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Future Business Journal (2023) 9:103
https://doi.org/10.1186/s43093-023-00275-4

Future Business Journal

REVIEW

Open Access

A scientometric analysis of entrepreneurship research in the age of COVID-19 pandemic

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Abstract

This article conducted a scientometric analysis of entrepreneurship research during the COVID-19 pandemic and its aftermath. The results show that the research focused on four thematic research clusters, namely (a) entrepreneurship and crisis management (b) social entrepreneurship and collaborative networks (c) entrepreneurship and entrepreneurial intentions, and (d) entrepreneurship and adaptation measures to the COVID-19 pandemic. Our analysis shows that while the COVID-19 pandemic has had significant negative impacts on entrepreneurship, innovation, digital transformation, resilience and adaptability, dynamic capabilities and organisational learning, collaborative networks, government support and customer-centric approaches enabled entrepreneurs to navigate the crisis. The review highlights the role of digital technologies, self-efficacy, organisational resilience, social entrepreneurship and entrepreneurship education in promoting small business development in the post-pandemic era.

Keywords Entrepreneurship, Small business, COVID 19 pandemic, Scientometric analysis

Introduction

The outbreak of the COVID 19 pandemic had a negative impact on business prospects in many countries. Many sectors were negatively affected, with companies and small businesses reporting lower or even negative growth. There have been supply chain disruptions, an economic downturn, and job losses [1–4]. The crisis also brought challenges to education systems in developing countries [5], lowered agricultural productivity [6, 7], hindered access to input and output market [8], and distorted efforts to achieve sustainable development goals [9]. Various response measures taken to combat the COVID 19 pandemic, such as lock downs, quarantine and social isolation impacted a variety of industries and small businesses, causing disruption to manufacturing activities and volatility in revenues. Many companies resorted to digital innovation to survive and respond to the crisis. This development accelerated digital transformation as many businesses switched to online delivery of services, including online ordering of products, online food ordering, online learning, and telecommuting. Individual consumption habits also changed, with some countries showing a greater preference for snacks and take-away meals. The aim of this study is to synthesise the literature on entrepreneurship during the COVID-19 pandemic and its aftermath, this is important to locate key knowledge bases and highlight future research agendas. Several review studies have been conducted to assess the effect of COVID 19 on entrepreneurship, with a focus on areas such as the impact of COVID 19 on economic sectors, the policy response to COVID 19, organizational coping and survival strategies, crisis management, and resilience and recovery strategies. These include, but are not limited to, studies on the economic impacts of the COVID-19 pandemic on small enterprises and entrepreneurship [10] and supply networks, companies, and manufacturing [11]. The optimization of MSMEs' empowerment in the face of competition in the global market during the COVID-19 Pandemic time, and the

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hospitality industry in the face of the COVID-19 Pandemic [12] are a few examples. Marketing mix strategies during and after the COVID-19 pandemic and recession are another. The majority of these studies, however, have employed systematic methods for literature reviews and have either examined the consequences of COVID 19 or the potential avenues for a legislative reaction and industrial recovery. The objective of this study is to synthesize the literature in a thorough manner in order to identify the research themes in entrepreneurship during and after the COVID 19 pandemic and offer some potential future research areas using scientometric approaches between the years 2020 and 2023. The specific objectives were:

- Identify the leading entrepreneurship authors, institutions, and countries during and after the COVID-19 pandemic.
- Locate the key knowledge bases and research clusters related to entrepreneurship during and after the COVID 19 pandemic, discuss the essential elements of the main studies, and discern trending research topics.

Methods and data

We use scientometric approaches, a quantitative analysis of research on the development of the field in this work. In order to map a particular field of knowledge using information taken from the academic database, it measures the impact of research and evaluates citation links. Research trends and future priorities as they are reflected at the research frontiers were mapped using citation analysis, keyword evolution, and bibliographic coupling [13]. The information came from Web of Science, which includes more than 12,000 journals with ISI indices [14, 15]. The search terms used were "entrepreneurship" OR "micro, small, and medium enterprises" OR "SMEs" OR "small business" AND "COVID-19" OR "*nCoV" OR "SARS-CoV-2" OR "new coronavirus" OR "coronavirus disease 2019" OR "severe acute respiratory syndrome coronavirus-2" and were limited to the title, abstract, and keywords. Previous research has shown that scientometric approaches analyse a large amount of literature and provide a nuanced summary of a particular field [16]. For example, Ante et al. [17] used a sample of 166 peer-reviewed articles to conduct a bibliometric analysis on blockchain and energy, Niknejad et al. [18] used 171 articles to map research trends on blockchain technology in the food and agriculture industry, and Ho and Mukul [19] used 13,918 documents to analyse publication performance and trends in mangrove forests. In this study, a total of 382 publications were analysed, which included articles and reviews from the fields of business and economics, psychology, information and library science, computer science, engineering, operations research, and management sciences. A systematic identification of articles was performed as shown in Fig. 1.

Results and discussion

Leading authors, institutions, and countries on entrepreneurship during and after the COVID-19 pandemic

The leading authors, institutions and countries on entrepreneurship during and after COVID -19 pandemic are shown in Table 1. The authors with the most influence, according to the number of citations, are Vatten V., Fairlie R., and Jones, P., with 368, 215, and 92 citations, respectively. Based on a number of outlets, Vatten V. is the most productive researcher with 10 publications. La Trobe University, University of California Santa Cruz, and University of Reading are the three universities that have received the most citations, with 443, 215, and 157, respectively. The top three countries in terms of citations are the United States, Australia, and the United Kingdom, with 868, 559, and 488 citations, respectively.

The top 10 most frequently cited articles

In Table 2 we show the citation history of the ten most cited articles in entrepreneurship research during and after the COVID-19 pandemic. Citation frequency reflects the impact of scientific publications, although this does not necessarily correlate with paper quality [20]. "The best articles can be classified as articles that most researchers can read and cite in peer-reviewed journals" [21]. Therefore, we discuss the five most frequently cited articles:

i. Employee Adjustment and Well-Being in the Era of COVID-19 [22]

The work of Carnevale and Hatak [22] received the highest citations. This paper discusses the human resource management (HRM) challenges during the COVID-19 crisis and how to enable human resources to cope and adapt to the new work environment. COVID-19 containment measures such as remote working, working from home, physical distancing resulted in increased feelings of loneliness and social exclusion among employees and childless and single employee were at relatively higher risk [23]. Previous research has shown that people working from home tend to report less inclusion than those working in traditional work arrangements [24], potentially leading to negative impacts on health- and well-being-related consequences and low productivity in many organizations. Carnevale & Hatak [22] propose social support from others to reverse the downsides of COVID 19 pandemic in particularly

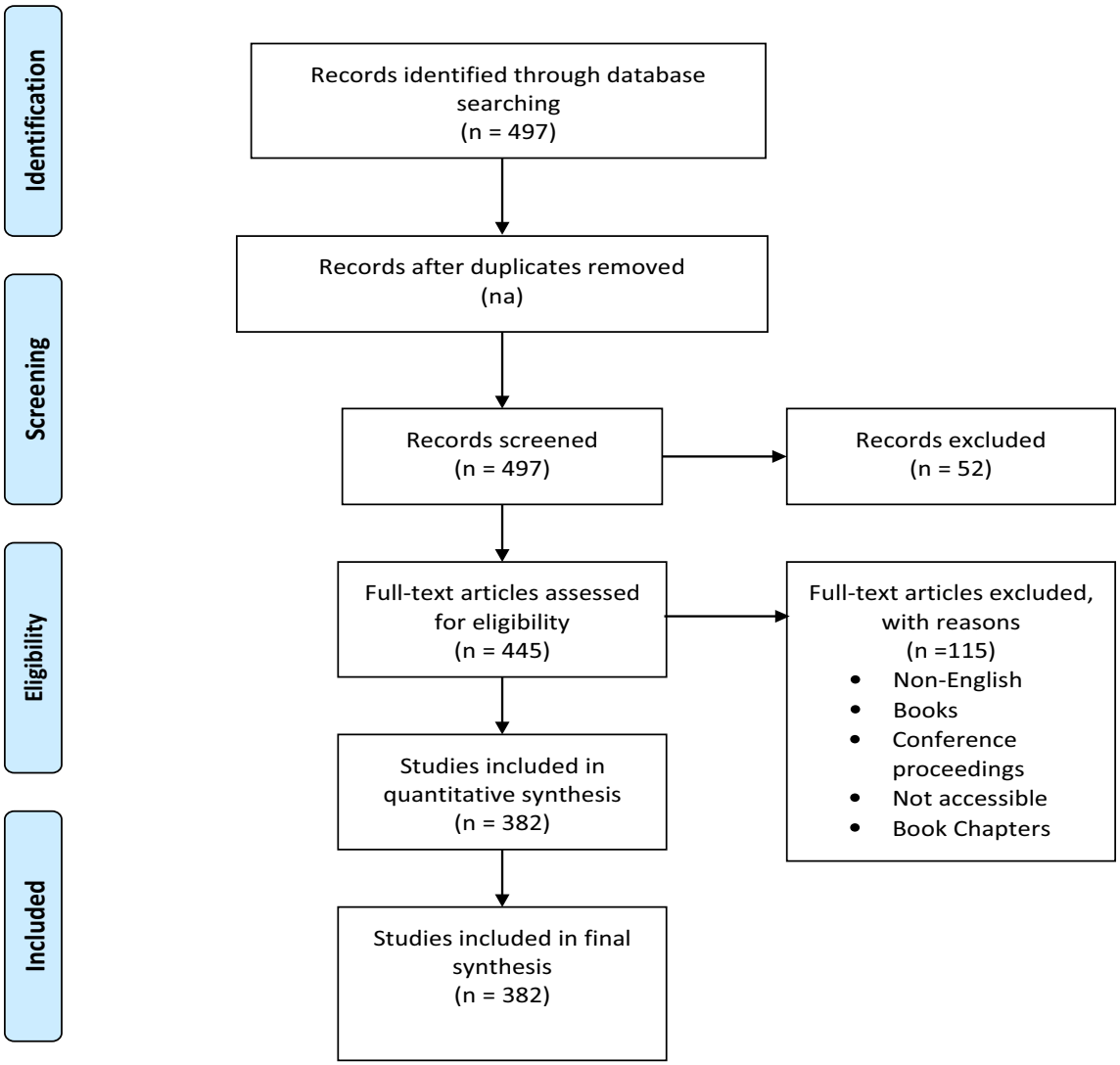

Fig. 1 The process for selecting records

through more inclusive approach taking into account different forms of family status.

ii. The impact of COVID-19 on small business owners [25]

Fairlie [25] is one of the first studies on COVID 19 to discuss the impact of COVID 19 on small business owners in the United States, showing that the decline in business and losses were felt across almost all industries, with African American businesses suffering the 41% decline in business activity, followed by Latino businesses (32%) and Asian companies (26%, as well as female business (25%). This study shows that the continued decline in business could have a negative impact on overall racial inequality due to the importance of small businesses in local job creation, economic advancement, and longer-term wealth inequality.

iii. The challenges and opportunities of a global health crisis: the management and business implications of COVID-19 [26]

This article was one of the first to provide an overview of the global supply chain disruption due to the COVID-19 pandemic. It shows that the pandemic brought risks and vulnerabilities to the electronics and semiconductor industries, challenging them to redesign their global supply chain model. It underlines the importance of resilience, strategic agility as well as entrepreneurship and government support for firms and societies in the fight against COVID-19. It suggests the use of

Table 1 Top 15 authors, institutions, and countries on entrepreneurship during and after COVID -19 pandemic

TC	Authors	TP	TC	Organization	TP	TC	Country	TP
368	Vatten V	10	443	La Trobe University	11	868	USA	60
215	Fairlie R	3	215	University California Santa Cruz	3	559	Australia	28
92	Jones, P	2	157	University of Reading	2	488	England	42
86	Cowling M	2	107	Iza (Institute of Labor Economics)	5	365	Spain	32
83	Brown R	1	92	Swansea University	2	362	Germany	25
83	Rocha, A	1	86	University Derby	2	350	Switzerland	5
81	Thurik R	2	83	University St. Andrews	2	265	Pakistan	13
77	Kritikos A	4	81	Erasmus school of Economics	2	253	Italy	27
75	Buck C	1	81	Montpellier Business School	2	253	China	33
75	De waal G	1	77	RMIT University	2	241	France	11
75	Maritz, A	1	77	Tecnologico Monterrey	3	140	Netherlands	12
75	Perenyi A	1	76	University Potsdam	3	124	Canada	16
62	Ndou, V	2	75	Gut	1	119	Scotland	7
53	Belitski M	1	75	Swinburne University of Technology	1	112	Portugal	12
53	Guenther C	1	75	University of Bayreuth	1	107	Wales	3

Table 2 Table Top 10 most frequently cited articles

Author	Title	Total Citations	TC Per Year	Normalized TC
Carnevale and Hatak [22]	Employee Adjustment and Well-Being in the Era of COVID-19: Implications for Human Resource Management	328	82	6.49
Fairlie [25]	The impact of COVID-19 on small business owners: Evidence from the first 3 months after widespread social-distancing restrictions	170	42.5	3.36
Liu et al. [26]	The challenges and opportunities of a global health crisis: the management and business implications of COVID-19 from an Asian perspective	104	26	2.06
Rizvi et al. [27]	Covid-19 and asset management in EU: a preliminary assessment of performance and investment styles	100	25	1.98
Brown et al. [28]	Financing entrepreneurship in times of crisis: Exploring the impact of COVID-19 on the market for entrepreneurial finance in the United Kingdom	83	20.75	1.64
Maritz et al. [50]	Entrepreneurship as the Unsung Hero during the Current COVID-19 Economic Crisis: Australian Perspectives	75	18.75	1.48
Al-Omoush et al. [34]	The impact of social capital and collaborative knowledge creation on e-business proactiveness and organizational agility in responding to the COVID-19 crisis	73	18.25	1.44
Portuguez Castro et al. [31]	Being an entrepreneur post-COVID19 – resilience in times of crisis: a systematic literature review	71	23.67	8.58
Ratten [41, 42]	Coronavirus and international business: An entrepreneurial ecosystem perspective	68	17	1.35
Ratten [41, 42]	Coronavirus (Covid-19) and the entrepreneurship education community	65	16.25	1.29

predictive models that take uncertainties and risk factors into account in supply planning, as well as greater collaboration between governments and industries to reduce disruptions in global supply chains in the future.

iv. Covid-19 and asset management in EU [27]

Rizvi et al. [27] examined how the COVID-19 pandemic affected financial markets between January and May 2020. The results show that managers migrated from high-risk options to low-risk options as an investment strategy. Likewise, a shift from high-risk

sectors to relatively less sensitive sectors and a transition of investments from countries with higher to those with lower cases were observed. However, it was found that social entrepreneurship funds had a consistent investment style at all phases, partly due to their superior risk-adjustment performance and managers did not find a need to change their investment mix.

v. Financing entrepreneurship in times of crisis [28]

The authors of this study examine how the COVID-19 crisis impacted key sources of entrepreneurial finance in the United Kingdom. The results show that seed financing was severely affected by the crisis and entrepreneurial start-ups faced the greatest financing obstacles. However, the government took some policy support measures, including the establishment of a new Future Fund with a budget of 250 million euros, and further support concerned debt financing in the form of loan guarantees and direct subsidized loans, as proposed by the OECD 29. However, greater resilience was observed in the UK compared to other countries such as China, which may be due to the more established nature and denser networks of equity finance players in the UK entrepreneurial finance market compared to countries such as China and the use of mobile technology [28].

A co-word analysis of entrepreneurship topics or themes during and after COVID 19 Pandemic

With the aid of a strategic diagram and author keywords, co-word analysis was employed to display keyword clusters. The strategic diagram (Fig. 2) aids in illustrating the research field and its identified sub-field. It displays themes along two axes—X-axis centrality and Y-axis density with four quadrants—according to their centrality and density rank scores. The strategic digram map shows that innovation, enterprise, firms, universities, start-ups, intention, and disaster are key elements associated to entrepreneurship during and after the COVID 19 epidemic as follows:

i. The top right quadrant of the screen contains motor themes. These are well-developed and crucial topics for organizing a study area. This quadrant illustrates that the major themes and topics characterizing the research field examined during

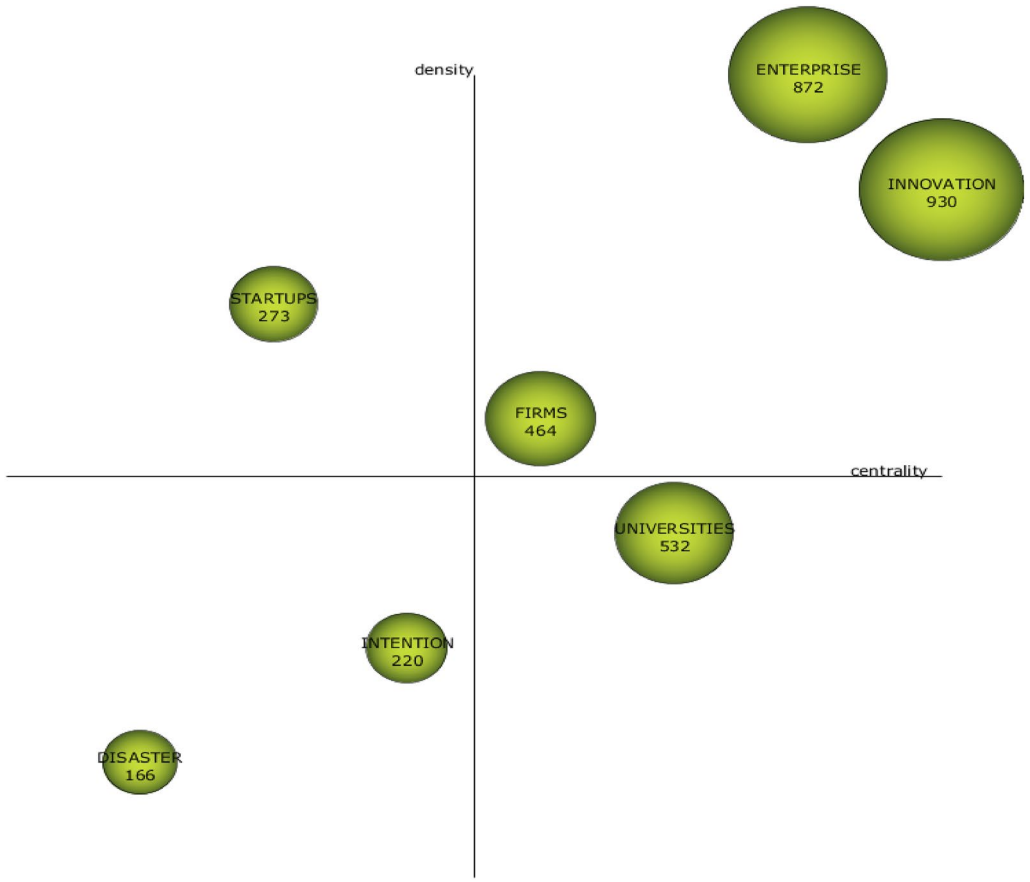

Fig. 2 Strategic Diagram and Thematic Networks. The number under the themes signifies the number of citations that belong to that theme

and after the COVID 19 epidemic are innovation, enterprise, and firms. Innovation is the primary subject in this cluster, as evidenced by the 185 published works that have had the most influence in terms of citations. This cluster consists of a number of related studies on numerous interconnected themes or subjects, such as digital innovation Cueto et al. [30] and resilience in times of crisis [31], digitally enabled entrepreneurial education and management inventive skills [32, 33]. With a total of 89 works, enterprise is the second theme in this cluster. This cluster gathers research on entrepreneurship and small business development during and after the COVID-19 pandemic, such as the economic effects of the pandemic [10], social capital and cooperative knowledge creation [34], survival strategies of micro-enterprises [35], and consolidation strategies of small family businesses [36]. The third theme, with a total of 54 works, is firms. The COVID 19 pandemic and entrepreneurship [37], financing in crises [38], fostering entrepreneurial resilience Schepers et al. [39], and digital responses of SMEs to the COVID 19 crisis [40] are also included in this cluster.

ii. In the lower-right quadrant, there are fundamental and transversal themes. These are cross-cutting and basic themes. This quadrant illustrates the predominance of university-related themes or topics. This shows that despite being an important area of research, universities were still in their infancy. Regarding the influence of citations, and published works, there were 532 and 83 respectively. This cluster gathers research on Covid-19 and entrepreneurship education, including Covid-19 and entrepreneurship education [41–43], social entrepreneurship education [Ndou 44], the entrepreneurial intention of academic students [45], and entrepreneurship perceptions on entrepreneurial intention [46–48].

iii. The upper left quadrant contains separate ideas that are well developed. Although they have unimportant exterior ties and only marginally relevant issues in the field, they still have strong internal connections. Startups were a marginal area of inquiry and a central theme in this quadrant. This cluster collects work related to starting and running businesses during and after the COVID 19 pandemic. It covers themes or topics such as competitive advantage for startups [45, 49], entrepreneurship during Covid-19 economic crisis [50], covid-19 and entrepreneurship education [41–43], social entrepreneurship education [Ndou 44], entrepreneurial intention of academic students [45], entrepreneurship perceptions on entrepreneurial intention [46–48] female entrepreneurship amid the Covid-19 crisis (2022) and international sport entrepreneurship (2022).

iv. The lower left quadrant contains topics that are developing or waning. These topics are unimportant, underexplored, developing, or unresolved problems. Intention and disaster were the developing or waning fields of research in the strategic diagram. Intention had relatively higher impact with 220 citation and 27 works. This cluster collects work related to entrepreneurial motivation during and after the COVID 19 pandemic such as entrepreneurial behaviour [51], entrepreneurial propensity [52], from decision to survival-shifting [53], and gender differences in enterprise performance [54]. On the other hand, disaster had 166 citations and 17 works. This cluster collects work related to disaster management during and after the COVID 19 pandemic such as digital innovations Majchrzak and Shepherd [55], crisis management in the hospitality sector [56], digital affordances [57], entrepreneurial behaviour [51], entrepreneurial propensity [52], from decision to survival-shifting [53], gender differences in enterprise performance [54], and resilience in a time of contagion [58].

Similarly, Vosviewer software was employed to figure out how often the authors' keywords appeared in the documents. This is a text mining technique that captures multiple keywords found in the documents. Seven clusters were extracted from keyword co-occurrence analysis (Table 3 and Fig. 3). The largest cluster of keywords is shown in red, representing the research entrepreneurship and crisis management. Other clusters are self-efficacy and entrepreneurship education, gender and entrepreneurship, SMEs and business opportunities, innovation and business performance, Covid 19 and business sustainability and social entrepreneurship and sustainable development.

These seven identified themes demonstrate different strategies that entrepreneurs adopted to respond and manage the COVID-19 crisis. They show the development, characteristics and changes of the field over time during the pandemic. Topics related to self-efficacy and entrepreneurship education, gender and entrepreneurship, SMEs and business opportunities, innovation and business performance, and social entrepreneurship and sustainable development will continue to dominate entrepreneurship research in the future.

We then used the conceptual structure and thematic map to further identify the themes of entrepreneurship

Table 3 Result of keyword co-occurrence analysis

S. N0	Cluster color	Label	Top 10 keywords with frequency
1	Red	Cluster 1: Entrepreneurship and crisis management	Entrepreneurship (196), crisis (64), business (58), resilience (56), management (49), pandemic (43), crisis management (23), capabilities (15), organizational resilience (14), uncertainty (13)
2	Green	Cluster 2: Self-efficacy and entrepreneurship education	self-efficacy (25), education (22), entrepreneurial intention (19), behavior (16), intention (14), students (13), entrepreneurship education (12), creativity (8), entrepreneurial orientation (7), entrepreneurial self-efficacy (6), universities (6)
3	Orange	Cluster 3: Gender and entrepreneurship	Gender (26), self-employment (16), challenges (13), success (13), work (12), female entrepreneurship (10), women (9), risk (8), women entrepreneurs (7), entrepreneurs (7)
4	Yellow	Cluster 4: SMEs and business opportunities	SMEs (19), firms (18), enterprise (9), opportunities (9), emerging markets (7), organizations (7), qualitative research (7), networks (6), leadership (6), India (6)
5	Purple	Cluster 5: Innovation and business performance	Innovation (63), performance (51), covid 19 pandemic (42), technology (17), knowledge (16), dynamic capabilities (15), policy (8), higher education (6), information (6)
6	Light Blue	Cluster 6: Covid 19 and business sustainability	Covid-19 (175), growth (21), orientation (18), sustainability (15), strategies (9), economic crisis (7), enterprises (7), digitalization (6), industry (6)
7	Blue	Cluster 7: Social entrepreneurship and sustainable development	Social entrepreneurship (20), creation (12), sustainable development (9), sustainable entrepreneurship (7), social enterprise (7), strategic management (6), culture (6)

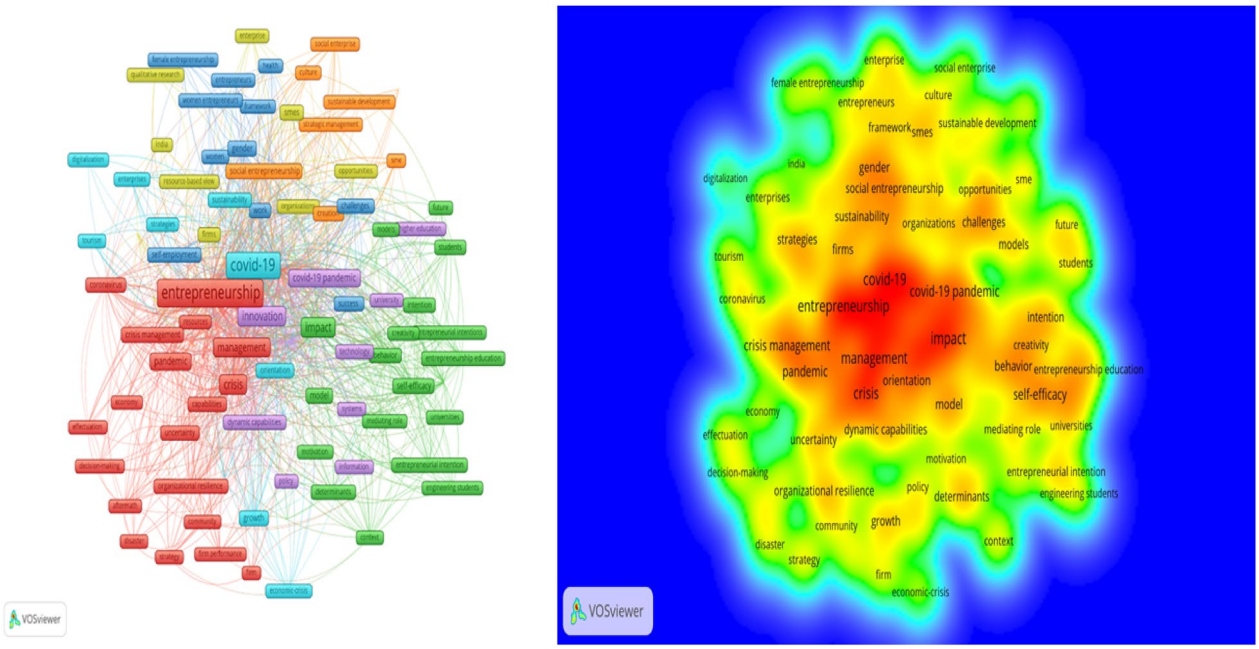

Fig. 3 Network of related keywords. The occurrence counts are represented by the node sizes. The co-occurrence of two nodes in the same document is represented by the connections connecting them. The number of co-occurrences for the two keywords increases with the distance between two nodes

research during the COVID-19 crisis and its aftermath. According to Fig. 4, two distinct clusters reveal the major themes and intersections within the field. Two dimensions of the MCA account for approximately 39.11% of the total variability. In Fig. 4, the closer the points are to each other, the more similar the profile they represent, and each cluster of points represents a characteristic profile [59]. The red cluster, representing

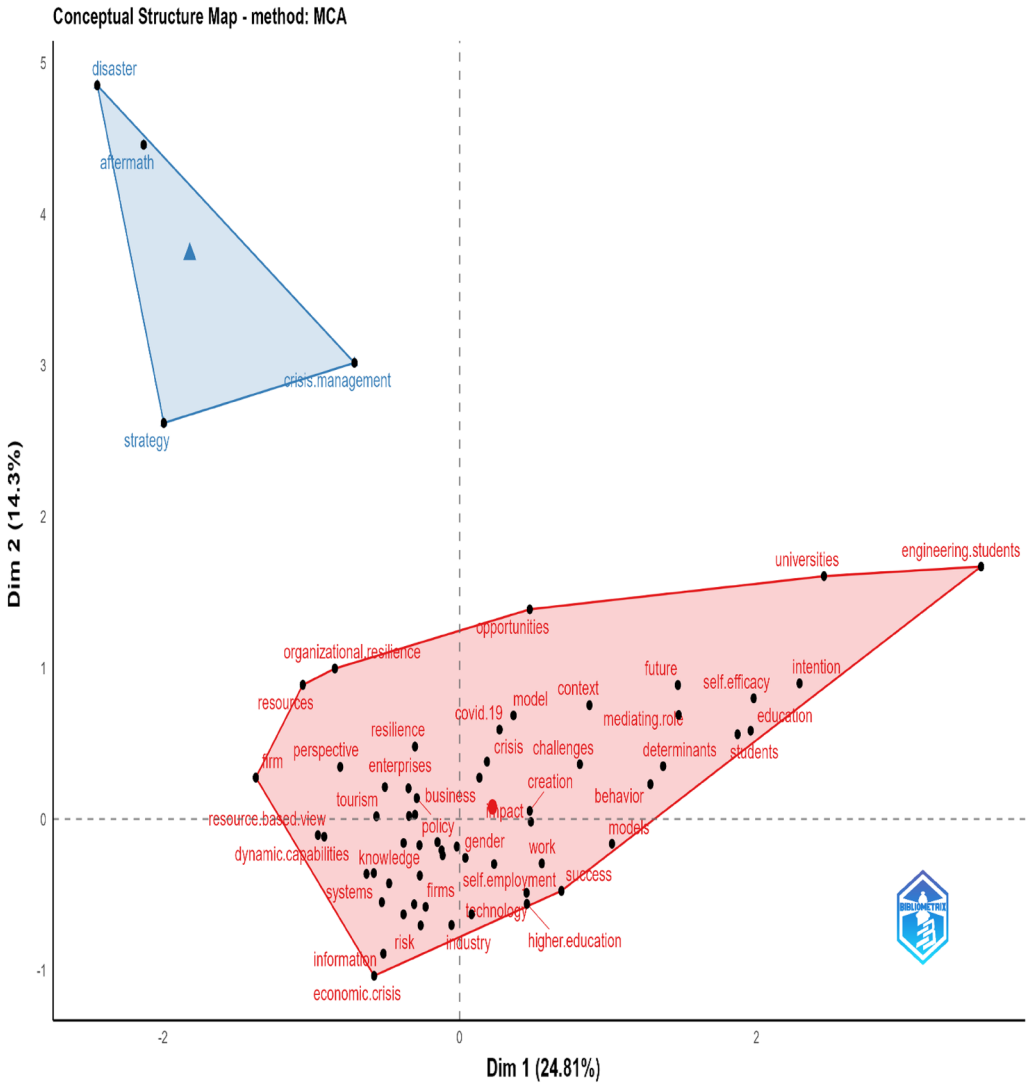

Fig. 4 Conceptual Structure Map-Method MCA

the most important themes, includes keywords related to resilience, adaptation measures and entrepreneurship education that underlie entrepreneurship research during the COVID-19 crisis and its aftermath, such as self-efficacy, dynamic skills and the role of higher education institutions. This cluster highlights important keywords related to crisis management, challenges and individuals' entrepreneurial behaviours in areas such as organizational resilience, entrepreneurial intentions, the role of technology, access to resources, gender differences in business performance, and the role of universities. The blue cluster includes keywords related to enabling strategies and disaster management. The two clusters highlight the need to integrate organizational resilience and dynamic capabilities aspects to improve small businesses' ability to respond to crises in the post-pandemic era.

Most prominent themes using bibliographic coupling

The study performed bibliographic coupling of the articles was examined. Bibliographic coupling reveals intellectual associations of scholarly publications by their referencing patterns, with scholarly publications citing similar sources forming bibliographic pairs to represent their intellectual associations. Based on the application of bibliographic coupling, four major thematic clusters were formed as follows (Table 4 and Fig. 5).

Table 4 Thematic clusters based on bibliographic coupling

Author	Article	Total Links	TC
Cluster 1: Entrepreneurship and Crisis Management			
Portuguez Castro [17]	"Being an entrepreneur post-COVID- 19 -resilience in times of crisis: a systematic literature review"	48	203
Belitski et al. [10]	"Economic effects of the COVID-19 pandemic on entrepreneurship and small businesses"	45	80
Burhan et al. [56]	"Crisis management in the hospitality sector SMEs in Pakistan during COVID-19"	45	59
Bivona and Cruz [83]	"Can business model innovation help SMEs in the food and beverage industry to respond to crises? Findings from a Swiss brewery during COVID-19"	44	31
Anwar et al. [63]	"Weathering a Crisis: A Multi-Level Analysis of Resilience in Young Ventures"	48	22
Haneberg [64]	"SME managers' learning from crisis and effectual behaviour"	46	18
Newman et al. [84]	"Small Businesses and Entrepreneurship in Times of Crises: The Renaissance of Entrepreneur-Focused Micro Perspectives"	46	16
Stephan et al. [85]	"Act or Wait-and-See? Adversity, Agility, and Entrepreneur Wellbeing across Countries during the COVID-19 Pandemic"	47	14
Callegari and Feder 61	"Entrepreneurship and the systemic consequences of epidemics: A literature review and emerging model"	46	13
Soluk [62]	"Organisations' Resources and External Shocks: Exploring Digital Innovation in Family Firms"	43	11
Kamaludin et al. [65]	"Social entrepreneurial sustainability during the COVID-19 pandemic"	46	8
Birhanu et al. [54]	"Gender Differences in Enterprise Performance During the COVID-19 Crisis: Do Public Policy Responses Matter?"	45	7
Ye et al. [101]	"How to Achieve Swift Resilience: The Role of Digital Innovation Enabled Mindfulness"	40	6
Blaique et al. [86]	"The impact of social and organisational capital on service innovation capability during COVID-19: the mediating role of strategic environmental scanning"	46	3
Isabelle et al. [87]	"A Machine-Learning Analysis of the Impacts of the COVID-19 Pandemic on Small Business Owners and Implications for Canadian Government Policy Response"	45	3
Shepherd and Williams [88]	"Different response paths to organizational resilience"	41	2
Pyrkosz-Pacyna et al. [60]	"Entrepreneurial Resilience in the COVID-19 Crisis: A Qualitative Study of Micro and Small Entrepreneurs in Poland"	44	1
Kansheba et al. [89]	"Cushioning the Covid-19 Economic Consequences on Entrepreneurial Ecosystems: The Role of Stakeholders` Engagement, Collaboration, and Support"	48	1
Foris et al. [90]	"The Start-Up Manager in Times of Crisis: Challenges and Solutions for Increasing the Resilience of Companies and Sustainable Reconstruction"	49	0
Conz et al. [91]	"Responding to unexpected crises: The roles of slack resources and entrepreneurial attitude to build resilience"	42	0
Cluster 2: Social entrepreneurship and collaborative networks during the COVID-19 pandemic			
Ratten [66]	"Covid-19 and entrepreneurship education: Implications for advancing research and practice"	49	205
Ratten [92]	"Coronavirus (Covid-19) and entrepreneurship: cultural, lifestyle and societal changes"	47	143
Ratten [69]	"Coronavirus (covid-19) and social value co-creation"	45	124
Ratten et al. [68]	"Sport entrepreneurship and value co-creation in times of crisis: The covid-19 pandemic"	46	52
Sharma et al. [70]	"Entrepreneurial challenges of COVID-19: Re-thinking entrepreneurship after the crisis"	49	23
Mishra [93]	"Principles of frugal innovation and its application by social entrepreneurs in times of adversity: an inductive single-case approach"	41	15
Durst et al. [67]	"Peruvian Small and Medium-Sized Enterprises in Times of Crisis—Or What Is Happening over Time?"	45	6
Santamaria-Velasco et al. [94]	"The refugee entrepreneurship process from/in emerging economies"	47	6
Ratten [92]	"COVID-19 and public policy and entrepreneurship: future research directions"	47	4
Subriadi and Kusuma Wardhani [71]	"Survivability Scenario of SMEs in Facing COVID-19 Crisis Based on the Social Commerce Framework"	46	3
Padhy and Bhaskar [72]	"Values in the time of a pandemic: a study of social entrepreneurial values against the backdrop of COVID-19"	47	0
Cluster 3: Entrepreneurship and entrepreneurial intentions during the COVID-19 pandemic			
Hernández-Sánchez et al. [74]	"Psychological Factors that Lessen the Impact of COVID-19 on the Self-Employment Intention of Business Administration and Economics' Students from Latin America"	46	88

Table 4 (continued)

Author	Article	Total Links	TC
Ruiz-Rosa et al. [75]	"Social Entrepreneurial Intention and the Impact of COVID-19 Pandemic: A Structural Model"	30	82
Krichen and Chaabouni [45]	"Entrepreneurial intention of academic students in the time of COVID-19 pandemic"	35	15
Kotsopoulos et al. [95]	"The effect of human capital, innovation capacity, and Covid-19 crisis on Knowledge-Intensive Enterprises' growth within a VC-driven innovation ecosystem"	49	14
Duong et al. [73]	"Moderating effects of Covid-19-related psychological distress on the cognitive process of entrepreneurship among higher education students in Vietnam"	44	7
Clark et al. [77]	"The malleability of international entrepreneurial cognitions: a natural quasi-experimental study on voluntary and involuntary shocks"	36	7
Botezat et al. [96]	"How Stable Are Students' Entrepreneurial Intentions in the COVID-19 Pandemic Context?"	28	4
Uansa-ard and Wannamakok [76]	"University students' entrepreneurial intentions during COVID-19: The perspective of social cognitive career theory"	34	1
Usman and Sun [97]	Global Pandemic and Entrepreneurial Intention: How Adversity Leads to Entrepreneurship	47	1
Cluster 4: Entrepreneurship and adaptation measures to the COVID-19 pandemic			
Miocevic [81]	"Investigating strategic responses of SMEs during COVID-19 pandemic: A cognitive appraisal perspective"	48	19
Guckenbiehl and Corral de Zubielqui [78]	"Start-ups' business model changes during the COVID-19 pandemic: Counteracting adversities and pursuing opportunities"	49	18
Lungu [53]	"From Decision to Survival—Shifting the Paradigm in Entrepreneurship during the COVID-19 Pandemic"	44	16
Hrivnak et al. [79]	"What Kept the Boat Afloat? Sustainability of Employment in Knowledge-Intensive Sectors Due to Government Measures during COVID-19 Pandemic"	48	16
Harima [82]	"Transnational migration entrepreneurship during a crisis: Immediate response to challenges and opportunities emerging through the COVID-19 pandemic"	47	11
Hermundsdottir et al. [98]	"Analysing the impact of COVID-19 on environmental innovations in manufacturing firms"	47	11
Krasniqi et al. [80]	"Covid-19 and SMEs in Kosovo: Assessing Effect and Policy Preferences"	47	8
Kryeziu et al. [99]	"COVID-19 impact and firm reactions towards crisis: Evidence from a transition economy"	45	6
Miocevic [100]"	"Don't get too emotional: How regulatory focus can condition the influence of top managers' negative emotions on SME responses to economic crisis"	45	5

Cluster 1: Entrepreneurship and crisis management

The COVID-19 pandemic's effects on entrepreneurship are discussed in this cluster of studies and response measures such as lockdown, and travel restrictions, and how entrepreneurs have weathered the crisis. The articles show that many entrepreneurs experienced significant negative impacts. However, businesses run by women faced greater challenges and experienced more severe negative impact than their male counterparts, reported lower sales, lower profitability, and higher business closure rates [54]. The articles show that resilience, adaptation, innovation, digital technologies and government support in the form of financial assistance programs, tax breaks, loan guarantees, and business support services enabled entrepreneurs to weather the crisis [10, 31, 56, 60]. Small businesses demonstrated resilience and adaptability by rapidly transforming their business models, adopting digital technologies and exploring opportunities including cost cutting measures, reallocating resources, renegotiating contracts, diversifying revenue streams and offering delivery and takeaway services [10, 56, 61, 62, 101]. Similarly, organizational resources, such as financial resources, human capital, and social networks, stakeholder support and certain entrepreneurial traits such as proactivity, risk taking, and self-efficacy played an important role in enhancing the resilience of young entrepreneurs [63–65]. Future research could examine the long-term effects of COVID-19 and how to create an environment for business recovery and growth in the post-pandemic period. A comparative study can also be carried out on the efficiency of different measures to eliminate gender variations in business performance and gender equality policies to support women entrepreneurs during the crisis and beyond.

Cluster 2: Social entrepreneurship and collaborative networks during the COVID-19 pandemic

This cluster consists of articles dedicated to entrepreneurship education and collaboration during the COVID-19

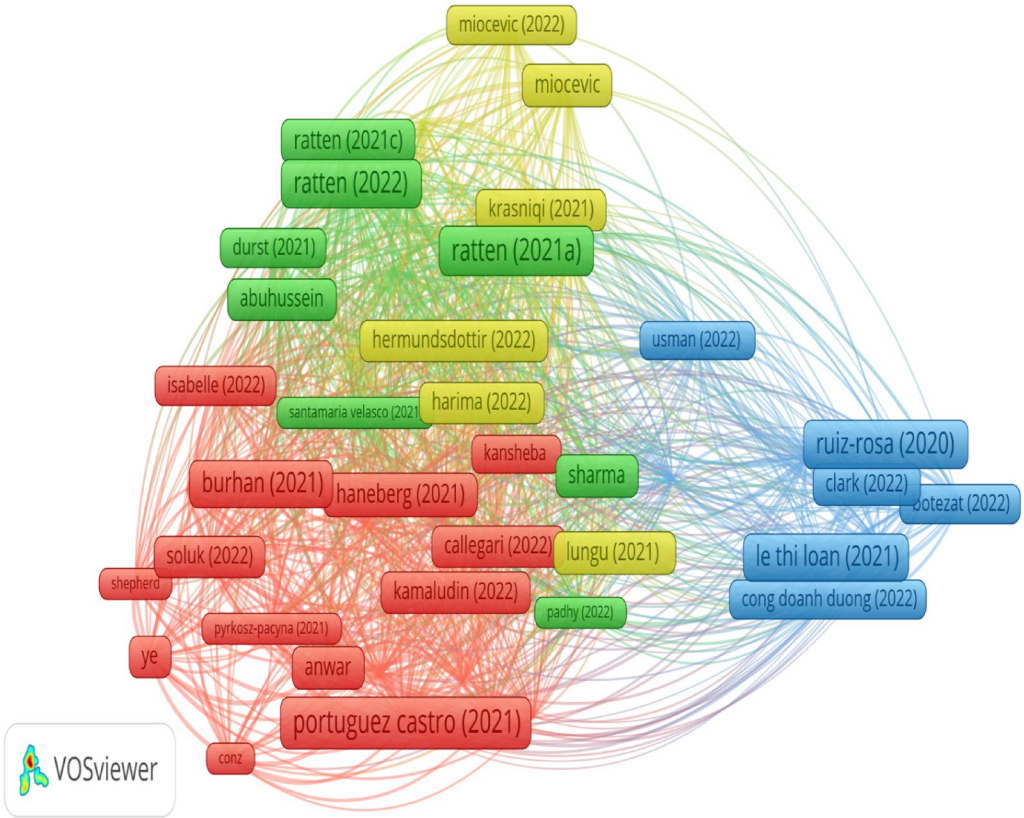

Fig. 5 Thematic themes based on Bibliographic Coupling

pandemic. The articles show that educational institutions have adapted their teaching methods and used various digital tools and platforms to deliver entrepreneurship education remotely and entrepreneurship support networks through incubators, accelerators, mentoring programs and industry partnerships have helped address the negative impact of COVID 19 on entrepreneurship education [66]. Similarly, the impact of COVID-19 on sports entrepreneurship and social value co-creation processes was studied, and digital technologies, partnerships, community engagement, collaboration, adaptability and policy support enabled effective co-value creation in a time of crisis [43, 67–71] Padhy and Bhaskar [72]. These articles underscore the importance of values in shaping the actions and responses of social entrepreneurs during times of crisis. Future research could examine how sports entrepreneurs used technology, social media, and other engagement platforms during the crisis to enhance the fan experience, build communities, and co-create value with fans. Future research could also examine the outcomes and impacts of various policy initiatives, funding programs and support structures on entrepreneurial activities and outcomes.

Cluster 3: Entrepreneurship and entrepreneurial intentions during the COVID-19 pandemic

This cluster consists of articles that explored entrepreneurial intention during the COVID 19 pandemic. While the results show that the COVID-19 pandemic has had a negative impact on academic students' entrepreneurial intentions, psychological factors such as perceived self-efficacy, entrepreneurial mindset, social support, digital entrepreneurship, and risk perception played a significant role in reducing the negative effect of COVID 19 on intentions of business students to become self-employed [45, 73–76]. Similar to this, the articles stress how crucial it is to comprehend how entrepreneurial cognitions can change in response to various shocks and how voluntary and involuntary experiences have a significant impact on how people perceive entrepreneurship, how policies are made, and how they are generally supported 77. Future studies could look at how cultural, institutional, and economic factors influence how entrepreneurial cognitions are affected by environmental or technology development. Comparing university students' entrepreneurial goals in

various cultural situations may help you understand how culture influenced such intentions during the pandemic.

Cluster 4: Entrepreneurship and adaptation measures to the COVID-19 pandemic

The articles in this cluster look at how SMEs have assessed and viewed the COVID 19 and its effects. It demonstrates that SMEs were able to respond well to the COVID-19 crisis and its aftermath despite facing severe challenges from decreasing client demand, decreases in sales and earnings, supply chain disruptions, and financial limitations. Dynamic capabilities and learning mechanisms allowed businesses to effectively address the issue [53, 78–82]. Business owners and managers' flexibility in adapting key elements of the business model to changing market conditions, innovation and creativity, entrepreneurial agility and resilience, collaboration and connectivity and digital adoption enabled them to navigate and survive the COVID-19 pandemic. Future research could assess startups' strategic responses including modification made to their business models. This is crucial for informing policies and support mechanisms that can help start-ups thrive in times of crisis. Likewise, understanding how SMEs develop and use their dynamic capabilities to respond to the crisis and the role of organizational learning in facilitating effective responses, represents an important research gap. Another area is examining the effectiveness and outcomes of the policies implemented during a crisis can provide insights into their effectiveness in supporting SMEs and identify areas for improvement, assess the effectiveness of policy measures, and conduct comparative analyses.

Conclusion and policy implications

The current study's objective was to locate, evaluate, and map the literature on entrepreneurship research during the COVID-19 pandemic and its aftermath. A total of 382 scholarly papers were analysed. The results show that the research focused on four thematic research clusters, namely (a) entrepreneurship and crisis management (b) social entrepreneurship and collaborative networks (c) entrepreneurship and entrepreneurial intentions, and (d) entrepreneurship and adaptation measures to the COVID-19 pandemic. Although the COVID-19 pandemic has had a significant negative impact on entrepreneurship, it has taught small businesses and companies valuable lessons about how to respond to risks and uncertainties that may arise in the future. Adopting new strategies such as incorporating digital transformation, increasing innovation, improving collaboration and networking, and changing business models during the crisis can serve as a source of increasing competitiveness in the post-pandemic era. The following are the future research agenda:

i. The long-term effect of COVID-19 and how to create an environment for business recovery and growth in a post-pandemic era.
ii. Comparative analysis of the effectiveness of different measures to support women entrepreneurs during the crisis to eliminate gender differences in business performance.
iii. How sports entrepreneurs leveraged technology, social media and other engagement platforms during the crisis to improve the fan experience, build communities and co-create value with fans.
iv. Examine the outcomes and impacts of various policy initiatives, funding programs, and support structures on entrepreneurial activities and outcomes.
v. Comparing university students' entrepreneurial goals in different cultural settings can help you understand how culture has influenced such intentions during the pandemic and strategies to respond to crisis in the post pandemic era.
vi. Startups' strategic responses including modification made to their business models. This is crucial for informing policies and support mechanisms that can help start-ups thrive in times of crisis.
vii. Examine the effectiveness and outcomes of the policies implemented during a crisis can provide insights into their effectiveness in supporting SMEs and identify areas for improvement, assess the effectiveness of policy measures, and conduct comparative analyses.

Limitations oof the study

Future scientometric research should address a number of weaknesses in the study. When searching for documents, initially only the Web of Science database was used; other data sources such as Scopus, Dimension and Google Scholar were not considered. To update the theories and antecedents used in entrepreneurship studies during and after the COVID-19 epidemic, future research could consider a thorough literature review. Second, we relied on scientometric analysis.

Abbreviations

SMEs	Small and medium enterprises
TC	Total citations
TP	Total publications
COVID-19	Coronavirus

Acknowledgements
Not Applicable.

Author contributions
FL "Writing and data analysis". EM "Editing and finalizing the manuscript".

Funding
Not Applicable.

Declarations

Competing interests
The author declares that they have no competing interests.

Ethics approval and consent to participate
Not Applicable.

Consent for publication
Not Applicable.

Availability of data and materials
Not Applicable.

Received: 10 July 2023 Accepted: 5 November 2023
Published online: 11 December 2023

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