents the international collaboration network on psychology-related COVID-19 literature around the world. The thickness of the lines indicates the strength of international collaboration between two countries. As the country with the most scientific production in this field, the United States also play an important role in connecting researchers among 47 countries in the academic world on psychology-related COVID-19. United States emerged as a top collaborator with Canada (17 publications), the United Kingdom (16 publications), Italy (15 publications) and Australia (12 publications), followed by Australia and United Kingdom, United Kingdom and Ireland, and United States and China (with 11 collaborated ppublications, respectively).
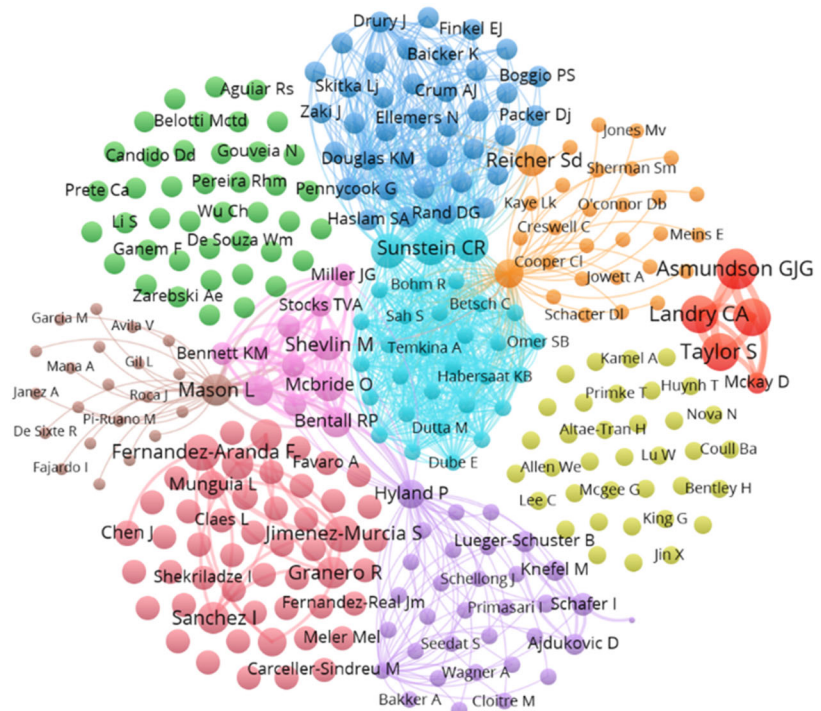
The 674 COVID-19 articles were published by 2717 authors including 647 first authors and 637 corresponding authors. Only 95 authors published single-author articles. G.J.G. Asmundson from the University of Regina in Canada published the most, at six articles, including one first-author article and two corresponding-author articles. Asmundson also published four editorial papers. D. McKay, C.A. Landry, M.M. Paluszek, M. Shevlin, and S. Taylor together published five articles, and ranked second. McKay from the Fordham University in the United States also published two first-atuhor articles and corresponding-author articles, as well as two editorial papers. Asmundson and McKay published four collaborative articles and two collaborative editorial papers. S. Taylor from the University of British Columbia in Canada published the most, at four first-atuhor articles and three corresponding-author articles, respectively, as well as two editorial paper. All seven publications by Taylor were collaborative with Asmundson, and included three collaborative articles with McKay. M. Shevlin from the Ulster University in the United Kingdom published two first-authors articles. Only three authors—Z.M. Cui from ACT Inc. in the United States, T. DuBose from Chicago School of Professional Psychology in the United States, and J.L. Lebow from Family Institute at Northwestern in the United States—published two single-author articles.

A total of 2717 authors have participated in the publication of the psychology-related COVID-19 papers. Of the 674 documents considered for the study there were 98 single-authored publications. The authors per publication was 4.03 on average, with the maximum number of authors 54. The co-authorship network of the top 300 authors is shown in Figure 3. The total link strength attribute indicates the total strength of the co-authorship links of a given author with other authors. Asmundson, Gordon J. G. from Univ Regina of Canada contributed six articles on psychology-related COVID-19 with the highest total link strength of five. The main collaborators with him are Taylor, Steven from Univ British Columbia, Landry, Caeleigh A and Paluszek, Michelle M from Univ Regina and McKay, Dean from Fordham Univ, as shown by the red color cluster.

3.5 | Words in title, author keywords, and *KeyWords Plus*

Methodologies for evaluating the frequency of keywords used has been developed, and adopted in this analysis (Mela et al., 1999). To minimize some limitations, such as the uncompleted meaning of single words in the title, the small sample size for author keywords, and the indirect relationship between *KeyWords Plus* and the research emphases, analysis of words in the title, author keywords, and *KeyWords Plus* together was applied (Fu & Ho, 2013). COVID-19 as the search keyword was used in 520 article titles (77% of 674 articles), with neglible rates for articles with coronavirus (60 articles; 8.9%) in the titles. The top three search keywords—"pandemic," "health," and "mental"—were used in article titles (Table 6). Again COVID-19 was used as the author keywords in 447 articles (71% of 631 articles with author keywords information in SSCI). A total of 1644 author keywords were used. Of these, 1322 keywords (80% of 1644 keywords) were used one time. Only 28 author keywords were used 20 times

FIGURE 3 Co-authorship of psychology-related COVID-19 research

TABLE 6 The top ten words of the title, author keywords, and *KeyWords Plus* in COVID-19 articles were published in the ten psychology-related categories in SSCI

Word in title	R (%)	Author keyword	R (%)	*KeyWords Plus*	R (%)
COVID-19	1 (77)	COVID-19	1 (71)	depression	1 (12)
pandemic	2 (34)	pandemic	2 (16)	stress	2 (11)
health	3 (19)	coronavirus	3 (15)	health	3 (11)
mental	4 (11)	mental health	4 (14)	mental-health	4 (8.3)
psychological	5 (11)	anxiety	5 (9.0)	anxiety	5 (7.7)
coronavirus	6 (8.9)	depression	6 (6.5)	impact	5 (7.7)
impact	7 (8.6)	stress	7 (5.7)	sars	7 (6.9)
social	8 (8.0)	trauma	8 (5.1)	risk	8 (5.4)
outbreak	9 (6.4)	COVID-19 pandemic	9 (4.0)	care	9 (4.6)
stress	10 (5.8)	resilience	10 (3.8)	model	9 (4.6)

Note: R: rank; %, the percentage of the frequency of a given word in the title, author keywords, or *KeyWords Plus* to the total number of articles.

or more. A total of 1044 *KeyWords Plus* were found in 480 articles published in 83 journals. Of these, 725 (69% of 1044 *KeyWords Plus*) were used once, and 41 ten times or more. Table 6 shows the top ten used words of the title, author keywords, and *KeyWords Plus* in COVID-19 articles published in the ten psychology-related Web of Science categories in SSCI. What is notable is that research has sharpened to highlight the impact COVID-19 has on anxiety and depression, as well as on associated problems (i.e., substance use; McKay & Asmundson, 2020a, 2020b). In further our understanding of how this pandemic has impacted the public psychological health is framing it through the behavioral immune system (BIS; Schaller & Duncan, 2007), which provides an explanatory structure to understand both the individual anxiety and avoidance responses due to the pandemic, as well as the social sequelae (i.e., xenophobia). The BIS was expressly cited by Taylor (2019) in describing psychological reactions that could be expected due to a future pandemic. Given the recency of the BIS model, and the emergence of a multifactorial syndrome (Taylor et al., 2020), there remains considerable room for additional research in this domain. Specifically, the extent and depth of consequences on anxiety and mood disorders warrant additional investigation given the widespread presence of each in the public, and the exacerbation of these due to the pandemic.

A total of 1636 different author's keywords have been used for psychology-related COVID-19 research. Figure 4 presents the keyword co-occurrence network from VOSviewer software. The minimum total link strength of 30 was selected; hence, 69 items met this criterion containing six clusters. The size of the circle shows the number of occurrence and total strength links with other keywords. The curves between the circles represents their co-occurrence in the same article. The shorter the distance between two circles, the larger the number of co-occurrence of two items. Each color represents the separate cluster. The keywords that appeared most were COVID-19 (total link strength 20,546) and pandemic (total link strength 6511). The top keywords with a significant number of occurrences and total link strength are mostly related to factors and performance of covid mental health. The top five keywords were COVID-19, pandemic, coronavirus, mental health and anxiety, which occurred 450, 98, 97, 87, and 57 times, respectively.

3.6 | Co-occurrence network of subject category

There are 26 subject categories involved in psychology-related COVID-19 publications, and a half of the total (347 articles) were also involved other subjects. The subject co-occurrence network containing eight clusters is shown in

Figure 5. The closer two subject categories are located to each other, the stronger their relatedness. In addition to "psychology," the subject category "psychiatry" is on the top of the list with 224 publications, followed by "pediatrics" with 26 publications, "environmental and occupational health public" with 23 publications, "neurosciences & neurology" with 23 publications and "family studies" with 19 publications. Some subjects that are not directly related to psychology, such as "business & economics," "engineering," "sport sciences," etc., have also contributed to this field. "Psychology" and "psychiatry" have strong correlation with other high-impact subject categories.

4 | DISCUSSION

A total of 674 COVID-19 documents in the ten psychology-related Web of Science categories in SSCI were found after the COVID-19 outbreak in December 2019 through November 2020. The first document was published in March in the *Journal of Social and Clinical Psychology*. An extremely high increasing trend of published articles was found since June. The majority of COVID-19 articles were published in the Web of Science category of clinical psychology. *Psychological Trauma-Theory Research Practice and Policy* published the largest proportion of papers on this topic. Authors from a total of 73 countries published the COVID-19 articles, primarily with no international partners. The United States was the dominant country with six publication indicators. Stanford University in the United States ranked top in three publication indicators. Asmundson, McKay, and Taylor were the most productive authors. Stress, mental health, and depression were the most concerned topics in the psychology field.

The findings from these analyses further show that, while there is high research engagement among clinical psychologists, much of the published work has focused on factors influencing psychological sequelae from
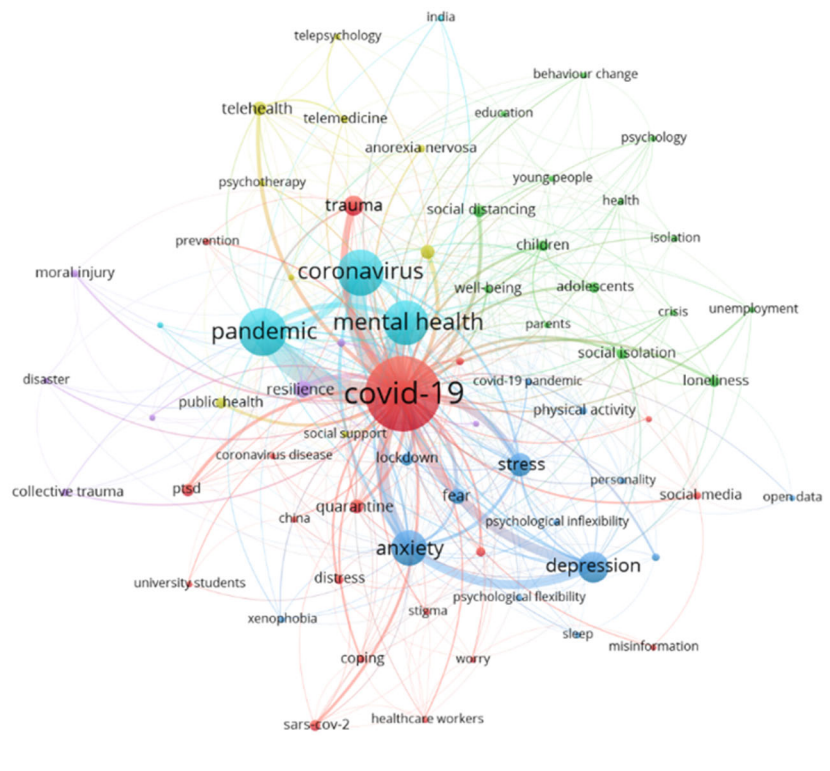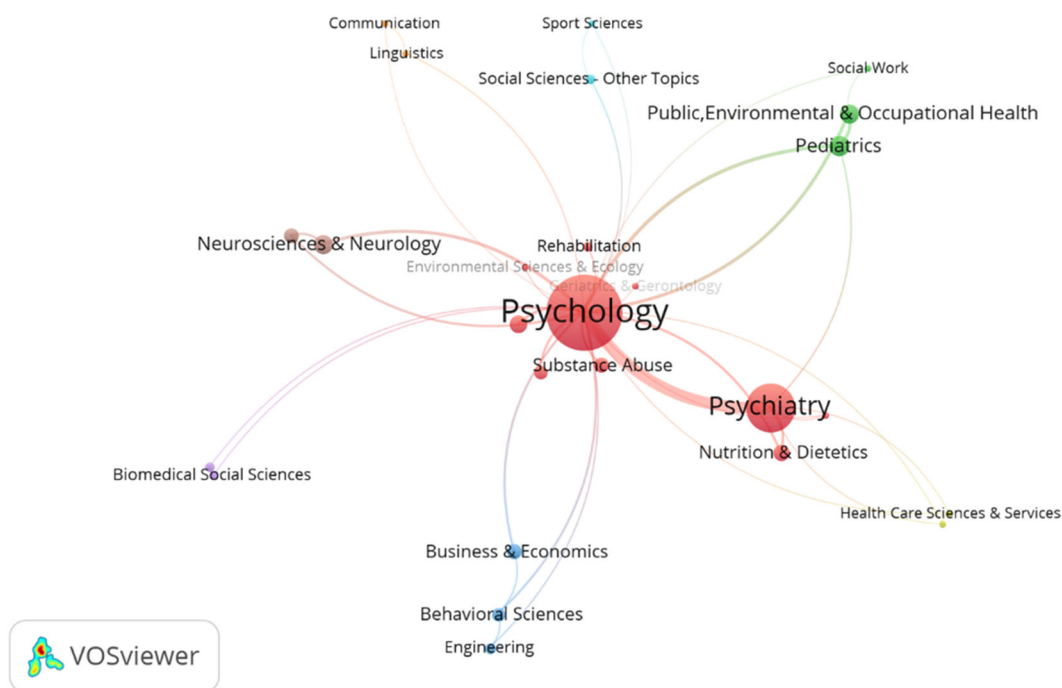

FIGURE 4 Keyword co-occurrence network of psychology-related COVID-19 research

FIGURE 5 Co-occurrence network of subject category of psychology-related COVID-19 research

COVID-19, and thus far there is limited work on treatment of the consequences of the pandemic. A large group of clinical psychological scientists wrote a comprehensive call for research and treatment engagement related to COVID-19 specific stress reactions (Gruber et al., 2021). While it is reasonable to expect a lag in treatment related findings, typically some case illustrations would show up at this point. To our knowledge, there are as yet no systematic case studies, however. The publication trends from prior pandemics this century has suggested that psychopathology and clinical psychology researchers have identified significant adverse effects from widespread disease risk (i.e., Skowronski et al., 2005). Considering the broad global systemic consequences of COVID-19, as well as the far longer timeline of its impact on the public, it is anticipated that research into the clinical and psychological effects of the virus will continue for some time, both during the acute phase of the public health crisis, and in it's immediate aftermath. In a similar vein to the lag in research on treatment of COVID-19 stress, education and developmental research has lagged. The challenge in this domain is from ensuring informed consent and assent, as well as the more time demanding nature of research in this subspecialty. We expect that in the next several months there will be a significant increase in published work in this subspecialty as researchers begin to prepare interim reports. Some early reports have documented challenges faced by educators in developing ways to engage in teaching while relying on modern digital technologies (i.e., Crawford et al., 2020). We anticipate that research on education methods, and their associated impact on social and emotional functioning and development will be published over the next 6–12 months, particularly as regions experience differential recovery from the pandemic. The findings from these analyses, specifically the co-occurrence network illustrated in Figure 5, shows that the broad implications of COVID-19 have been demonstrated that connect psychological findings to numerous other areas, including public health, nutrition, rehabilitation, and economics. In line with recommendations from other recent bibliometric analyses (Chahrour et al., 2020), additional research, including cross-disciplinary investigations. The need for cross-disciplinary work has been emphasized elsewhere recently, where it was shown that social sciences lagged generally in producing research on the consequences of COVID-19 compared to other health sciences (Aristovnik et al., 2020).

Considering the growing recognition of clinical and psychopathology impact of COVID-19, the findings from this bibliometric research has implications for treatment. First, practitioners should integrate assessment of how facets of the pandemic has affected their clients, regardless of reason for presenting for treatment. The available research suggests that the pandemic has adverse impact on every mental health condition (Gruber et al., 2021). Second, as recent research in obsessive-compulsive disorder illustrates, clinicians also face specific adverse consequences from the pandemic in how they may engage in delivering therapy (Sheu et al., 2020). Additionally, some changes in how treatment is delivered is expected to have lasting consequences, with some adjustments likely to continue well after the pandemic has ended, specifically telepsychology (Pierce et al., 2020). Third, research into the multisystemic consequences of the pandemic, particularly in disadvantaged communities as well as with essential workers, should continue to identify ways to provide care and address disparities these groups face in receiving care. While the findings from this bibliometric analysis are encouraging in showing high engagement by the psychological research community into the impact of COVID-19, there are several limitations worth noting. First, the analyses presented here do not address the relative quality of the research produced. Future research syntheses should refine the analyses to include quality assessments of published work to refine the assessment of areas in need of more rigorous investigation. Second, there is a high representation of editorial and opinion pieces. Editorials and letters accounted for approximately 24% of the publications. These contributions are meritorious, of course, in that these provide perspectives that can inform empirical investigations. Accordingly, the rate of empirical work is lower than the total number of publications. Third, while it was noted above that developmental and educational research deserves greater attention, it is also observed that research in those areas are more challenging to conduct than some of the clinical research, where community surveys can be readily deployed and analyzed. It is expected that, considering the funding streams that emerged during the pandemic that more controlled and rigorous psychological research will be published in the near term.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author, and are posted in full to the Open Science Framework.

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APPENDIX A

Publication performance of authors were further analyzed with the Y-index which is related to the number of first-author publications (FP) and corresponding-author publications (RP). The Y-index combines two parameters (j, h), to evaluate the publication potential and contribution characteristics as a single index. The Y-index is defined as (Ho, 2012, 2014a):

$$j = FP + RP$$

$$h = \tan^{-1}\left(\frac{RP}{FP}\right)$$

where j is the publication potential, a constant related to publication quantity; and h is publication characteristics which can describe the proportion of RP to FP. The greater the value of j, the greater the number of first- and corresponding-author articles by the author. Different values of h represent different proportions of corresponding-author articles from first-author articles.

$h = \pi/2$, j is the number of corresponding-author articles;

$\pi/2 > h > 0.7854$ indicates more corresponding-author articles;

$h = 0.7854$ indicates the same number of first- and corresponding-author articles;

$0.7854 > h > 0$ indicates more first-author articles;

$h = 0$, j is the number of first-author articles.

Y-index was applied to evaluate the authors in 672 articles (99.6% of the 675 articles) with both of first author and corresponding author information in SSCI. A total of 672 articles were published by 2711 authors in

which 1922 authors (71% of 2711 authors) had no first- or corresponding-author articles with Y-index = (0, 0); 144 (5.3%) authors published only corresponding-author articles with $h = \pi/2$; eight (0.30%) authors published more corresponding-author articles with $\pi/2 > h > 0.7854$; 481 (18%) authors published the same number of first- and corresponding-author articles with $h = 0.7854$; four (0.15%) authors published more first-author articles with $0.7854 > h > 0$; and 152 (5.6%) authors published only first-author articles with $h = 0$. Figure A1 shows distribution of the Y-index (j, h) of the top 502 authors with $j \geq 2$. Each dot represents one value of the Y-index that could be one author or many authors (Ho, 2014b), for example E. Kazlauskas and other 463 authors who share the same Y-index = (2, 0.7854). S. Taylor from the University of British Columbia in Canada had the highest publication potential with a j of 7 and Y-index = (7, 0.6435). Taylor published five articles including the most four first-author articles and most three corresponding-author articles, and the most four single-author articles. K.M. Fitzpatrick from the University of Arkansas in United States ranked 2nd with Y-index = (6, 0.7854). Fitzpatrick published three articles as the first author and also the corresponding author. D. McKay from Fordham University in USA and other 15 authors had Y-index = (4, 0.7854). However, McKay published second most five articles including two first author and corresponding author respectively. J.X. Chen with Y-index = (3, $\pi/2$), G.J.G. Asmundson and other seven authors Y-index = (3, 1.107), and S. Kaur, X. Zhou, and S. Barello with Y-index = (3, 0.4636) had a j of 3. These authors are located on the same curve ($j = 3$) in Figure A1, indicating that they had the same publication potential with the same value of j but different publication characteristics (Ho & Hartley, 2016). Chen published only corresponding-author articles with h of $\pi/2$. Asmundson published higher ration of the number of corresponding-author articles to the number of first-author articles with an h of 1.107. Kaur published lower ration of the number of corresponding-author articles to the number of first-author articles with an h of 0.4636. Similarly, D. Marchetti and other four authors with Y-index = (2, $\pi/2$), E. Kazlauskas and other 463 authors with Y-index = (2, 0.7854), and M. Shevlin, M. Chao, and C.Y. Lin with Y-index = (2, 0) are also located on the same curve ($j = 2$). Marchetti published only corresponding-author articles with h of $\pi/2$. Kazlauskas published the same number of first-author articles and corresponding-author articles with h of 0.7854. Shevlin published only first-author articles with h of 0. These authors had the same publication potential with a j of 2 but the publication characteristics were also different. K.M. Fitzpatrick with Y-index = (6, 0.7854), D. McKay and other 15 authors with Y-index = (4, 0.7854), and E. Kazlauskas and other 463 authors with Y-index = (2, 0.7854) are located on the line ($h = 0.7854$),

TABLE A1 The top nine productive authors with four or more articles

Authors	Rank (TP)	Rank (FP)	Rank (RP)	h	Rank (j)
G.J.G. Asmundson	1 (6)	25 (1)	4 (2)	1.107	19 (3)
D. McKay	2 (5)	3 (2)	4 (2)	0.7854	3 (4)
C.A. Landry	2 (5)	N/A	N/A	0	790 (0)
M.M. Paluszek	2 (5)	N/A	N/A	0	790 (0)
M. Shevlin	2 (5)	3 (2)	N/A	0	31 (2)
S. Taylor	2 (5)	1 (4)	1 (3)	0.6435	1 (7)
F. Fernandez-Aranda	7 (4)	25 (1)	4 (2)	1.107	19 (3)
E. Kazlauskas	7 (4)	25 (1)	33 (1)	0.7854	31 (2)
P. Hyland	7 (4)	N/A	N/A	0	790 (0)

Abbreviations: FP, first-author articles; j and h, constant of Y-index; N/A, not available; RP, corresponding-author articles; TP, total number of articles.
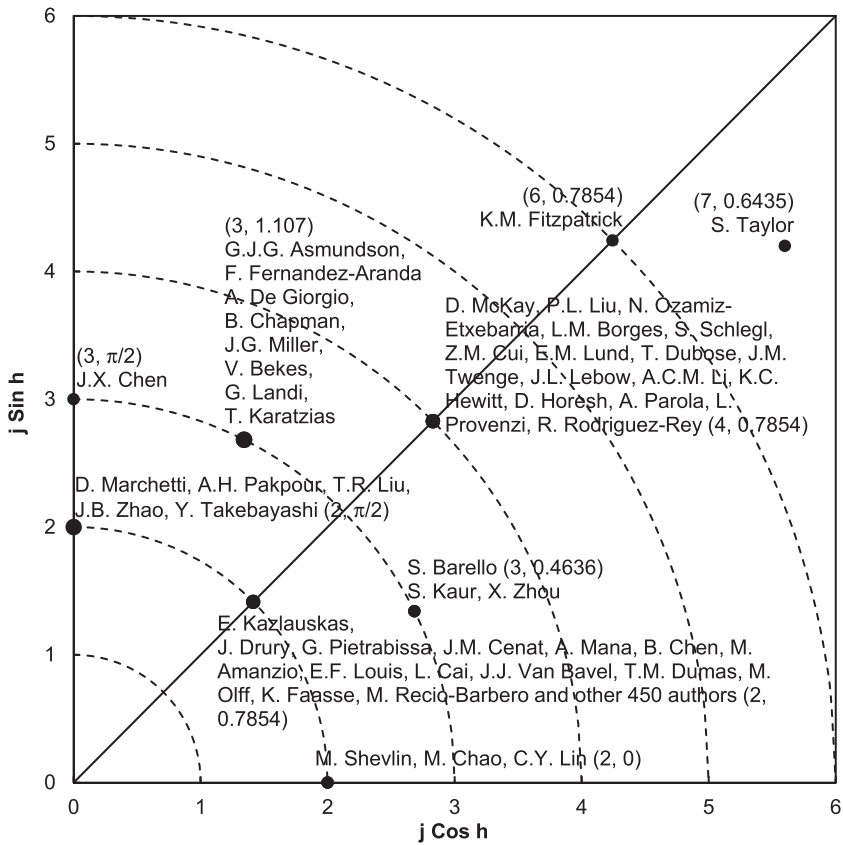
FIGURE A1 Distribution of the top 502 authors with their Y-index values ($j \geq 2$)

indicating that they had the same publication characteristics but different publication potential (Chuang & Ho, 2015). Fitzpatrick had the greater publication potential with a *j* of 6, followed by McKay with a *j* of 4 and then Kazlauskas with a *j* of 2. It has been pointed out that a bias in analysis of authorship might occur when different authors had the same name, or one author used different names (eg. maiden names) in their articles (Zhang et al., 2012).