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Research Article

A Bibliometric Analysis of Missed Nursing Care Research: Current Themes and Way Forward

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Background. Missed nursing care adversely affects nurse and patient outcomes in healthcare settings. Comprehensive bibliometric overview of research output in this field is limited, which restricts knowledge of this complex phenomenon in terms of research trends, author's productivity, and thematic focus of scientific publications. This study aims to examine publications on missed nursing care by conducting a comprehensive bibliometric analysis. *Methods*. A search was performed in the Scopus database to identify 276 published studies on missed nursing care from inception to 20th February 2022. A bibliometric approach was used to comprehensively analyse retrieved publications based on trend, thematic focus, and scientific production. The R based software was used for data analysis. *Results*. The result from this bibliometric analysis indicates that the first study performed on the concept of missed nursing care was published in 2006. The United States of America (USA) ranked first in number of publications, and the study by Ball et al. published in 2014 was the most cited paper among the documents analysed. The results also identified names of prolific authors such as Kalisch B.J., Ausserhofer D., Willis E., Papastavrou E., Schubert M., Palese A., Simon M., and Aiken L. H. and relevant institutions in this field. Trending keywords identified included "missed nursing care," "unfinished nursing care," "patient safety," and "care left undone." In addition, thematic analysis showed emerging themes such as "neonatal intensive care unit," "patient satisfaction," "health resources," "failure to maintain," and "adverse events." *Conclusion*. Findings from this study reveal a lack of bibliometric analysis in missed nursing care research. This study provides significant contribution by presenting a comprehensive overview on thematic focus, hotspots studies, and directions for future research in this field. Findings from this study can guide scholars in defining research focus and aspects of research on missed nursing care for future exploration.

1. Introduction

Missed nursing care (MNC) has been widely reported in healthcare settings such as acute care [1], community care [2, 3], and paediatric and neonatal care [4]. The term MNC is defined as any aspect of nursing care that is partly or fully left undone [5]. This term was first conceptualised by Kalisch [6] in a qualitative study which identified that nurses frequently missed elements of patient care such as hygiene, documentation of intake and output, patient teaching, ambulation, and patient feeding and turning.

Research findings have demonstrated that MNC such as not administering medication, delaying giving medication before or after the scheduled time, missing hand hygiene, not turning, or helping patient to ambulate can lead to undesirable patient outcomes including medication errors, pressure injuries, and hospital acquired infections [7]. MNC can also contribute to emotional exhaustion and depression impacting nurses' wellbeing, causing staff shortage, and intensifying workload [8]. Over the past 16 years, some institutional and country collaborations have been developed to study MNC and nurse-patient outcomes [1, 9].

With the prevalence of MNC becoming more apparent [10], this phenomenon is expected to continue across healthcare systems. Following this increase in prevalence of MNC, some review articles have been conducted to identify and synthesize existing evidence on frequently missed care, predictors of MNC, and the impact on nurses and patients

[11]. Papastavrou et al. [12] reviewed quantitative evidence on types, factors, processes, and impact of MNC and found that family communication, ambulation, and mouth care were frequently MNC. In addition, increased nurse workload and barriers to communication were linked to MNC. Furthermore, patient outcomes such as falls, hospital acquired infections, and patient dissatisfaction were reported. Lastly, nurse participants in the study linked job satisfaction to less MNC [12]. Similar results have been reported by Jones et al. [13] in their review that identified patient outcomes such as falls, medication errors, hospital-acquired infections, and moral distress among nurses leading to intention to leave. Recent reviews have shown that MNC is a contributing factor to undesirable nurse-patient outcomes [14–17].

Overall, these studies have significantly improved researcher's understanding of the elements of care missed and the association between nurse and patient outcomes. It should be noted that irrespective of the increasing global prevalence (55–90%) and awareness of MNC across health care systems, no universal definition or measurement of MNC exist [13]. Related terminology such as implicit rationing of nursing care, care left undone, task undone, unfinished nursing care, and rationed care has been used interchangeably [13].

Although literature reviews on MNC have synthesized past study findings to provide scientific insight in this phenomenon, up to now, little attention has been paid to the bibliometrics of trends in MNC research studies based on global scientific research output. Hence, it remains pertinent to explore the extent of MNC worldwide by aggregating research trends and milestones for future directions. It is essential to use bibliometric or science mapping, a quantitative approach to capture publications trends on MNC including scholars' productivity and thematic focus in this domain. This study compliments existing reviews that use systematic methods to examine MNC. The results from this review will provide better understanding to the landscape of research on MNC, help in expanding the current knowledge structure about the phenomenon, aid in the identification of well-developed research areas, and help to gain insight in emerging and under-researched themes that need to be further researched. In addition, the findings of this study can be used by nurse researchers and policy makers as a point of reference in navigating the field of MNC.

The aim of this paper was to present a comprehensive review of current scientific production on MNC using a bibliometric analysis. The authors were interested in determining the trends of published literature on MNC such as document type, document content, author information, and author collaboration. An additional aim was to determine productive authors, institutions, country, and collaboration network. A notable aim of this research was to use mapping analysis to visualise authors' production and themes of interest and how themes have evolved over the years. In addition, analysis of author's keywords was performed. To the best of the research teams' knowledge, no study has used a bibliometric approach to analyse MNC scientific research production. This study fills the knowledge gap and presents an overview on prolific research themes and directions for future research in this domain.

2. Methods

Bibliometric analysis is the use of statistical methods to analyse materials such as books, articles, and publications. Bibliometric method is useful in providing objective, reliable, and structured point in time analysis of trends over time, shifts in disciplines, research themes, and most productive authors and author institution, thereby presenting a broader picture of the field researched through time [18, 19]. Donthu et al. [20] have concluded that the use of bibliometric approach is an expedient way to investigate trends in research domains such as topics and conceptual and intellectual structure. Research studies in various fields including nursing have used bibliometric analysis to evaluate developments in specific specialities such as cancer [21], nursing research [22, 23], orthopaedics [24], tuberculosis [25], and diabetes [26]. Although extensive research has been carried out on MNC, no previous study has used the bibliometric approach to understand the conceptual and intellectual structure of this research domain.

To overcome this limitation, this research used a science mapping approach to understand the topical foci of MNC research. The use of science mapping in bibliometric studies helps researchers to understand the extent of the topic, emerging trends, and domain evolution over time [27]. According to Bhattacharyya and Verma [28], this approach is holistic and objective and provides better understanding compared with the traditional literature review.

To address the aim of this study, publications were obtained from the Scopus database. The authors selected this database which ensures a wide range of peer-reviewed journals with high-quality compared to databases such as Google scholar, PubMed, and Web of Science [29]. Existing literature related to the domain of MNC in Scopus was retrieved using the following search query: ("missed nursing care" OR "unfinished nursing care" OR "care left undone" OR "ration* of nursing care" OR "omitted nursing care" OR "unmet nursing care"). The keyword search in Scopus database was set to include articles, abstracts, and keywords to capture all relevant publications. The search for literature was set to include published articles from January 2006 [6] to 20th February 2022. The initial search query yielded 385 documents. Documents were further refined by document type and language. Only "articles" and "reviews" written in English language were considered for analysis. Documents such as "meeting abstracts" ($n = 18$), "editorial materials" ($n = 17$), "early access" ($n = 15$), "letters" ($n = 3$), "news items" ($n = 1$), and "proceeding papers" ($n = 1$) were excluded. Documents ($n = 11$) written in languages other than English were also excluded. No time limiters were applied to the search query. The remaining 319 documents were further refined by reading through article abstracts to identify duplicates and unrelated terminologies; 43 out of the 319 studies were further excluded. The search query used to retrieve relevant articles based on the inclusion criteria was reviewed by the librarian of the academic institution.

Figure 1 illustrates the research design for this bibliometric study, and the inclusion and exclusion criteria are presented in Table 1.

Overall, a total of 276 relevant articles were retrieved from the Scopus database. Next, the data (276 articles) were exported and saved in plain text file and finally loaded and analysed in R statistical software using the package Bibliometrix and Biblioshiny https://www.bibliometrix.org/home/index.php/layout/biblioshiny [18]. In order to maintain quality and reliability of this study, all the researchers were involved, and they reviewed the material independently and conferred on the data quality [30].

To investigate the annual trends of scientific production on MNC from inception to 20th February 2022, the retrieved documents were analysed using different aggregation levels in the bibliometrix software. Regarding document source, the software provides indicators such as number of publications, relevant sources, most relevant authors, total number of citations, and affiliations/institution productivity. Since research productivity alone in any given domain is not enough to provide substantial understanding, normalised citation analysis has proven to be a valuable technique used to assess the impact of research output. This technique allows a better understanding of research impact and provides equal credit to both older and current publications [31]. Thus, this technique was applied in this study. In addition, the analysis of thematic map, co-occurrence network, collaboration network, word cloud, and trend topics are also provided. The analysis was based on author keywords which are words or phrases chosen by authors to reflect document content and has been widely used in bibliometric studies [32]. The minimum keyword occurrence to be included was set at two (2).

3. Results

The findings from this study are presented in this section reflecting (i) growth and trends in MNC research based on publication output, sources, and citations; (ii) productive authors, affiliations, and social networks; and (iii) thematic focus of MNC research.

3.1. Growth and Trends of Missed Nursing Care (MNC) Research. The findings on annual scientific production of MNC are presented in this section. Table 2 presents the descriptive information about the documents retrieved including main data information, document type, and authors' collaboration. The overall documents retrieved (276) included articles and review papers. A total of 772 authors were identified, with 1391 author appearances. There were six authors of single-authored documents and 766 authors of multiauthored documents. There were 5.04 co-authorship per documents and 2.86 collaboration indexes between authors.

In Figure 2, the publication trend on MNC in Scopus database is presented from inception [6] through to 20th February 2022. The oldest article using the terminology MNC was published in 2006 [6]. Since then, annual production increased steadily, then an exponential increase in the last six years. Although the number of publications between 2006 and 2010 fluctuated, between 2011 and 2021, MNC publications have seen significant increase suggesting a strong research interest in the field. Significantly, the number of annual scientific production of publications leaped from 18 in 2015 to 62 in 2020 suggesting a growing trend in the area.

The analysis also presents results of the top 20 sources that published articles in the domain of MNC based on the data extracted from Scopus database. The findings from Figure 3 indicate that the Journal of Advanced Nursing remain the topmost publication source for MNC research. This is followed by Journal of Nursing Management, International Journal of Nursing Studies, Journal of Clinical Nursing, Journal of Nursing Care Quality, Journal of Nursing Administration, Nursing Open, BMC Nursing, BMJ Quality and Safety, and International Nursing Reviews and Collegian. Overall, MNC studies have been published in reputable nursing research journals and the 20 most productive journals list is shown in Figure 3. In addition, Table 3 highlights the top 20 most cited sources.

Further analysis of this section investigated global citations of published documents. In this citation analysis, from 2006 to February 2022, the results of the 20 most cited documents alongside their total citations, total citations per year, and normalised total citations are shown in Table 3. The most cited paper was the study published by Ball and colleagues, recording total citations of 337 (33.7 citations per year) in BMJ Quality and Safety [33]. The authors of the topmost cited paper used cross-sectional survey to investigate the nature, prevalence, and associated factors of missed patient care in English National Health hospitals. The study formed part of the many projects led by the international Nurse Forecasting (RN4CAST) group. The next most cited papers was the first MNC qualitative study by Kalisch, published in Journal of nursing Care Quality with 330 citations (18.33 citations per year) [6], followed by Jones and colleagues' state of science literature review in International Journal of Nursing Studies with 320 citations (35.56 total citation per year) [13]. According to the normalised citation scores, the review paper by Jones and his team published in 2015 [13] gained the most impact with a normalised score of 5.79 (Table 4). Since MNC currently is expected to occur in health care settings, many researchers studying the missed care phenomenon most likely will review and cite these papers, thus increasing their total citation counts.

Regarding country citations, Table 4 presents the top 20 highly cited countries with USA ranking first followed by Switzerland, United Kingdom, Australia, and Cyprus among others.

3.2. Productive Authors, Institutions, Country, and Collaboration Network. Analysis of the top 20 prolific authors in the field of MNC from 2006 to 20th February 2022 is presented in Figure 4. These scholars have shown consistency in contributing to MNC research. Top productive authors over time

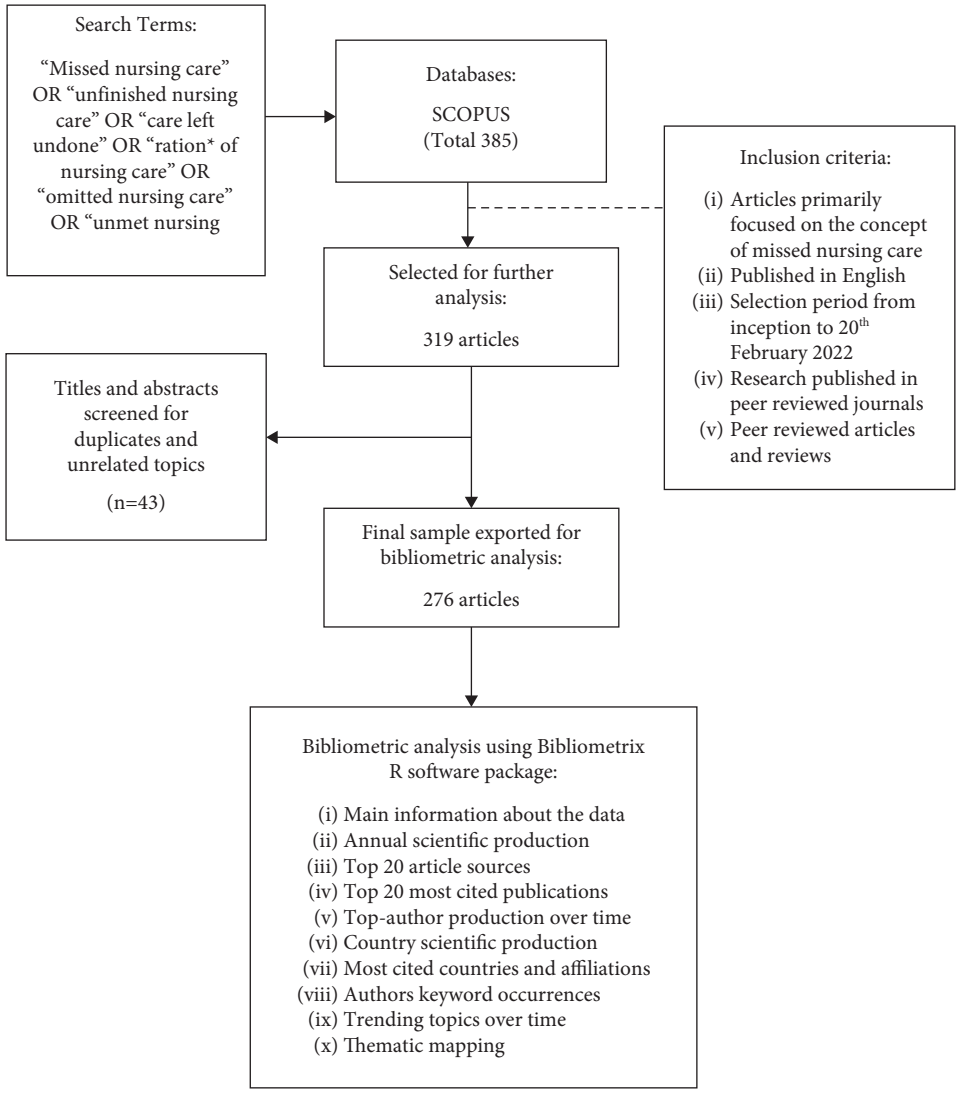

Figure 1: Research design flow chart for this bibliometric study.

Table 1: Inclusion and exclusion criteria for extracting the dataset.

	Criteria
Inclusion criteria	Documents primarily focused on the concept of missed nursing care and containing the keywords in either title, abstract, or keywords Studies published in English language Research published in peer-reviewed on the concept since inception All studies published as reviews or articles
Exclusion criteria	Studies that are not research articles or reviews such as news items, conference papers, and letters Studies with publication state "in press"

include Kalisch B.J., Ausserhofer D., Willis E., Papastavrou E., Schubert M., Palese A., Simon M., and Aiken L. H. The author with the highest number of articles was Kalisch B. J. Other significant authors and their scholarly work in the field are shown in Figure 4. The lines within Figure 4 represent author-production timeline. The size of the bubble is proportional to number of documents each author produced per year indicating that the bigger the bubble the higher the number of articles. The intensity of the bubble colour is also proportional to total citations per year for each author. In addition, the first appearing bubble on the line indicates the first publication on missed nursing care for each author.

Table 2: Characteristics of studies included in the bibliometric analysis.

Descriptions of data extracted	Results
Main information about data	
Timespan	2006–2022
Sources (journals, books, etc.)	102
Documents	276
Average years from publication	4.08
Average citation per documents	30.61
Average citations per year per document	4.03
References	9086
Document types	
Article	250
Review	26
Document contents	
Keywords plus	948
Authors	541
Author information	
Authors	772
Author appearances	1391
Authors of single-authored documents	6
Authors of multi-authored documents	766
Authors collaboration	
Single-authored documents	8
Documents per author	0.36
Authors per document	2.8
Co-authors per documents	5.04
Collaboration index	2.86

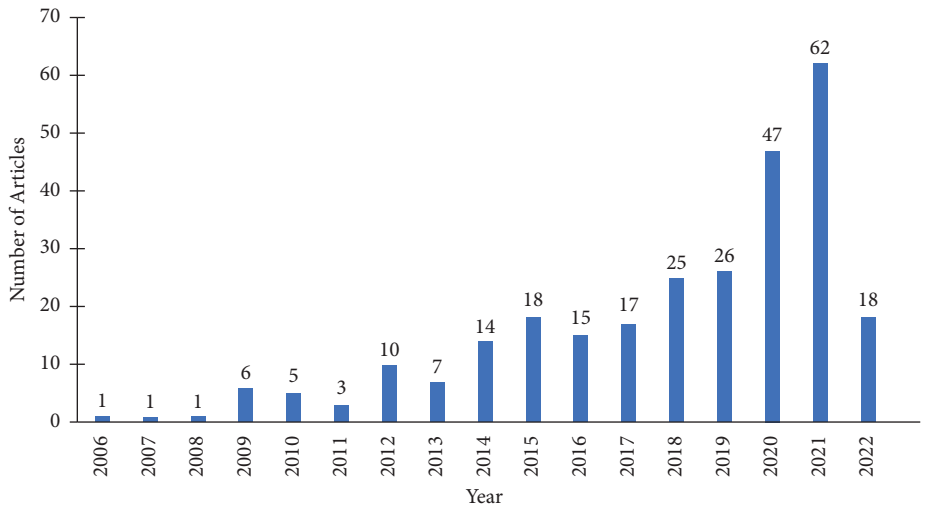

Figure 2: Annual scientific production of MNC research from 2006 to February 2022.

The number of scientific productions by authors in the field understudied increased considerably from 2014 which can be due to the increased awareness of this phenomenon and global interest on safe and quality healthcare delivery that meet patient and staff outcomes.

A visualisation map of prolific authors, author country, and theme of interest in MNC research is shown in Figure 5 and illustrated by a three-field plot of document contribution by country (on the left column), authors (names of authors in the middle column), and themes (most used author keywords) of MNC research. The occurrences of the author keywords form themes in this study. In the three-field plot, the height of the boxes and the thickness of the connecting lines signify the volume of work published. Thus, longer box heights and thicker lines indicate higher volumes of work published. Again, the results show that Switzerland has more author affiliations compared to the USA. The analysis showed that major contributions of research activity

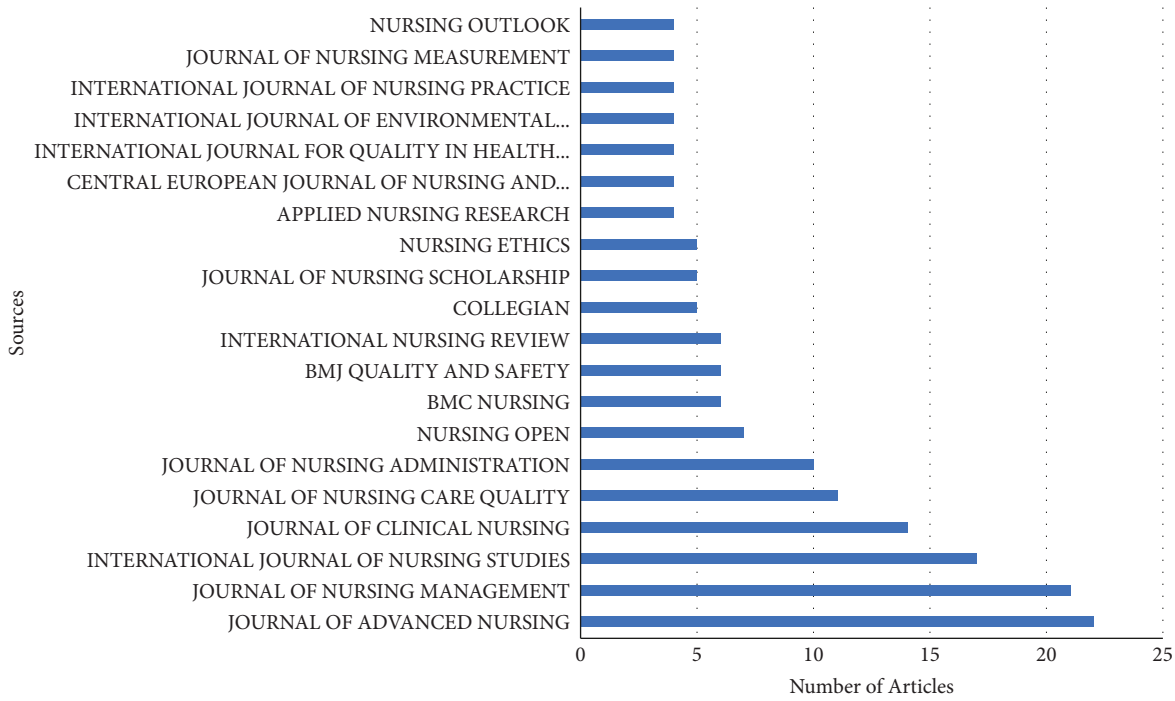

Figure 3: Top 20 most relevant publication sources of on MNC.

has been from authors in countries such as Switzerland, USA, Australia, Italy, Cyprus, United Kingdom, and Poland among others. The topmost theme in the field of MNC used by the prolific authors is "missed nursing care" (Figure 5). Other themes that have been used by these scholars include "missed care," "nursing," "unfinished nursing care," "patient safety," "care left undone," "care rationing," and "quality of care." Again, the analysis showed that themes such as "teamwork," "patient outcomes," "nurse staffing," "work environment," and "job satisfaction" and how they relate to MNC have not seen significant global contributions on research output in most poor resourced countries.

Scientific production identifies the amount of studies undertaken by researchers in the field of study within countries and/or continents [18]. In Figure 6, the map illustrates the country research production on MNC. The blue colour intensity of the shaded country/regions is proportional to the total number of documents produced by that country/region. The deeper the colour, the higher the number of published documents in the field. Deep blue shades represent increased number of research publications in countries such as USA, Australia, and Switzerland.

Regarding the analysis of institutions and document productions, the results of top 20 most relevant institutions (Table 5) show that the University of Basel, Switzerland tops with 70 documents. This is followed by the University of Michigan, USA with document count of 54. Next is University of Pennsylvania (USA) with document count of 42 documents. In addition, Flinders University (Australia), University of Udine (Italy), Cyprus University of Technology, University of Ostrava (Czech Republic), University of Southampton (United Kingdom), and Sun Yat-Sen University (China) are included in the top 20 institutions with document count of 39, 38, 34, 27, 21, 20, and 19, respectively. This shows that MNC research domain has been well researched by different institutions spread across the globe.

In respect to co-authorship and social collaboration analysis, this study examined the social structure of MNC research in the bibliometric R-package [18]. This type of network shows the relationship or existing collaboration between two or more authors, institutions, or countries. In this study, the collaboration network map between authors and countries is shown in Figures 7 and 8.

Figure 7 illustrates the names of authors written in the boxes, the bigger the size of the box, the wider the collaboration network. The lines connecting the authors represent the strength of collaboration. The thicker the line, the stronger/wider the network (contributing to increased scientific production among authors). In addition, there are networks within networks such as Tschannen D. and Lee K.H. all connected to Kalisch B.J. The results show that scholars including Kalisch B.J., Ausserhofer D., Shubert M., Willis E., Papastavrous E., Palese A., Zelenikova R., Simon M., and Griffiths P. among others have established networks with other significant authors (Figure 7).

Although the scholars are actively contributing to research in MNC, Figure 8 shows that countries such as Philippines and Oman are in isolation with no collaboration network. However, a well-established collaboration network exists between USA, Switzerland, Italy, United Kingdom, Australia, and New Zealand among other networks as presented in Figure 8 which maps country collaborations and social

Table 3: Top 20 most cited references.

#	Title of documents	Authors and year published	Publication sources	Total citations	Total citation per year	Normalized total citation
1	"Care left undone" during nursing shifts: associations with workload and perceived quality of care	Ball, Murrells, Rafferty, Morrow and Griffiths (2014)	BMJ Quality and Safety	337	33.7	3.36
2	Missed nursing care: a qualitative study	Kalisch (2006)	Journal of Nursing Care Quality	330	18.33	1.00
3	Unfinished nursing care, missed care, and implicitly rationed care: state of the science review	Jones, Hamilton, and Murray (2015)	International Journal of Nursing Studies	320	35.56	5.79
4	Prevalence, patterns, and predictors of nursing care left undone in European hospitals: results from the multicountry cross-sectional RN4CAST study	Ausserhofer et al., (2014)	BMJ Quality and Safety	315	31.5	3.14
5	Missed nursing care: a concept analysis	Kalisch, Landstrom, and Hinshaw (2009)	Journal of Advanced Nursing	287	19.13	1.87
6	Rationing of nursing care and its relationship to patient outcomes: the swiss extension of the international hospital outcomes study	Schubert, Glass, Clarke, Aikin, Schaffert-Witvliet, Sloane, and De Geest (2008)	International Journal of Quality in Health Care	227	14.19	1.00
7	Development and psychometric testing of a tool to measure missed nursing care	Kalisch and Williams (2009)	The Journal of Nursing Administration	211	14.07	1.37
8	Missed nursing care: errors of omission	Kalisch, Landstrom, and Williams (2009)	Nursing Outlook	200	13.33	1.30
9	Postoperative mortality, missed care, and nurse staffing in nine countries: a cross-sectional study	Ball et al. (2018)	International Journal of Nursing Studies	192	32.00	4.58
10	Validation of the Basel extent rationing of nursing care instrument	Schubert, Glass, Clarke, Schaffert-Witvliet, and De Geest, (2007)	Nursing Research	174	10.24	1.00
11	The association between nurse staffing and omissions in nursing care: A systematic review	Griffiths et al., (2018)	Journal of Advanced Nursing	166	27.67	3.96
12	Hospital variation in missed nursing care	Kalisch, Tschannen and Lee (2011)	American Journal of Medical Quality	166	12.77	1.42
13	Nurses' shift length and overtime working in 12 European countries: the association with perceived quality of care and patient safety	Griffiths et al. (2014)	Medical Care	156	15.60	1.55
14	Nursing care quality and adverse events in US hospitals	Lucero, Lake, and Aiken (2010)	Journal of Clinical Nursing	146	10.43	1.40
15	Rationing of nursing care and nurse–patient outcomes: a systematic review of quantitative studies	Papastavrou, Andreou, and Efstathiou (2014)	The International Journal of Health Planning and Management	144	14.0	1.43
16	Nurses' work environments, care rationing, job outcomes, and quality of care on neonatal units	Rochefort and Clarke (2010)	Journal of Advanced Nursing	137	9.79	1.31
17	The impact of teamwork on missed nursing care	Kalisch and Lee (2010)	Nursing Outlook	133	9.50	1.27
18	Missed nursing care, staffing, and patient falls	Kalisch, Tschannen, and Lee (2012)	Journal for Nursing Care Quality	131	10.92	2.66

Table 3: Continued.

#	Title of documents	Authors and year published	Publication sources	Total citations	Total citation per year	Normalized total citation
19	The association of patient safety climate and nurse-related organizational factors with selected patient outcomes: a cross-sectional survey	Ausserhofer, Schubert, Desmedt, Blegen, De Geest, and Schwendimann (2013)	International Journal of Nursing Studies	125	11.36	2.22
20	What impact does nursing care left undone have on patient outcomes? review of the literature	Recio-Saucedo et al. (2017)	Journal of Clinical Nursing	119	19.83	2.84

Table 4: Top 20 most cited countries in the domain of missed nursing care.

#	Countries	Total citations	Average article citations
1	USA	3379	51.98
2	Switzerland	1345	79.12
3	United Kingdom	1094	91.17
4	Australia	300	15.79
5	Cyprus	264	44.00
6	Korea	241	26.78
7	Canada	163	40.75
8	Iceland	120	40.00
9	Italy	120	7.50
10	China	102	12.75
11	Czech Republic	88	6.77
12	Belgium	64	64.00
13	Israel	62	12.40
14	Iran	45	5.62
15	Ireland	36	7.20
16	Sweden	30	4.29
17	Brazil	26	13.00
18	India	22	11.00
19	Mexico	22	7.33
20	Poland	22	2.20

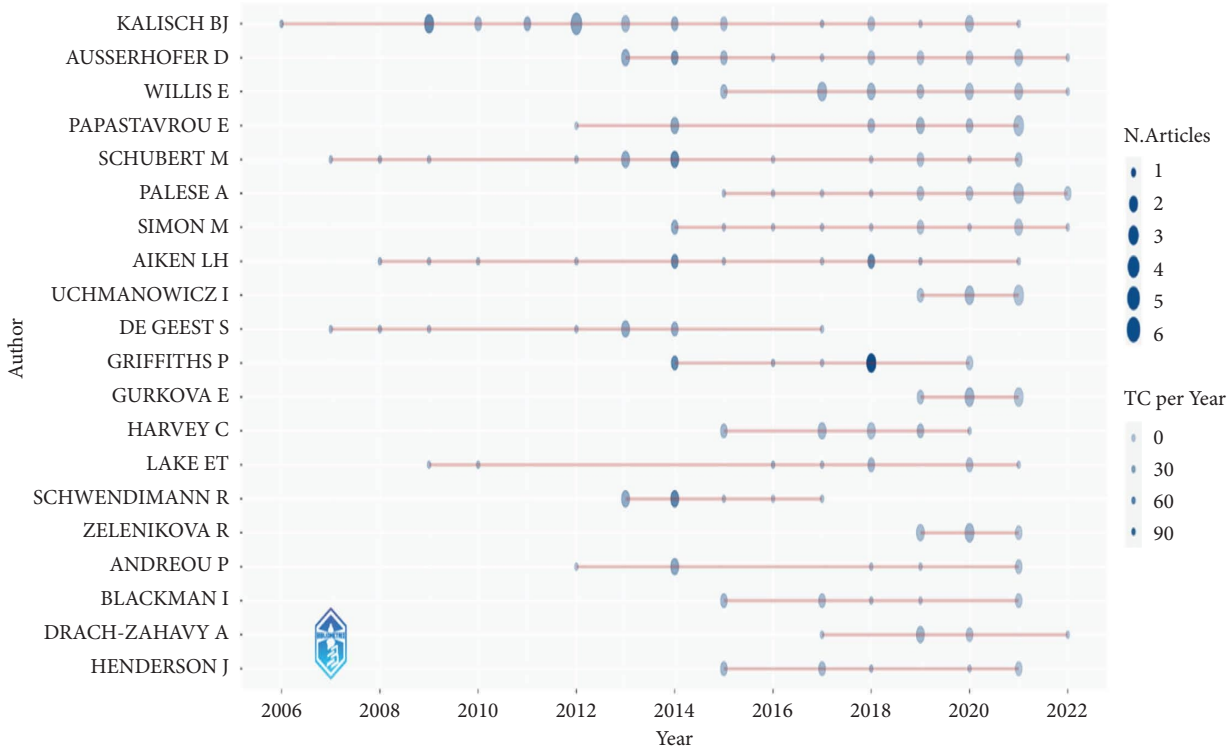

Figure 4: Top 20 authors production over the years.

networks. Countries with a larger network of collaboration are bold while those with few networks or none are smaller.

3.3. Thematic Focus of the Field of Missed Nursing Care. In this section, research publications on MNC were investigated to identify themes that dominate the field. Keyword analysis was conducted to identify yearly growth and cumulative occurrences of the keywords in the area studied [18]. The researchers analysed co-occurrence networks and visualised the word cloud and lastly trending topics in the area. Song and colleagues [34] highlighted that authors keyword analysis in published documents is an essential tool for examining trend topics and authors study focus. In Figure 9, a visualisation of the word cloud shows frequently used keywords in MNC publications. These findings suggest that, frequently used keywords include "unfinished nursing

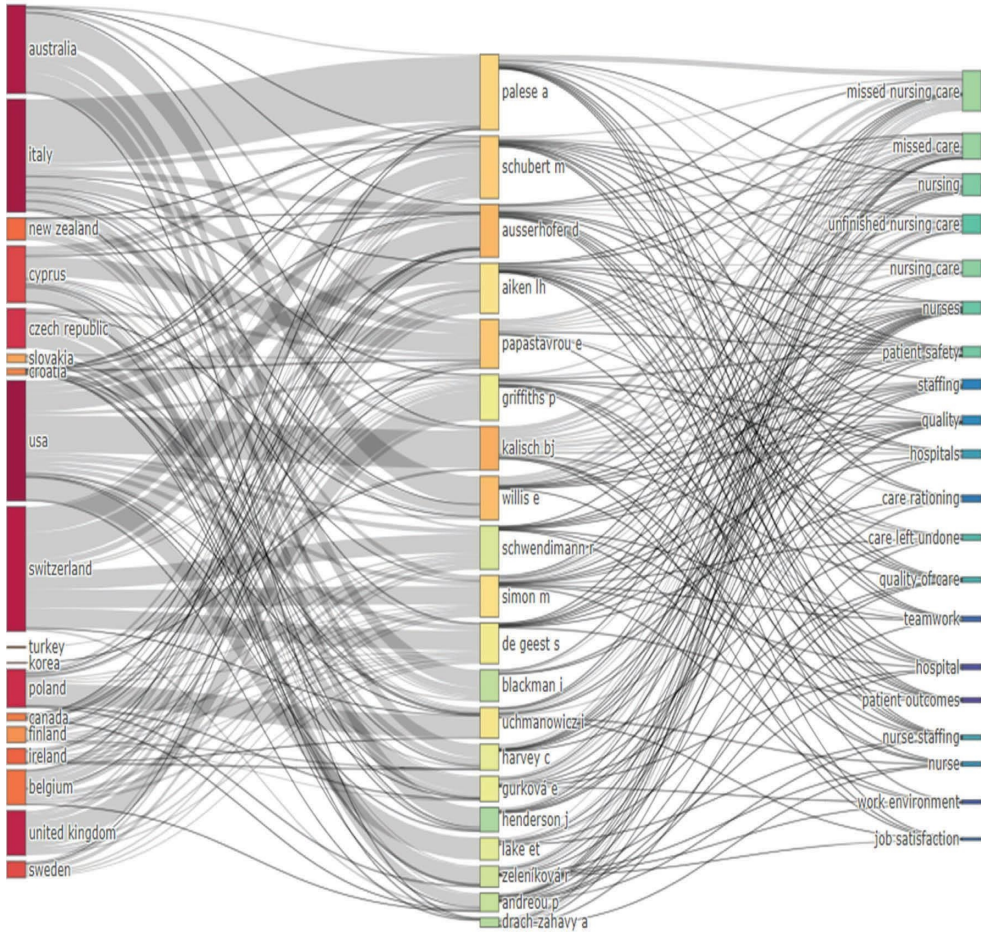

Figure 5: Three-field plot using countries, authors, and themes of missed nursing care.

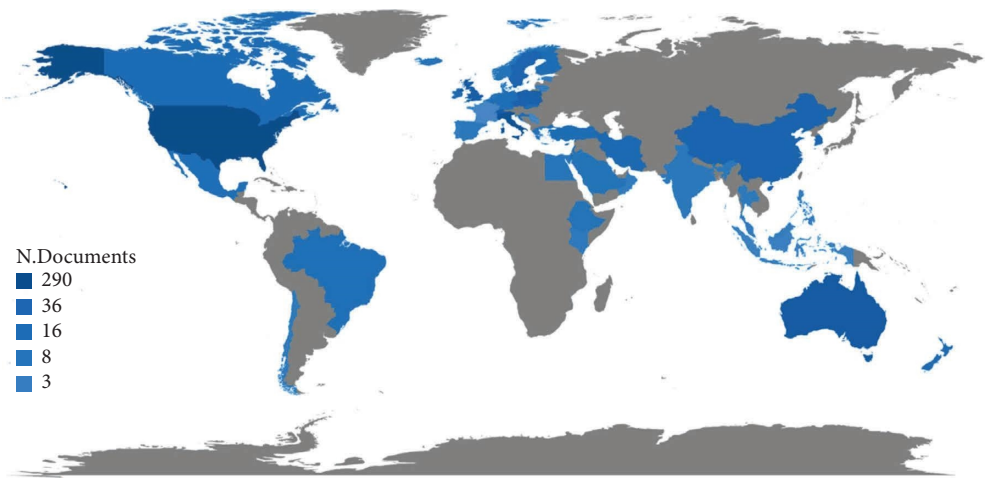

Figure 6: Global scientific production.

care," "care left undone," "patient safety," and "quality of care."

In addition, the co-occurrence network analysis was investigated to further gain insight in MNC. Co-occurrence analysis presents links between keywords in existing literature, thereby providing in-depth knowledge in the domain researched. This study identified keywords as shown in the word cloud in Figure 9. In Figure 10, the authors went further to identify the link between keywords highlighting significant keywords and their strong collaboration with other keywords. The thickness of the line (Figure 10) indicates the strength of association between keywords. Hence,

Table 5: Top 20 institutions.

#	Affiliations	Country	Articles
1	University of Basel	Switzerland	70
2	University of Michigan	USA	54
3	University of Pennsylvania	USA	42
4	Flinders University	Australia	39
5	University of Udine	Italy	38
6	Cyprus University of Technology	Cyprus	34
7	University of Ostrava	Czech Republic	27
8	Wroclaw Medical University	Poland	21
9	University of Southampton	United Kingdom	20
10	Sun Yat-Sen University	China	19
11	King's College London	United Kingdom	16
12	University of Haifa	Israel	16
13	University of Genoa	Italy	15
14	Comenius University in Bratislava	Slovakia	14
15	Karolinska University Hospital	Sweden	12
16	American University of Beirut	Lebanon	10
17	University of Turku	Finland	10
18	Verona University	Italy	10
19	Eastern Institute of University	New Zealand	9
20	Tehran University of Medical Sciences	Iran	9

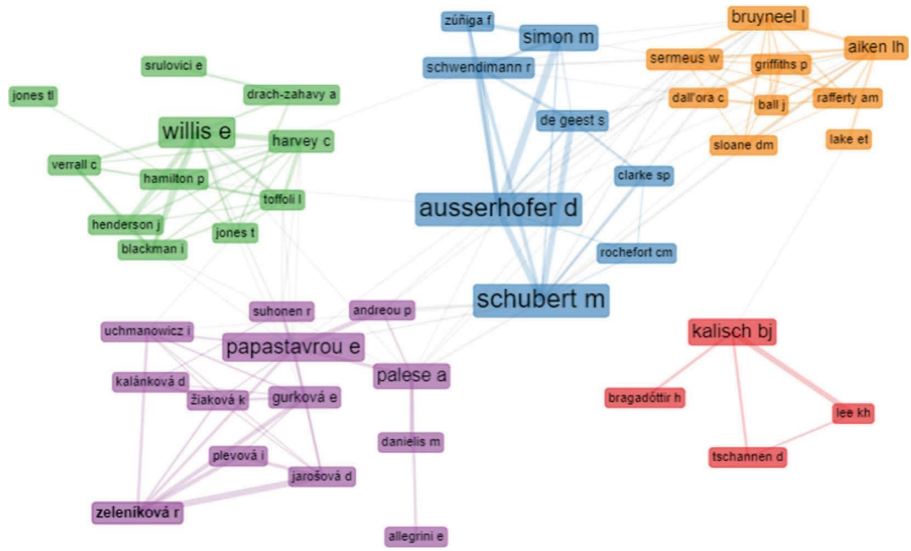

Figure 7: Mapping of collaboration network among authors.

the thicker the lines, the stronger the association. Absence of lines connecting keywords indicate that no relationships exist among keywords.

The analysis of trend topics on published studies shows the rise and fall in popularity of trending topics. In Figure 11, the size of the nodes (small to big) represents the amount of research publications that have used the topic or term in a specified year. Identifying emerging research topics in MNC which is a rapidly growing field in nursing may provide valuable insights into the "what," "how," and "why" this phenomenon occurs. Likewise, identifying fading MNC research topics can provide understanding of the intellectual structure of this domain. Hence, the analysis of annual trends of MNC research topics is as shown in Figure 11. The results show significant increases in MNC research topics such as "pandemic," "workforce," "systematic review," "practice guidelines," "COVID-19," "patient safety," "job satisfaction," "controlled study," and "qualitative research" within the last two years. Overall, most of the articles analysed have used trend topics such as cross-sectional study, questionnaire, and nursing staff. This attests to the differences in conceptual models and tools used in measuring MNC globally.

The thematic map analysis in this study aimed at gaining insight into current status of the field of MNC and what future research holds. This type of analysis is useful in providing knowledge in MNC to researchers, health care systems, and policy makers regarding the potential for development of themes for future research in the field of MNC [18, 35, 36]. In thematic analysis, clusters of author keywords

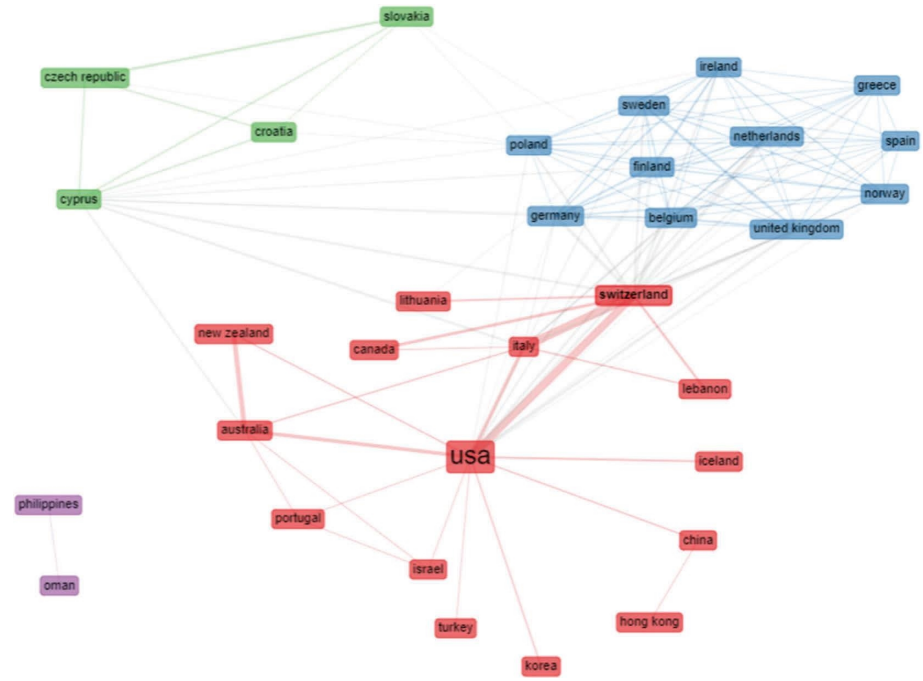

Figure 8: Mapping of countries collaboration and social networks.

Figure 9: Word cloud visualisation of frequently and repeatedly used author keywords in missed nursing care research.

and interconnections between the keywords are obtained. The obtained themes are categorised by "density" and "centrality" which measure how less or well developed or significant topics are [36]. The vertical axis represents density while the horizontal axis represents centrality. The latter measures the degree of association among themes and the former measures cohesiveness or interconnections among nodes. Figure 12 presents the thematic map of MNC divided in four sections on the map. These sections contain motor or driving themes, basic or underlying themes, emerging or declining themes, and niche or specialised themes.

The findings from this thematic analysis suggest that niche themes such as "adverse events," "emergency department," "medical units," "neonatal intensive care units," "patient safety," "health resources," "failure to maintain," and "organisation culture" are undeveloped research topics in the field of MNC in different patient populations. For example, prospective researchers can be guided by questions such as the following: (1) what is the relationship between MNC and adverse events such as patient falls, medication errors, or pressure ulcers in acute, community, and nonacute healthcare settings? (2) To what extent those MNC influence patient safety in different healthcare settings? (3) The impact of failure to maintain fundamental nursing care such as patient mobility, communication, feeding, or care of the skin. These studies can be examined in specialised hospital units to ascertain the impact of MNC on patient safety. In addition, motor or driving themes identified in this study include "unfinished care," "rationing," and "psychometrics." This finding suggests that several studies conducted in this domain have used varying psychometric tools and terminologies to measure MNC as highlighted in a state of science review by Jones et al. [13]. This is confirmed by the display of terms such as "care left undone," "missed nursing care," and "unfinished nursing care" within the basic or underlying themes in the map. Emerging or declining themes identified include "care rationing," "implicit rationing," and "rationed care." Since the field of MNC is still emerging, these themes are likely to rise or decline depending on prospective authors' choice of conceptualisation of MNC and/or terminology.

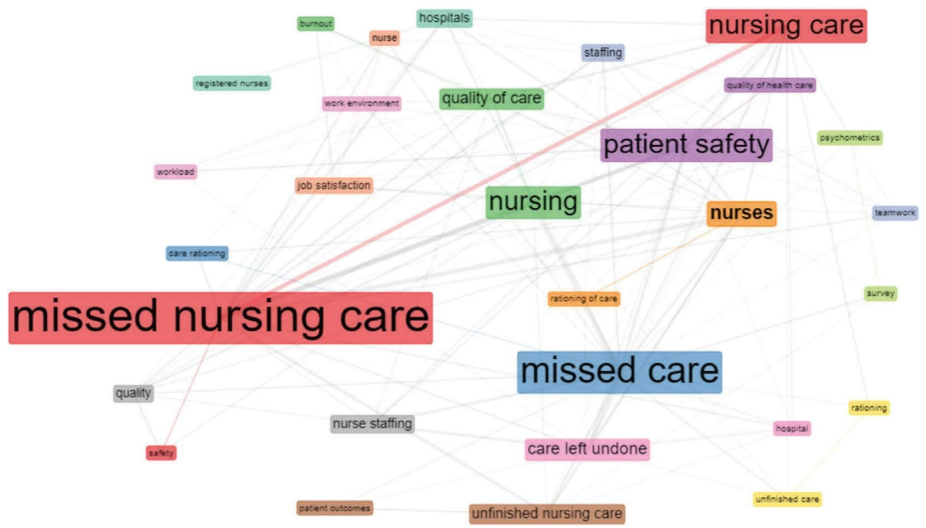

Figure 10: Co-occurrence network of keywords.

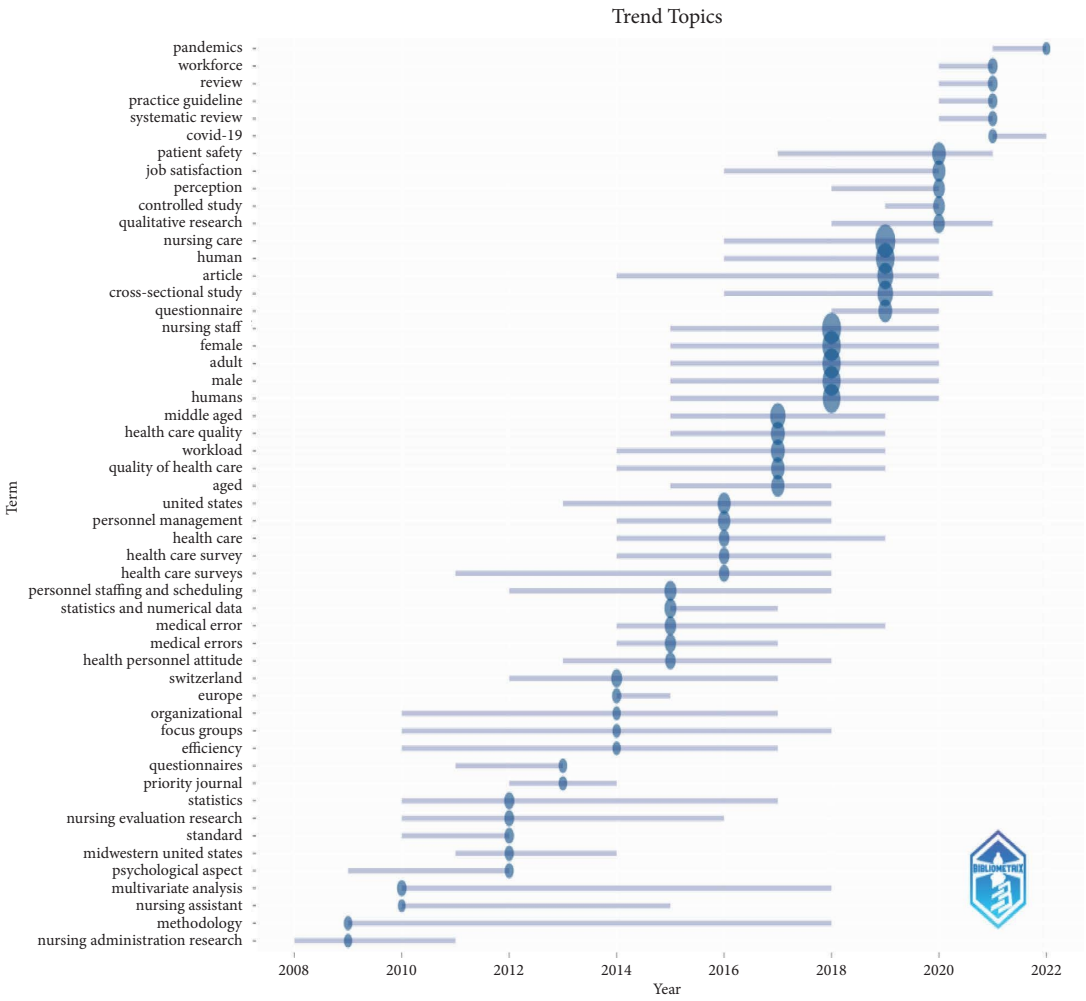

Figure 11: Trend topics over time.

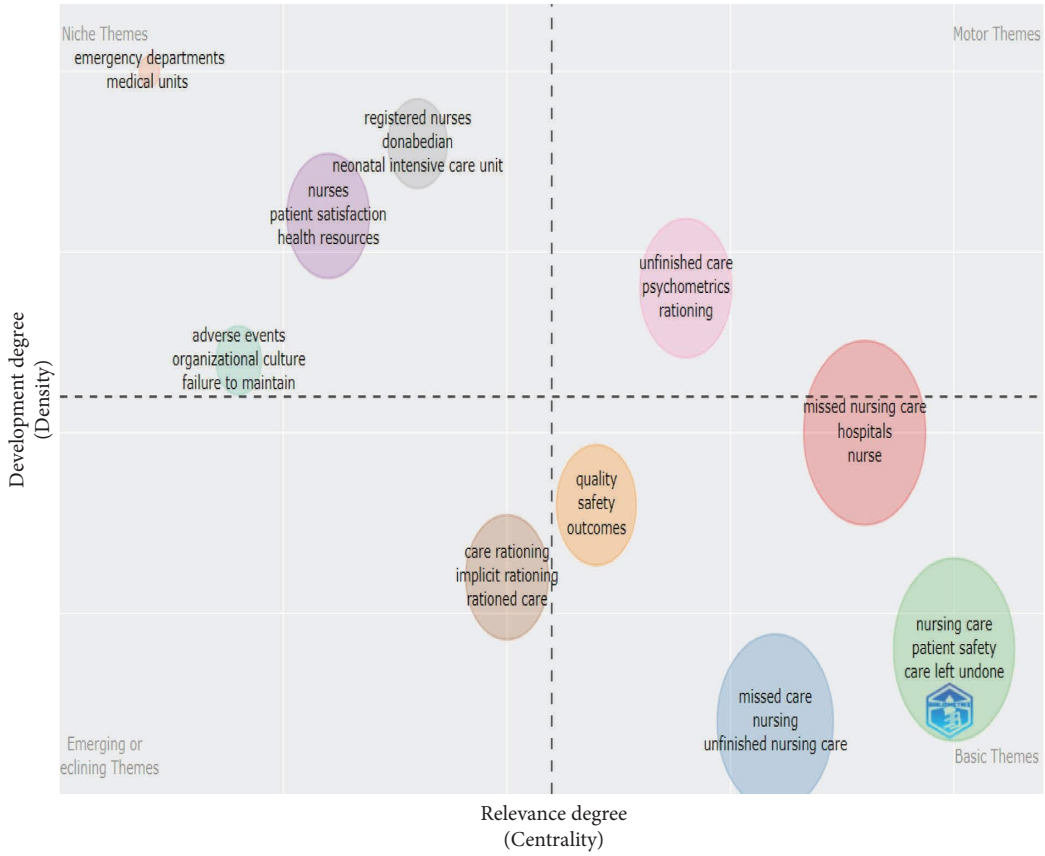

Figure 12: Thematic maps of authors keywords.

4. Discussion

Bibliometric analysis of scientific research output enables readers to understand the history and development of a research area [18]. The purpose of this study was to give a bibliometric overview of research output on MNC. The timing of this study is vital for at least three reasons. First, several international scholars are preparing policy directions to control MNC [37]. Next, the research awareness of MNC in healthcare systems is increasing globally, and thirdly, the outcomes of this phenomenon can have serious implications on patients [38].

The significance of MNC and associated nurse-patient outcomes in the healthcare setting was evident in this bibliometric analysis. This analysis showed a noticeable increase in MNC research production and citations. Several reasons such as the significant prevalence of MNC [13] and most likely researchers motivated by the search for measures to reduce the occurrence of MNC could be cited for this observation. This analysis showed that the USA had extensively investigated missed care and was also the topmost cited country. In addition, countries such as Switzerland, Australia, Italy, and the United Kingdom amongst others have explored MNC. This finding may be due to the large amount of funds invested in MNC research in these countries. In addition, the existence of well-established social networks among authors in these countries and increased number of their publications indicate that collaboration has become the preferred method to conduct scientific research and reduce the high burden of MNC [7, 39]. On the whole, other countries, especially low- and middle-income countries which may have higher burden of MNC [40], should find their gaps in MNC research and using the high performing countries as their benchmark, accelerate research on MNC and strive to improve research strength and academic impact in this domain.

Citations help researchers to retrieve the emerging themes, concepts, and future trends for a specific discipline; the high citations of articles retrieved is indicative of MNC importance, particularly in Anglo countries [37]. Such control cannot be achieved without nurse managers, nurse researchers, consumers, and policy makers' involvement. Addressing the problem on a shift or ward-based redesign using lean production systems to focus on patients, nursing ethics, and time management can be a success story [41] and create an impressive reduction in MNC burden worldwide.

In terms of global citations, the most cited reference was a cross-sectional study conducted by Ball and colleagues [33], followed by a qualitative study by Kalisch [6], and then, a state of the science review by Jones et al. [13]. In addition, surveys conducted by experts on behalf of the Registered Nurse Forecast (RN4CAST) consortium [42] and Schubert and his colleagues [43] are all in the top most cited references. The most cited founding contributions have allowed the development of research in this field using varying terminology-specific tools aimed at providing further

understanding to MNC and implementing innovation [14, 17, 33, 38, 42, 44–52].

While the global scientific output maps an image of country scientific production, there is considerable need for research in Sub-Saharan Africa where many low-income countries are located hence the potential for more MNC [53]. In addition, such countries and their institutions can benefit from international collaboration to study the amount of MNC and contributing factors and compare its occurrence to that of developed countries. Again, analysis of institutions and affiliations showed little involvement and collaboration from African institutions. The growth in the field of MNC in this region is vital and can promote awareness of this phenomenon leading to in-depth scientific exploration of what care gets missed and how it impacts patients living in low-income countries.

Research focusing on MNC has an important place in terms of healthcare organisations. The results from this study also showed the oldest publications dated from 2006 following a growing interest in the area. The annual growth rate increased by 600% in 2009, tripled in 2015 and increased exponentially from 2018. Thus, it is anticipated that annual scientific output in this domain will continue to rise. Whilst some MNC articles are not found in open access journals, it is hypothesized that MNC articles will likely receive more citations if published in open access journals to be easily accessible to researchers in low- and middle-income countries.

Analysis of trending topics showed current interest in research on MNC and COVID-19 pandemic. The growth of research in this area can evidently promote scientific exploration into what factors contribute to or worsen MNC in pandemics and the impact on nurse-patient outcomes. Results on keyword analysis showed that the most active author keyword used in the retrieved articles was "missed nursing care." This interest in the term MNC is likely motivated by the quest for the objective measurement of this phenomenon across countries [11]. In addition, thematic map analysis of authors keywords provided insight into four themes of various words and phrases that have been used over time (such as missed nursing care, unfinished nursing care, patient care, and quality of care) as well as emerging (such as emergency department and primary health care).

This study is the first to analyse MNC using bibliometric method. However, the authors acknowledge that the present study has some limitations that need to be addressed. The main limitation was the use of one database (Scopus) for data collection. The authors selected this database because it ensures a wide range of high-quality peer-reviewed journals [29]. Although the authors did their best to use all relevant keywords in the field of MNC, the possibility of a limited false positive or negative remain a possibility. Again, potential bias exists in terms of sources including publication and language bias. Future researchers can reduce this bias by adding languages other than English with interpretations in search query. In addition, the researchers acknowledge that there are some recent published papers in this domain, which have not yet accumulated several citations as the seminal in the field. Notwithstanding, this study provides insight into trends in scientific production of MNC literature and shows gaps in research in low-income countries. Investigating the concept of MNC and how it impacts low-income countries and the nexus between MNC and COVID-19 are important next steps towards evident based research in this domain.

5. Conclusions

This research applied bibliometric approach to quantitatively analyse available published studies on MNC using the biblioshiny, a bibliometrix app in R software package. Using this analytical method, data retrieved from Scopus were analysed and mapped. The bibliometric analysis showed that since its inception, MNC research has increased rapidly spreading from USA to parts of Europe and in several countries with majority of these scientific papers occurring in the last five years. Different terms have been used to refer to MNC in these papers (such as missed care, rationing of nursing care, unfinished care, care left undone, implicit rationing, and errors of omission) [39, 54]. Despite this, extent of impact of COVID-19 on MNC research remains elusive.

In addition, the country scientific production map showed limited research in low-income countries highlighting the opportunity for further research and institutional collaboration to support and improve research in these regions. Also, it is suggested that healthcare systems, authors, and policy makers should invest more in MNC research in relation to adverse events and specific care missed (such as medication, feeding, skin care, communication and turning) as this study shows that they are potential topics. Finally, given the exponential growth of research in MNC, this research provides valuable insight to current trending topics and themes useful for the development of research questions in clinical settings to investigate MNC and provide further interventions to reduce this phenomenon globally.

Abbreviations

MNC: Missed nursing care.

Data Availability

The data and materials used to support the study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

AAS contributed to the study conception, data collection, and drafting of the manuscript. DA, LG, and ATB contributed to study conception, editing, and approval of this research manuscript. The final manuscript was read and approved by all authors.

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