

## Coronavirus Pandemic

# Worldwide scientific efforts on nursing in the field of SARS-CoV-2: a cross-sectional survey analysis

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### Abstract

**Introduction:** Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection has been a global public health issue. This study aimed to characterize global nursing research on SARS-CoV-2.

**Methodology:** Nursing-related publications through December 31, 2022, were identified using Scopus. The number of studies, study types, countries, institutions, journals, authors, h-index, total confirmed cases, total deaths, and the highest-cited studies were investigated.

**Results:** In total, 12,427 studies were identified. The number of studies increased rapidly, particularly between 2020 and 2021, with a 2.36-fold increase. The United States published the most studies (3,289, 26.47%), followed by the United Kingdom (1,059, 8.52%) and China (877, 7.06%). Scientific productivity significantly correlated with the total confirmed cases ( $r = 0.701$ ,  $p = 0.024$ ) and total deaths ( $r = 0.804$ ,  $p = 0.005$ ). The United States had the highest h-index (80), followed by China (59), and the United Kingdom (57). The University of Toronto published the most studies (181), followed by Harvard Medical School (165), and the University of São Paulo (107). Gravenstein S (23) was the most prolific author, followed by Mor V (22), and Rosa WE (19). The *International Journal of Environmental Research and Public Health* published the most papers (436), followed by *PLOS ONE* (219), and *BMJ Open* (185).

**Conclusions:** Several countries, institutions, journals, and authors contributed greatly to SARS-CoV-2-related nursing studies. Countries with larger numbers of confirmed cases and deaths tended to publish more nursing studies. The United States, United Kingdom, and China had the highest quantity and quality of studies.

**Key words:** SARS-CoV-2; COVID-19; nursing; publication; survey.

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### Introduction

The rapid spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has been a global public health concern [1,2]. The World Health Organization declared this coronavirus disease-19 (COVID-19) to be a pandemic given the high morbidity and mortality associated with SARS-CoV-2 infection [2,3]. Healthcare systems have been confronted with this challenging pandemic, particularly in the nursing field.

Nursing personnel play important roles in interdisciplinary teams through providing care to individuals and families, in hospitals and communities [4]. Nurses comprise the largest percentage of the > 20 million healthcare workers worldwide [5]. From the beginning of the outbreak, many nurses and researchers conducted SARS-CoV-2-related nursing studies [2-6]. However, these nursing-related studies concerning SARS-CoV-2 infection have seldom been analyzed.

Scientific publications are at the center of scientific activity, with the quantity and quality of studies widely used to indicate scientific achievement [7-13]. In recent

years, survey analyses of research output have been increasingly used to characterize scientific efforts in many fields [7-13]. Therefore, this study aimed to characterize nursing research on SARS-CoV-2 infection and provide insights into worldwide scientific efforts in this field.

### Methodology

#### *Study design*

This cross-sectional survey analyzed worldwide nursing-related research productivity in the field of SARS-CoV-2 infection.

#### *Data collection*

Ethical approval was not required as no human or animal participants were included in the study. This survey analysis was developed based on methodological steps reported elsewhere [7-13]. The database selected for this study was Scopus, given its extensive coverage of the largest available peer-reviewed publications [7-13]. It has been widely used in similar studies and encompasses over 22,000 titles

from more than 5,000 publishers worldwide [7-13]. Scopus offers a comprehensive collection of scholarly literature, with more than 55 million records, and complete MEDLINE coverage [7-13]. This platform combines the features of both Web of Science and PubMed, providing an enhanced service for conducting research activity surveys [7-13].

We conducted an online search in Scopus from database inception until December 31, 2022. The literature search was performed using the following keywords: SARS-CoV-2, 2019-nCoV, Coronavirus disease-19, COVID-19, COVID19, Coronavirus disease-2019, 2019 novel coronavirus, nurse, and nursing. Only original research and reviews were included. Letters, notes, and editorials were excluded. Language restrictions were not imposed.

We collected the following information: number of relevant publications, study types, countries, institutions, journals, authors, h-index, total confirmed cases, total deaths, and the highest-cited studies. The number of studies was defined as an indicator of the number of nursing studies. The h-index was used as an indicator of study quality. The total confirmed cases and deaths were extracted on January 8, 2023, from the World Health Organization website ([www.who.int](http://www.who.int)). The h-index, extracted from the Scopus database,

indicates the number of studies (n) that received at least n citations [7-13]. In other words, a country, institution, or author with an h-index of 10 has published 10 papers, each of which has attracted 10 or more citations [7-13]. Countries, institutions, journals, authors, and the most cited studies were extracted from the Scopus database and ranked in order. Only the highest 10 samples were extracted.

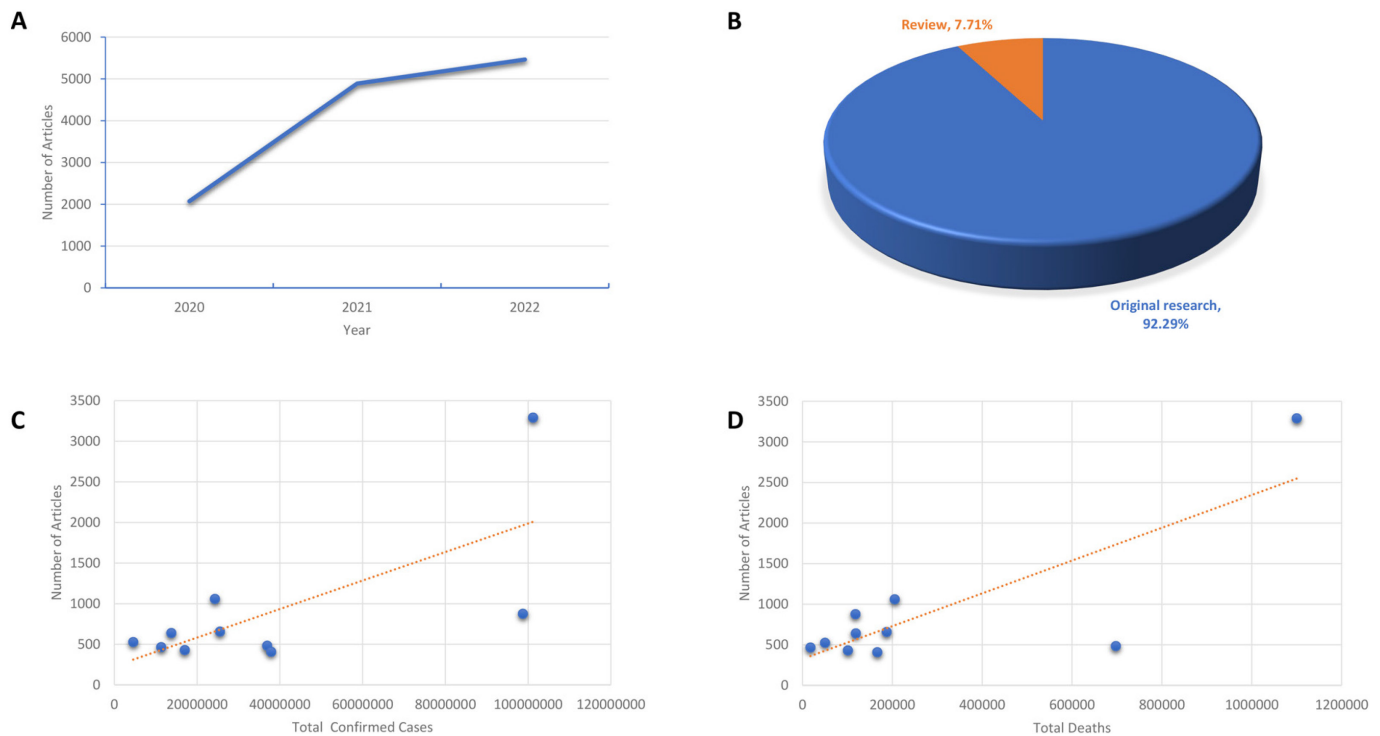
*Data analysis*

Statistical analyses were performed using SPSS version 19.0 (SPSS Inc., Chicago, IL, USA) software. Correlation analyses between the number of studies and the total confirmed cases/total deaths were performed. Statistical significance was set at  $p < 0.05$ .

**Results**

In total, we identified 12,427 nursing studies concerning SARS-CoV-2 infection in the Scopus database. The selected studies were published between 2020 and 2022. The number of studies rapidly increased during the study period, particularly between 2020 and 2021 (Figure 1A). Compared with 2,073 studies published in 2020, 4,890 were identified in 2021, indicating a 2.36-fold increase. Most were original

**Figure 1.** The characteristics of SARS-CoV-2-related nursing studies.



**A:** The number of studies presented a rapid increase during the study period, especially between 2020 and 2021; **B:** Most studies (11469, 92.29%) were original research, and 958 (7.71%) were reviewed; **C, D:** Scatter plots indicate that the number of studies from different countries correlates significantly with their total confirmed cases ( $r = 0.701$ ,  $p = 0.024$ ) and total deaths ( $r = 0.804$ ,  $p = 0.005$ ).

**Table 1.** Top 10 countries in nursing research of SARS-CoV-2 according to Scopus database till December 31, 2022.

| Rank | Country        | Number of Papers | Proportion | H-index | Total confirmed cases | Total deaths |
|------|----------------|------------------|------------|---------|-----------------------|--------------|
| 1    | United States  | 3289             | 26.47%     | 80      | 101211478             | 1100421      |
| 2    | United Kingdom | 1059             | 8.52%      | 57      | 24315983              | 205540       |
| 3    | China          | 877              | 7.06%      | 59      | 98747318              | 117794       |
| 4    | Italy          | 657              | 5.29%      | 44      | 25488166              | 187272       |
| 5    | Spain          | 639              | 5.14%      | 40      | 13740531              | 118712       |
| 6    | Canada         | 527              | 4.24%      | 40      | 4560962               | 50629        |
| 7    | Brazil         | 484              | 3.89%      | 20      | 36907890              | 697583       |
| 8    | Australia      | 466              | 3.75%      | 36      | 11309388              | 17803        |
| 9    | Turkey         | 429              | 3.45%      | 28      | 17004677              | 101419       |
| 10   | Germany        | 409              | 3.29%      | 37      | 37893892              | 166660       |

research (11,469, 92.29%), and 958 (7.71%) were reviewed (Figure 1B).

The 10 countries with the highest number of published studies are listed in Table 1. These countries published 8,836 (71.1%) of the 12,427 nursing-related studies concerning SARS-CoV-2 infection worldwide. The largest number of studies derived from the United States (3,289, 26.47%), followed by the United Kingdom (1,059, 8.52%) and China (877, 7.06%). The highest h-index was identified in studies undertaken in the United States (80), followed by China (59), and the United Kingdom (57).

The United States had the largest number of confirmed cases (101,211,478), followed by China (98,747,318) and Germany (37,893,892). Moreover, the United States had the largest number of deaths (1,100,421), followed by Brazil (697,583), and the United Kingdom (205,540). The number of studies from different countries significantly correlated with the total number of confirmed cases ( $r = 0.701, p = 0.024$ , Figure 1C) and total deaths ( $r = 0.804, p = 0.005$ , Figure 1D).

The ten most prolific institutions are listed in Table 2. Five of the institutions were located in the United States, whereas the other institutions were located in China, Brazil, the United Kingdom, and Australia. The University of Toronto published the greatest number of relevant studies (181, 1.46%), followed by Harvard Medical School (165, 1.33%), and the University of São Paulo (107, 0.86%). Harvard Medical School had the highest h-index (28), followed by Huazhong University

of Science and Technology (27) and the University of Toronto (24).

The ten most prolific authors, having published at least 15 studies each, are listed in Table 3. Gravenstein S published the highest number of studies (23, 0.19%), followed by Mor V (22, 0.18%) and Rosa WE (19, 0.15%). Eight of the 10 authors were from the United States and there was one author each from from Italy and Australia. Jernigan JA and Reddy SC had the highest h-index (12), followed by Mor V (11) and Labrague LJ (11).

The leading 10 journals, based on the number of studies published, are listed in Table 4. The *International Journal of Environmental Research and Public Health* published the highest number of studies (436, 3.51%), followed by *PLOS ONE* (219, 1.76%), and *BMJ Open* (185, 1.49%). Studies in the *International Journal of Environmental Research and Public Health* had the highest h-index (28), followed by the *Journal of the American Medical Directors Association* (26), *PLOS ONE* (23), and the *Journal of Nursing Management* (23).

Table 5 lists the 10 most cited studies (citation numbers ranged from 827 to 3821). Two of the 10 studies were published in the *New England Journal of Medicine*, and two were published in *Brain, Behavior, and Immunity*. The other eight studies were published in *The Lancet*, *Military Medical Research*, *The Lancet Psychiatry*, *Annals of Internal Medicine*, and *Psychiatry Research*.

**Table 2.** Top 10 institutions in nursing research of SARS-CoV-2 according to Scopus database till December 31, 2022.

| Rank | Institution                                   | Country        | Number of Articles | Proportion | H-index |
|------|---|----------------|--------------------|------------|---------|
| 1    | University of Toronto                         | Canada         | 181                | 1.46%      | 24      |
| 2    | Harvard Medical School                        | United States  | 165                | 1.33%      | 28      |
| 3    | University of São Paulo                       | Brazil         | 107                | 0.86%      | 11      |
| 4    | Huazhong University of Science and Technology | China          | 93                 | 0.75%      | 27      |
| 5    | King's College London                         | United Kingdom | 91                 | 0.73%      | 22      |
| 6    | University of California                      | United States  | 91                 | 0.73%      | 17      |
| 7    | Johns Hopkins University                      | United States  | 82                 | 0.66%      | 16      |
| 8    | University of Pennsylvania                    | United States  | 81                 | 0.65%      | 22      |
| 9    | Monash University                             | Australia      | 77                 | 0.62%      | 16      |
| 10   | Emory University                              | United States  | 74                 | 0.60%      | 15      |

**Table 3.** Top 10 authors in nursing research of SARS-CoV-2 according to Scopus database till December 31, 2022.

| Rank | Author        | Number of Articles | Proportion | H-index | Affiliation  |
|------|---------------|--------------------|------------|---------|--|
| 1    | Gravenstein S | 23                 | 0.19%      | 9       | Brown University, United States  |
| 2    | Mor V         | 22                 | 0.18%      | 11      | Brown University, United States  |
| 3    | Rosa WE       | 19                 | 0.15%      | 8       | Memorial Sloan-Kettering Cancer Center, United States                        |
| 4    | White EM      | 18                 | 0.14%      | 9       | Brown University, United States  |
| 5    | Jernigan JA   | 17                 | 0.14%      | 12      | National Center for Emerging and Zoonotic Infectious Diseases, United States |
| 6    | Vitale E      | 17                 | 0.14%      | 6       | Local Health Authority of Bari, Italy  |
| 7    | Halcomb E     | 16                 | 0.13%      | 6       | University of Wollongong, Australia  |
| 8    | Labrague LJ   | 16                 | 0.13%      | 11      | Loyola University of Chicago, United States                                  |
| 9    | Reddy SC      | 16                 | 0.13%      | 12      | National Center for Emerging and Zoonotic Infectious Diseases, United States |
| 10   | Feifer RA     | 15                 | 0.12%      | 8       | Genesis HealthCare, United States  |

**Table 4.** Top 10 journals in nursing research of SARS-CoV-2 according to Scopus database till December 31, 2022.

| Rank | Journal   | Impact factor | Number of Articles | Proportion | H-index |
|------|---|---------------|--------------------|------------|---------|
| 1    | International Journal of Environmental Research and Public Health | 4.614         | 436                | 3.51%      | 28      |
| 2    | PLOS ONE  | 3.752         | 219                | 1.76%      | 23      |
| 3    | BMJ Open  | 3.006         | 185                | 1.49%      | 17      |
| 4    | Journal of Nursing Management                                     | 4.680         | 159                | 1.28%      | 23      |
| 5    | Frontiers in Public Health  | 6.461         | 157                | 1.26%      | 13      |
| 6    | Journal of the American Medical Directors Association             | 7.802         | 137                | 1.10%      | 26      |
| 7    | Healthcare  | 3.160         | 104                | 0.84%      | 11      |
| 8    | Journal of Advanced Nursing                                       | 3.057         | 101                | 0.81%      | 14      |
| 9    | Frontiers in Psychiatry   | 5.435         | 96                 | 0.77%      | 18      |
| 10   | Journal of Clinical Nursing                                       | 4.423         | 95                 | 0.76%      | 18      |

**Table 5.** Top 10 cited articles in nursing research of SARS-CoV-2 according to Scopus database till December 31, 2022.

| Rank | First Author | Year | Title  | Journal                         | Citations |
|------|--------------|------|--|---------------------------------|-----------|
| 1    | Lai J        | 2020 | Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019   | JAMA Network Open               | 3821      |
| 2    | Huang C      | 2021 | 6-month consequences of COVID-19 in patients discharged from hospital: a cohort study  | The Lancet                      | 1886      |
| 3    | Pappa S      | 2020 | Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: A systematic review and meta-analysis                                 | Brain, Behavior, and Immunity   | 1761      |
| 4    | Jin YH       | 2020 | A rapid advice guideline for the diagnosis and treatment of 2019 novel coronavirus (2019-nCoV) infected pneumonia (standard version)   | Military Medical Research       | 1344      |
| 5    | Arons MM     | 2020 | Pre-symptomatic SARS-CoV-2 infections and transmission in a skilled nursing facility   | New England Journal of Medicine | 1327      |
| 6    | Rogers JP    | 2020 | Psychiatric and neuropsychiatric presentations associated with severe coronavirus infections: a systematic review and meta-analysis with comparison to the COVID-19 pandemic | The Lancet Psychiatry           | 1188      |
| 7    | Oran DP      | 2020 | Prevalence of asymptomatic SARS-CoV-2 infection. A narrative review  | Annals of Internal Medicine     | 1134      |
| 8    | Chew NWS     | 2020 | A multinational, multicenter study on the psychological outcomes and associated physical symptoms amongst healthcare workers during COVID-19 outbreak                        | Brain, Behavior, and Immunity   | 867       |
| 9    | McMichael TM | 2020 | Epidemiology of COVID-19 in a long-term care facility in King County, Washington   | New England Journal of Medicine | 832       |
| 10   | Luo M        | 2020 | The psychological and mental impact of coronavirus disease 2019 (COVID-19) on medical staff and general public – A systematic review and meta-analysis                       | Psychiatry Research             | 827       |

## Discussion

As a worldwide event, the COVID-19 pandemic has been among the most damaging to human health to date [14,15], placing unprecedented pressure on healthcare systems [4-6] and greatly challenging the healthcare workforce, especially nursing providers [3,5]. Nursing personnel play key roles in different healthcare settings, and their multiple roles and responsibilities have been vital during the COVID-19 pandemic [5]. Treatment, prevention, and control of SARS-CoV-2 infection have developed significantly owing to scientific efforts worldwide [2,4,6]. However, the characteristics of the output of nursing research in relation to COVID-19 have rarely been examined. Survey analyses have been widely used to reveal the global characteristics of research in multiple fields [7-13]. This study provides a general picture of worldwide nursing-related research productivity concerning COVID-19 for the nursing workforce and investigators.

An increase or decrease in scientific output reflects the speed of development of science and technology [10,16-18]. A rapid change in the quantity of studies suggests a crucial turning point in a certain field [7,8,13]. Our study findings showed a rapid increase in the number of nursing publications, particularly from 2020 to 2021, which is likely to reflect trends in nursing research concerning the COVID-19 pandemic. After having identified some cases of unknown pneumonia due to a coronavirus variant on December 8, 2019, in Wuhan, China, public health investigators paid increasing attention to the rapid global spread of a new disease [1,5,14]. With increasing research on COVID-19, the number of studies in this field rapidly increased, which is consistent with our findings on publication trends in nursing, particularly from 2020 to 2021 [3,5,6,15], and indicates that this period was significant in the development of nursing research.

Regarding the number of papers published in different countries, the United States ranked highest in nursing-related COVID-19 research. This finding was not surprising because the United States ranks first in many medical fields according to the number of publications [7-13]. The United Kingdom and China ranked second and third, respectively. This suggests that these two countries also contributed substantially to nursing research concerning COVID-19. Moreover, studies from the United States, the United Kingdom, and China have the highest h-indices. This suggests that, in addition to high levels of research output, these countries had the highest quality of nursing publications, indicating their importance in scientific efforts in this field.

Geographic distributions of scientific output reflect research abilities and technological progress in different countries [10,16,17,19,20]. This study revealed that 71.1% of the total studies were mainly published in 10 countries, indicating that worldwide nursing-related COVID-19 research was concentrated in only a few countries, which is consistent with findings in other fields [16,19-23].

We found that scientific nursing research productivity in relation to COVID-19 significantly correlated with the total confirmed cases and deaths. Countries with greater numbers of confirmed cases and deaths published more nursing studies. This can be attributed to several factors. The countries with more cases had advantages in conducting research and clinical trials due to the large number of patients and novel virus samples [1,2,7-9]. In addition, most countries with the highest research productivity levels are classified as developed countries. These nations typically possess substantial financial resources, highly skilled research personnel, and access to cutting-edge technologies in the medical research field [7,11-13]. However, some countries with large patient populations, such as China, Spain, Brazil, and Turkey, do not fall within the category of developed countries. Compared with developed countries, developing countries may face numerous challenges that can inhibit their research productivity. These challenges include limited financial support, inadequate access to experienced mentors, insufficient training in research methodologies, and lower English language proficiency, which are often necessary to operate effectively within the global scientific community [24,25]. Developed countries or international organizations, such as the World Health Organization, bear responsibility for fostering research capacity in these countries. This can be achieved by providing financial support for research activities and offering training in research methodologies. Through addressing these challenges, research productivity in these countries could be significantly enhanced.

Our study findings indicated that the most prolific authors were from the United States, followed by Italy, and Australia. In addition, an analysis of the highest 10 institutions in terms of publications indicated that the United States had the largest number of institutions publishing COVID-19-related nursing research. These findings indicate that the United States has the greatest research power on nursing in SARS-CoV-2.

The largest number of papers were published in the *International Journal of Environmental Research and Public Health*, suggesting its important role in terms of

sharing new knowledge in this field. The *International Journal of Environmental Research and Public Health* had the highest h-index. These findings indicate that nursing research published in the *International Journal of Environmental Research and Public Health* was both extensive and of high quality and that this journal has had a significant influence in terms of nursing-related COVID-19-related research.

This study had several limitations. First, the Scopus database was used to identify nursing-related studies on SARS-CoV-2. Studies from other databases may have been missed in this analysis. Second, only original studies and reviews were included. Studies published in other fields were not included. Third, the h-index was used to evaluate the quality of the studies. Other indicators such as citations and impact factors have also been used in some studies. However, there are no optimal indicators for assessing study quality. Therefore, the h-index, which has been widely used in similar publications [7-13], was used in this study. Fourth, this study employed a cross-sectional design and a single search. The list rankings may change if the search is to be repeated subsequently. Fifth, differentiating studies that specifically focus on nursing research on SARS-CoV-2 infection or COVID-19 from those that merely mention these terms was challenging. Nevertheless, given the extensive scope and number of reviewed articles, this study offers a comprehensive survey of nursing research related to SARS-CoV-2. This survey could be useful in monitoring overarching trends and identifying areas of widespread interest.

## Conclusions

Numerous nursing studies about the COVID-19 pandemic have been conducted. Specific countries, institutions, journals, and authors have made valuable contributions to scholarship. Countries with larger numbers of confirmed cases and deaths tended to conduct more nursing research. The United States, the United Kingdom, and China were the leading countries in terms of the quantity and quality of studies published.

## Authors' contributions

YX and XL: study design, data analysis, and interpretation, writing manuscript and coordination of the entire study, LX, RZ, and XL: data collection and analysis, interpretation, and revision of the manuscript.

## Data availability statement

The data supporting this study's findings are available from the corresponding author upon reasonable request.

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