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## Review of work from home empirical research during Covid-19

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## ABSTRACT

This study synthesizes the empirical research on Work From Home (WFH) during COVID-19 from 2020 to 2022. The study addressed two objectives; (1) to find the common WFH practices during the COVID-19 2020–2022 period and (2) to find the areas that are not common in WFH practices in the research landscape during COVID-19 in 2020–2022 and (3) the areas that need attention in future research on WFH practices. A Systematic Literature Review (SLR) methodology and Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were used to address these objectives. Following a predetermined article selection criteria, 108 articles were included from Scopus for the review. The study addressed the first objective and found five areas of outcomes which are; (1) Work attitudinal outcomes and means for WFH, (2) Gender-related outcomes, (3) Leadership challenges and mental health outcomes, (4) Work-related outcomes, and (5) Mobility-related outcomes. Addressing the second objective, we have seven areas for future research, including the five outcomes related to the first objective and (1) Determinants and (2) Occupational health outcomes of WFH, which were found in addressing the second objective. Moreover, research implications for practicality and future researchers are also provided.

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## 1. Introduction

The workforce demanded flexibility through WFH even before the Pandemic. One reason is the workforce's demographic trends and the vital requirement of freedom in location and time (Bellmann & Hübler, 2021; Gajendran & Harrison, 2007). Another reason is its ability to increase employees' flexibility (Tietze & Musson, 2010). With the outbreak of COVID-19 and its spreading across nations (Gao & Yu, 2020), "stay-at-home" and "social distancing" policies were implemented. These caused organizations to go for WFH without prior preparedness (Kao, Wang, Ho, Chen, & Chen, 2023; Yang & Lin, 2022), adapting and automating the new offices (Dahri et al., 2020; Guerrieri, 2020; Hall et al., 2022; Kaur Bagga, Gera, & Haque, 2022).

The European Framework Agreement (2002) defined WFH as task performances from multiple places using information

technology (Wojcák & Baráth, 2017). Previous studies linked various determinants to WFH. They include psycho-social factors like a positive attitude towards WFH (Beno & Hvorecky, 2021; Rose & Brown, 2021), spousal support, peer influence (Jain, Currie, & Aston, 2022a) and previous experience with WFH (Albro & McElfresh, 2021; Bizilj, Boštjančič, & Sočan, 2021). Organizational factors like organizational and managerial support (Choukir, Alqahtani, Khalil, & Mohamed, 2022), infrastructure provisions like computer-mediated communication (McGloin, Coletti, Hamlin, & Denes, 2022), and supportive office ergonomics (Mayer & Boston, 2022) at home also determine the WFH. The possible outcomes of WFH include convenience and autonomy (Mehta, 2021), greater productivity (Afrianty, Artatanaya, & Burgess, 2021; Beno & Hvorecky, 2021), leadership efficacy (Bizilj et al., 2021; Stoker, Garretsen, & Lammers, 2022), job satisfaction (Bailey & Kurland, 2002), and organizational communication (McGloin et al., 2022). Moreover, increased job engagement (Albro & McElfresh, 2021), emotional well-being (Zapata-Garibay et al., 2021), and happiness (Mehta, 2021) are other outcomes of WFH. Besides, women's increased workload (Feng & Savani, 2020; Jasrotia & Meena, 2021; Syed, Gupta, & Rai, 2021; Yaish, Mandel, & Kristal, 2021), social isolation (Toscano & Zappalà, 2020), high work demands, and work

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overload in general (Molino et al., 2020; Tanpipat, Lim, & Deng, 2021) are the other outcomes of WFH. Additionally, behavioral stress, occupational stress (Molino et al., 2020; Thomas et al., 2021; Wiradendi Wolor, Nurkhin, & Citriadin, 2021), psychological distress (Prabowo, Ellenzy, Wijaya, & Klopings, 2022), work-family conflicts (Neo, Tan, & Chew, 2022), and work-related fatigue (Palumbo, 2020) are also the outcomes of WFH.

Although COVID-19 is over, Facebook, Microsoft, Spotify, Twitter, Zillow, Salesforce, Upwork, and many other organizations use WFH in post-pandemic situations (Stoller, 2021) as many significantly prefer it (Menon, Keita, & Bertini, 2020; Yeke, 2023). However, some (Pratt, 1984) raise the question of “shirking from home” (Bloom et al., 2015) and still have a skeptical attitude towards it (Silva-C et al., 2019), revealing the prevalence of different perspectives on WFH (Dingel & Neiman, 2020). This create a need to examine the established knowledge in WFH’s research landscape (Das, Mukhopadhyay, & Suar, 2022). WFH has been the focus of many studies because of its significant prevalence during COVID-19 (Z. Chen, 2021). Their findings and synthesis of those findings are paramount in the new normal (van Hoek et al., 2022) for four reasons. The first is that a synthesis summarizes all the findings, giving an overall picture of the current knowledge of WFH applications. The second is that a recent estimate found that a COVID-19-like pandemic is 38% likely to strike in a person’s lifetime (Marani, Katul, Pan, & Parolari, 2021). The findings estimate that the likelihood of catastrophic outbreaks could triple over the next few decades (Joy, 2022; Marani et al., 2021). The third is that the WFH is still highly demanded (ILO, 2020) due to its ability to maintain employee satisfaction, cost saving to both the employer and employee and productivity (Kong, Zhang, Xiao, Das, & Zhang, 2022). Finally, synthesizing the previous WFH research findings may help practicality, theory, and future research directions.

Due to these reasons, we tried to find a review study synthesizing the findings of WFH research during COVID-19. This study must include publications by different countries to have a broader overview and vast results of WFH empirically investigated (Abiddin, Ibrahim, & Abdul Aziz, 2022). The empirical investigations ensure enough consistency for methodological quality to provide findings that satisfy internal validity (Petticrew & Roberts, 2006; Priyashantha, De Alwis, & Welmilla, 2022a). We discovered a review study on WFH in COVID-19 (Febriani & Churiyah, 2022) 2) that suffers from flaws in the criteria above. Besides, the authors are unaware of a complete synthesis of the empirical study findings on identifying the current knowledge and gaps of WFH in COVID-19 research, notably conducted between 2020 and 2022, despite the prevalence of several review studies on WFH in COVID-19. This idea is supported by a study highlighting the dearth of studies that synthesize the results of WFH experiments (Hossain, 2020). These reasons provided sufficient rationality and motivation to conduct a review study synthesizing the findings of empirical studies on WFH during the COVID-19 period between 2020 and 2022.

The primary objectives of the study were to find; (1) the common WFH practices during the COVID-19 2020–2022 period, (2) the areas that are not common in WFH practices in the empirical research landscape during COVID-19 period between 2020 and 2022, and (3) the areas that need attention in future research on WFH practices. To address these, we conducted an SLR using 108 articles published between 2020 and 2022 that adhered to the PRISMA guidelines. The articles were retrieved from Scopus. The keyword co-occurrence analysis was performed using VOSviewer to address the objectives.

The following structure was utilized to present the paper’s content: A detailed description of the study’s “materials and methods” and its “results and findings” can be found in the

following sections of the article. The materials and methods section explains the processes and methods carried out. The most significant findings made during the study are detailed in the “results and findings” section. The four subheadings that make up this section are “selection of articles,” “characteristics of articles,” “results of the articles,” and “reporting the bias assessments.” Then after that, the “discussion,” “conclusion,” and “practicality and research implications” are provided.

## 2. Materials and methods

### 2.1. Article selection process and methods

This study followed the SLR methodology. The SLRs must follow the PRISMA framework as recommended guidelines for planning, conducting, and report writing in an SLR (Liberati et al., 2009). Thus, complying with the PRISMA requirements, we prepared a protocol at this study’s planning level, and the content of it is given in Table 1. It includes the article selection method, search terms, inclusion criteria, analysis methods, and reporting structure. According to Table 1, the article selection method, analysis methods, and reporting structure were designed based on the PRISMA guidelines. The search terms and article inclusion criteria were decided at the planning level, outlined in Table 1. Concerning inclusion criteria 5 (journal articles) and 6 (empirical articles), they were selected for use in this study as there are justifications to include them for screening articles in SLRs. The inclusion of the journal articles is justified in part due to their strong credibility, having undergone an arduous peer-review process. Other justifications for including the empirical articles include; their recommendation as part of the SLRs (Tranfield, Denyer, & Smart, 2003; Xiao & Watson, 2019), their ability to ensure enough internal validity (Petticrew & Roberts, 2006; Popay et al., 2006), and methodological consistency to draw valuable conclusions (Okoli & Schabram, 2010).

As noted in Table 1, the article selection was performed by the PRISMA requirements for which the PRISMA flow diagram has been developed. It has three steps, “identification,” “screening,” and “included.” Fig. 1 shows how these steps were followed in the study. In the “identification,” the search terms were: “2019-nCoV,” “COVID-19,” “Coronavirus Disease 2019,” “Novel Coronavirus Pneumonia,” “NCP 2019,” “novel coronavirus,” “SARS-CoV-2 2019” “Novel Coronavirus Diseases,” “novel coronavirus,” “pneumonia” “Work from home,” “WFH,” and “Remote work.” They were typed in the Scopus database with OR operative for similar terms and operative for different terms. In the screening of articles, we followed automatic and manual screening. The automatic screening was conducted against criteria one to five listed in Table 1 using the default limiting options of the databases. The articles that did not meet criteria one to five were excluded.

After automatically screening the articles, the remaining articles’ full versions were retrieved for manual screening and eligibility assessment. The study authors manually screened articles independently against criteria 6 and 7 in Table 1. In this stage, the criteria of Meline (2006), “minimum acceptable level for the methodological quality,” was followed. The minimum acceptable level set was the articles that followed “the quantitative methodology” (Criteria 7). Thus, only articles that used a quantitative methodology were included, while those that did not were excluded.

### 2.2. Study risk of the bias assessment

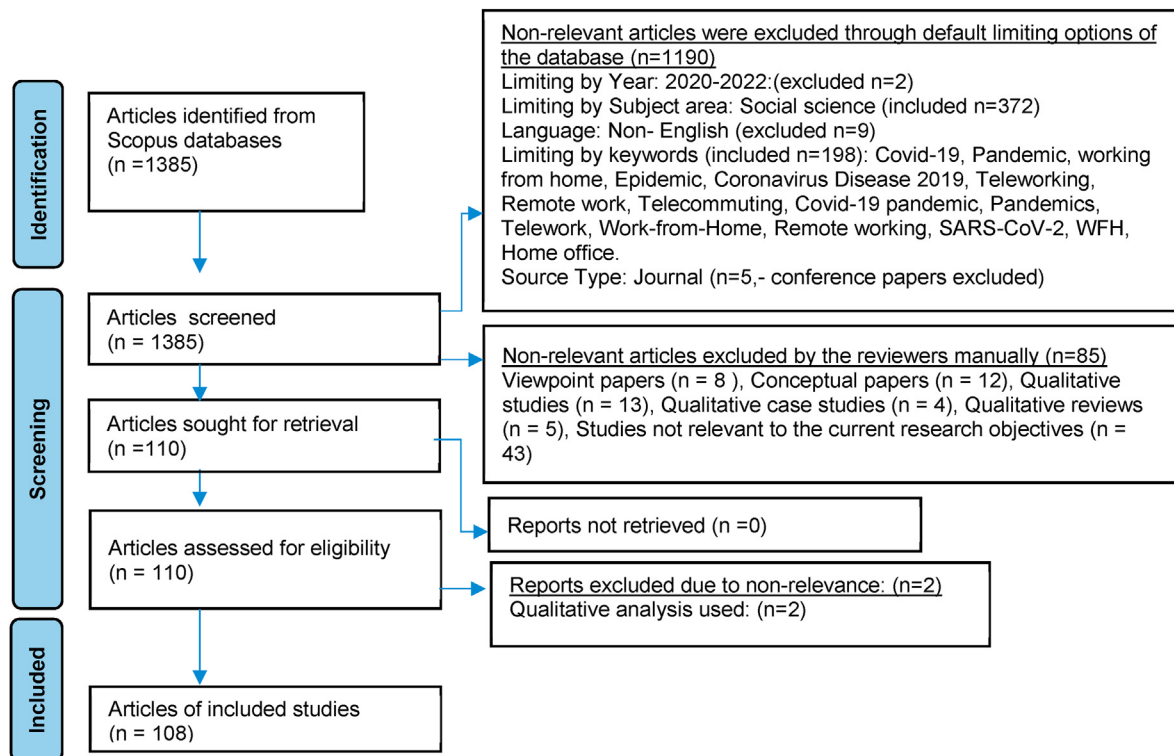
The reviewer bias can be evident in both article inclusion and analysis. To minimize it, following a systematic procedure for

**Table 1**

Review protocol.

Article selection method	PRISMA guidelines
Search terms	"2019-nCoV," "COVID-19," "Coronavirus Disease 2019," "Novel Coronavirus Pneumonia," "NCP 2019," "novel coronavirus," "SARS-CoV-2 2019" Novel Coronavirus Diseases," "novel coronavirus," "pneumonia" "Work from home," "WFH," and "Remote work."
Article inclusion criteria	1. Year range: 2020–2022 2. Subject area: All subject areas categorized in the Scopus database 3. Language of article: English 4. Keywords: COVID-19, Pandemic, working from home, Epidemic, Coronavirus Disease 2019, Teleworking, Remote work, Telecommuting, COVID-19 pandemic, Pandemics, Telework, Work-from-Home, Remote working, SARS-CoV-2, WFH, Home office. 5. Publication source type: Journals 6. Type of the study: Empirical articles (quantitative studies which were peer-reviewed) 7. Methodological quality: Articles that followed the quantitative methodology
Analysis methods	PRISMA guidelines
Reporting structure	PRISMA guidelines

Source: Authors' conception (2023)

**Fig. 1.** PRISMA article selection for flow diagram.

Source: Authors creation based on the PRISMA flow diagram (2023)

article inclusion, performing a concurrent unbiased quality assessment of articles by different researchers (Brereton, Kitchenham, Budgen, Turner, Khalil, 2007), and using unbiased analytic techniques are essential (Kitchenham & Charters, 2007; Xiao & Watson, 2019). Thus, the potential bias risk associated with article inclusion and analysis was eliminated by adhering to the criteria above.

### 2.3. The analysis methods

We have used Biblioshiny and VOSviewer-based mathematical tools as they are designed to analyze the content and structure of an article (Aparicio, Iturralde, & Maseda, 2019; Paule-Vianez, Gómez-Martínez, & Prado-Román, 2020; Van Eck & Waltman, 2014). The tools perform two types of analysis: (1) performance analysis and (2) scientific maps. The performance analysis includes studying the

articles' performance and productivity (Cobo, López-Herrera, Herrera-Viedma, & Herrera, 2012; Priyashantha, De Alwis, & Welmilla, 2022b). The scientific maps analyze the article's structure, development, and relevant players (Aparicio et al., 2019; Cobo et al., 2012; Noyons, Moed, & Luwel, 1999). The maps are generated through bibliometric networks, and there are various units of analysis, such as keywords, terms, authors, citations, country of publication, or source types (Callon, Courtial, Turner, & Bauin, 1983; Cobo et al., 2012; Noyons et al., 1999; van Eck & Waltman, 2014). The most common unit of analysis is the keywords that reflect the main content of an article (Andrić, Priyashantha, & De Alwis, 2023; Callon et al., 1983). In the case of finding the common or most minor areas of investigation, this co-occurrence of keywords in articles is taken as the unit of analysis (Andrić et al., 2023; Aparicio et al., 2019; Priyashantha, De Alwis, & Welmilla, 2021a, 2021c, 2022b; Priyashantha, 2022; Priyashantha, Dahanayake, &

Maduwanthi, 2022). Thus, the links of such networks can be created using the co-occurrence relationship of such keywords in the articles (Aparicio et al., 2019). VOSviewer visualizes them as “keyword co-occurrence network visualization” (van Eck & Waltman, 2014).

After relativizing the interconnection of keywords, meaningful information about the content in the keyword co-occurrence network visualization can be obtained (Cobo et al., 2012; Priyashantha et al., 2022b). This process is done by normalizing the keyword co-occurrence network visualization (Andrić et al., 2023; van Eck & Waltman, 2014). As a result, by default, the VOSviewer employs association strength normalization and generates a network in a two-dimensional space (Priyashantha et al., 2022a; van Eck & Waltman, 2014). In that space, significantly linked keywords represented by nodes are found near one another, whereas less significant ones are found far away (Priyashantha, 2022; Van Eck & Waltman, 2014). The VOSviewer then distributed the nodes to a network of clusters, with highly correlated nodes assigned to the same cluster (X. Chen, Chen, Wu, Xie, & Li, 2016; Priyashantha, De Alwis, & Welmilla, 2021c). VOSviewer uses colors to denote the cluster assigned to a node. As a result, a cluster may indicate a common theme (Andrić et al., 2023; X. Chen et al., 2016; Dogra & Parrey, 2022; van Eck & Waltman, 2014). This keyword co-occurrence analysis was used since the first objective was finding the common WFH practices during COVID-19 in 2020–2022. There, findings related to each clustered keyword were surveyed by reading each article’s abstract and results sections. Subsequently, the common themes under which the keywords and their related findings are outlined in section 3.3.1. Those common themes were listed in Table 5 with respective author information of keywords taken in each study. The citations received for each theme were calculated based on the number of citations received for each study, including respective keywords allocated under the common theme and outlined in Table 5.

The second objective was to find the areas not common in WFH practices in the research landscape during COVID-19 in 2020–2022, which was addressed through the keywords density visualization map of VOSviewer. This is explained in section 3.3.2. Posited by the VOSviewer user manual, the default colors of the keyword density visualization map at each point range from blue to green to red, and weightage is denoted by the number of keywords in its vicinity (Andrić et al., 2023; van Eck & Waltman, 2014). Keywords pointing to blue indicate the lower weight, and green denotes average weighted keywords (Andrić et al., 2023; X. Chen et al., 2016; van Eck & Waltman, 2014). Therefore, keywords in the blue and green vicinity were treated as areas lacking (not common) investigation (Priyashantha, 2022; van Eck & Waltman, 2014), which addresses the study’s second objective.

The third objective of the study was to identify the areas that need attention in future research on WFH practices, which is addressed in section 6. The areas that need future research are identified using the keywords co-occurrence density visualization in Fig. 8.

Moreover, “overall information of the article set,” “annual article publication,” “average citation received,” “source journals of articles,” and “country-wise article publications” were obtained using the software to elucidate the article’s defined profile in the review. R-Biblioshiny was used to generate the first four outputs, and the final output was generated with the aid of VOSviewer.

### 3. Results and findings

#### 3.1. Selection of articles

We identified 1385 articles using the PRISMA flow diagram

during its first stage. Articles published from 2020 to 2022 were included; others were excluded as they did not meet the inclusion criterion 1 listed in Table 1. Then out of the remaining articles, 372 were included as they comply with criterion 2. Additionally, nine articles were excluded as they were not in English, which was to comply with criterion 3. According to criterion 4, applying the keywords, we retained 198 articles by excluding 165 articles as they did not meet criterion 4 in Table 1. According to criterion 5, five conference proceedings were excluded as they were not published in journals. The remaining 193 articles were manually screened against all seven inclusion criteria, and it was found that 87 articles were irrelevant as they did not meet criterion 6. The 87 articles include viewpoint papers (n = 8), conceptual papers (n = 12), qualitative studies (n = 15), qualitative case studies (n = 4), qualitative reviews (n = 5), and studies not relevant to the current research objectives (n = 45) all of which were then excluded. Subsequently, all the retained articles’ (n = 110) full versions were retrieved for eligibility checking. The study authors manually checked eligibility against criterion 7 in Table 1. We found that two articles were irrelevant as they followed qualitative analysis and excluded as they did not meet criterion 7. The entire selection of articles is shown in Fig. 1.

#### 3.2. Characteristics of articles

The focus is given in this section to explain the included article’s characteristics. Table 2 shows the overall information of the articles. Accordingly, the review included 108 articles published between 2020 and 2022 in 95 journals. There were 398 authors from 18 countries. It implies that we have had wider coverage of articles. Concerning the citations, they received an average citation of 11 per article for the whole period. The total references included were 6985, and there were 370 author keywords. Fig. 2 shows the increase in the overall article publication, depicting that most studies were conducted in 2021. Fig. 3 points out the average citation received for the articles. It indicates that 20 citations have been received for the articles published in 2020. There are five citations received for the articles published in 2021. The citations received show the popularity of the topic. Fig. 4 shows the relevant source journals of the articles. It points to the 15 journals with the most cited articles. Accordingly, the Sustainability Journal has the highest number of publications (16 articles). Transportation Research Part A: Policy and Practice is second on the list, with eight articles. Further, third on the list is the Transport Policy, and Transportation Research Interdisciplinary Perspective, which published four articles. Besides, only two articles have been published by the rest of the journals listed in Fig. 4.

Fig. 5 depicts the article publication according to countries. It briefly signifies how countries depend on each other for publications and citations. To design it, we chose the option of a minimum of 2 documents produced by a country through the VOSviewer. Fig. 5 shows that the United States has the most central node

**Table 2**  
Overall information of article set.

Description	Results
Timespan	2020:2022
Journals	95
Countries	18
Journal articles	108
Average citation per year	11
References	6985
Author’s keywords	370
Authors	398



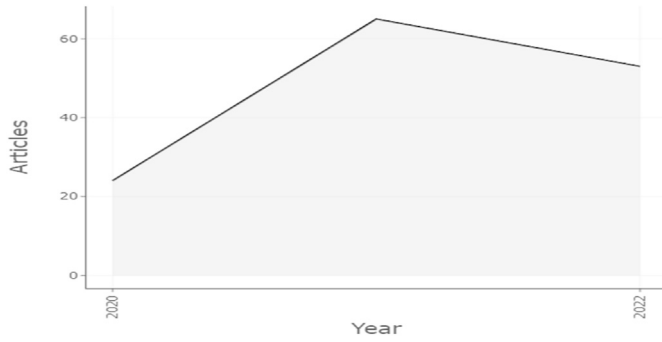


Fig. 2. Annual article publication.

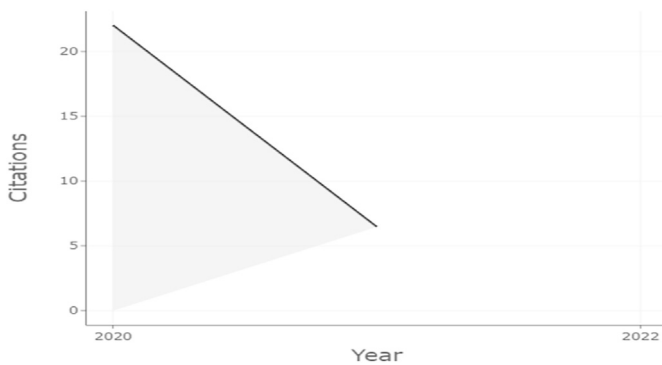


Fig. 3. Average citation received.

depicting the highest number of publications. India and Australia are second and third in number. Different color codes represent the collaboration in terms of article production and citations.

3.3. Results of the articles

This section explains the findings that are relevant to the research objectives. The results were developed using keyword co-occurrence analysis, “network visualization,” and “density visualization.” The keyword co-occurrence network visualization, in particular, addressed the first objective: finding the common areas in WFH practices during COVID-19 in 2020–2022. The keyword co-occurrence density visualization addressed the second objective, finding the areas not common in WFH practices in the empirical research landscape during COVID-19 in 2020–2022.

3.3.1. The current empirical knowledge in WFH practices during COVID-19

Using the VOSviewer software’s (version 1.6.18) minimum keyword occurrences functionality, we observed that different threshold keywords were reported from one to eight. In VOSviewer, we gradually increased the minimum occurrences of a keyword, beginning with one, until the threshold keyword level reached a level that covered more keywords. The threshold keyword numbers received at different occurrence levels are given in Table 3. Since only a few threshold keywords (e.g., four) were generated at the highest number of minimum keyword occurrences (e.g., eight occurrences), we chose 15 at four minimum occurrences for finding the most common areas of WFH practices. We did so as we considered that it was clear enough to understand the areas of study in WFH practices during COVID-19. Table 4 indicates the frequency of the 15 keywords and their interrelationships in Fig. 6.

The line thickness in Fig. 6 denotes the strength of the relationship between the keywords (Priyashantha et al., 2022; van Eck & Waltman, 2014). The size of the node denotes the frequency of occurrences. Higher frequency denotes the larger size of the nodes. Thus, COVID-19 and WFH connect in thicker lines and are located closer. It indicates a stronger relationship and implies that many WFH practices have been investigated with COVID-19. The thicker

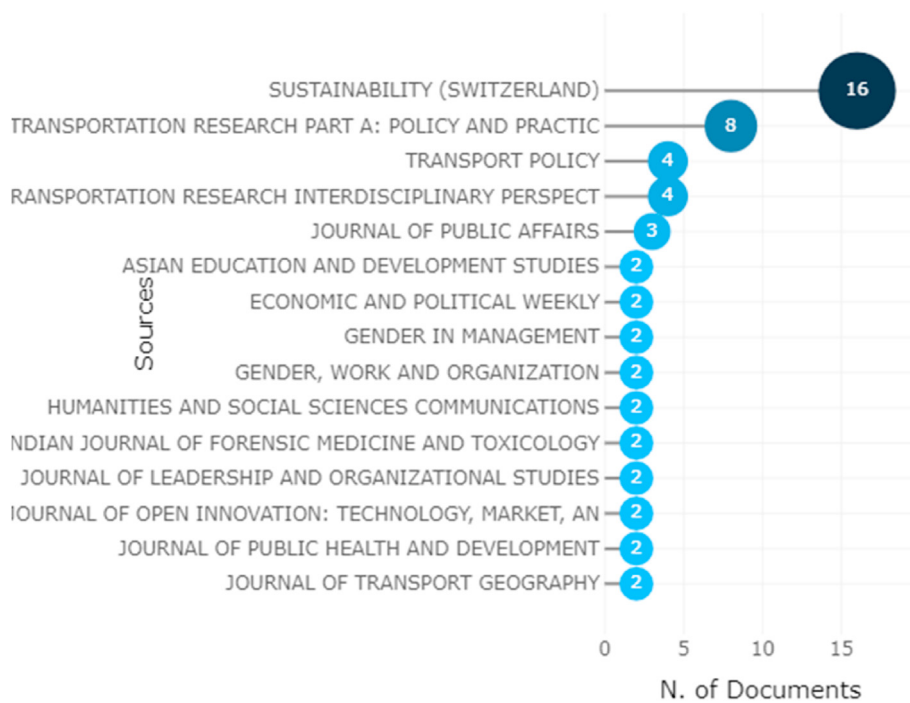


Fig. 4. Source journals of articles.

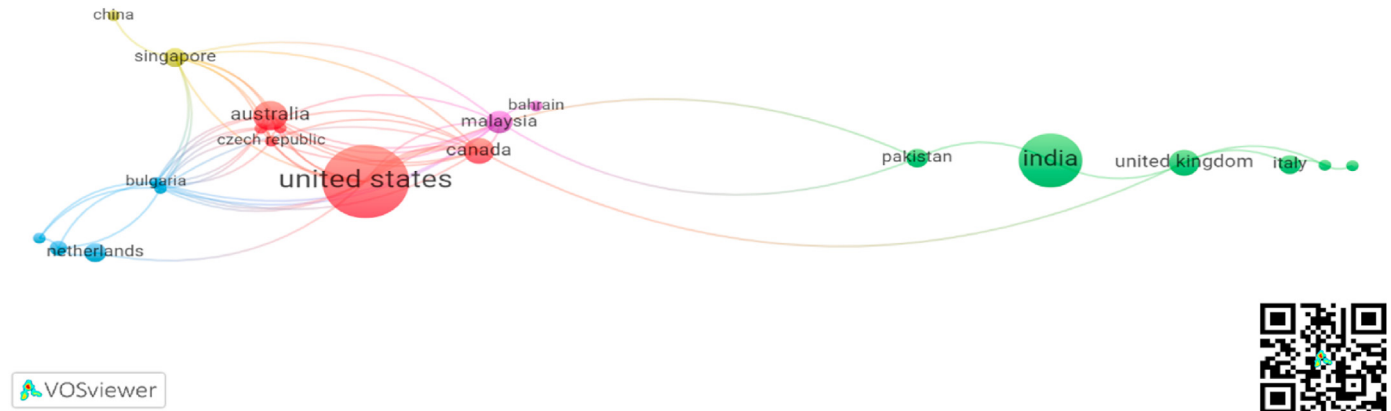


Fig. 5. Country-wise article publications.

**Table 3**  
Occurrence of keywords in articles.

Minimum keywords occurrences	Threshold keywords level
1	370
2	54
3	21
4	15
5	11
6	8
7	5
8	4

**Table 4**  
Keywords with a minimum of four occurrences in articles.

Keyword	Occurrence
COVID-19	84
Work from home	27
Productivity	6
Job satisfaction	6
Telework	6
Travel behavior	5
Attitude	5
Work-life-balance	5
Gender	4
Leadership	4
Work stress	4
Work-family conflict	4
Work engagement	4
Mental health	4
Crisis management	4

links between productivity and job satisfaction indicate their correlation with COVID-19 and WFH. Aside from that, the other links in Fig. 6 are analyzed with the keywords clustered into different colors. VOSviewer has grouped the keywords in different clusters depending on the number of keyword occurrences. When we group the keywords in a particular cluster, it signifies that they are all connected and are from one phenomenon only (Priyashantha et al., 2021a; 2022a). Hence, Table 5 shows the five common themes that emerged from the five clusters. They are; (1) Work attitudinal outcomes and means for WFH, (2) Gender-related outcomes, (3) Leadership challenges and mental health outcomes, (4) Work-related outcomes, and (5) Mobility-related outcomes.

**3.3.1.1. Work attitudinal outcomes and means for WFH - red cluster.** The keywords Attitude, Job Satisfaction, Productivity, Telework, and WFH come under this cluster. Since WFH is the primary search term, we did not include it in this cluster as the entire study relates to WFH. Thus, besides WFH, as all other keywords in the cluster should have a common theme, providing the cluster's source journals and citation information is critical. As a result, Table 5 lists the sixteen journals that published articles with those keywords. Furthermore, 468 citations were identified for articles containing those keywords. It implies that a vast amount of empirical knowledge can be gathered in this cluster with significant impact. Furthermore, the findings related to each keyword are detailed below.

**Attitude:** Attitudes or the perception regarding WFH is positive in the COVID-19 experience (Beno & Hvorecky, 2021; Choukir et al., 2022; Jain, Currie, & Aston, 2022b). The experience of WFH activities during COVID-19 has resulted in positive attitudes toward using it in the post-pandemic (Rose & Brown, 2021).

**Job Satisfaction:** WFH results in job satisfaction (Irawanto et al., 2021; Kaufman & Taniguchi, 2021; Rožman & Čančer, 2022). Mainly, WFH practices reduce stress and increase work-life balance, ultimately resulting in job satisfaction (Irawanto et al., 2021; Kaufman & Taniguchi, 2021; Toscano & Zappalà, 2020). Besides, women reported less job satisfaction during the Pandemic due to household activities (Feng & Savani, 2020).

**Productivity:** Research has found that productivity increases due to WFH (Danker et al., 2022; Feng & Savani, 2020; Stoker et al., 2022; Tanpipat et al., 2021; Wiradendi Wolor et al., 2021). This is due to low-stress levels, managerial support (Danker et al., 2022), changes in leadership behavior (Stoker et al., 2022), high job motivation, norms in remote working (Tanpipat et al., 2021), and increased work-life balance (Wiradendi Wolor et al., 2021). Besides, one study found that WFH harms productivity (Beno & Hvorecky, 2021).

**Telework:** Most of the WFH practices have been implemented through telework (Irawanto et al., 2021; Jain et al., 2022b; Katalin, 2021, pp. 153–169; Mayer & Boston, 2022; Olde Kalter et al., 2021; Raabe et al., 2020; Rose & Brown, 2021; Stefaniec et al., 2022).

Hence, according to the findings in cluster one, attitude, job satisfaction, productivity, and telework are outcomes related to WFH during COVID-19. Naturally, the common theme for this cluster should be the outcomes of WFH during COVID-19.

**Table 5**  
Five clusters with the categorization of keywords.

Cluster/ color	Cluster theme	Keywords	Authors	Total citations received	Journals
Red	Work attitudinal outcomes and means for WFH	Attitude Job satisfaction Productivity Telework	(Beno & Hvorecky, 2021), (Choukir et al., 2022), (Jain et al., 2022), (Rose & Brown, 2021) (Rožman & Čančer, 2022), (Irawanto, Novianti, & Roz, 2021), (Kaufman & Taniguchi, 2021), (Toscano & Zappalà, 2020), (Feng & Savani, 2020) (Danker, Yap, Zalzuli, Ho, & Ang, 2022), (Feng & Savani, 2020), (Stoker et al., 2022), (Tanpipat et al., 2021), (Wiradendi Wolor et al., 2021), (Danker et al., 2022), (Stoker et al., 2022), (Tanpipat et al., 2021), (Wiradendi Wolor et al., 2021), (Beno & Hvorecky, 2021) (Irawanto et al., 2021), (Jain et al., 2022), Katalin, 2021, pp. 153–169), (Mayer & Boston, 2022), (Olde Kalter, Geurs, & Wismans, 2021), (Raabe, Ehlert, Johann, & Rauhut, 2020), (Rose & Brown, 2021), (Stefaniec, Brazil, Whitney, & Caulfield, 2022)	468	Frontiers in Communication Sustainability Transportation Research Part A: Policy and Practice Economics Socius Gender in Management Journal of Police and Criminal Psychology Journal of Leadership and Organizational Studies Humanities and Social Sciences Letters Teruleti Statistika Cities Transportation Research Interdisciplinary Perspectives Humanities and Social Sciences Communications Behavioral Sciences Journal of Transport Geography Perspectives in Management International Journal of Disaster Risk Reduction Gender and Society Asian Social Work and Policy Review Computers, Environment, and Urban Systems Journal of Leadership and Organizational Studies Changing Societies and Personalities Communication Research Reports Sustainability (Switzerland) Social Sciences Journalism Studies Journal of Leadership and Organizational Studies Journal of International Women's Studies Frontiers in Education International Journal of Sexual Health
Blue	Gender-related outcomes	Gender Leadership Work-family conflict	(Singh, Watson, & Nair, 2022), (Syed et al., 2021) (Yaish et al., 2021), (Jasrotia & Meena, 2021) (Long & Reuschke, 2021). (Eichenauer, Ryan, & Alanis, 2022), (Bizilj et al., 2021; Eichenauer et al., 2022; McGloin et al., 2022) (Kuleto et al., 2021), (Molino et al., 2020), (Neo et al., 2022).	157	International Journal of Disaster Risk Reduction Gender and Society Asian Social Work and Policy Review Computers, Environment, and Urban Systems Journal of Leadership and Organizational Studies Changing Societies and Personalities Communication Research Reports Sustainability (Switzerland) Social Sciences Journalism Studies Journal of Leadership and Organizational Studies Journal of International Women's Studies Frontiers in Education International Journal of Sexual Health
Green	Leadership challenges and mental health outcomes	Crisis management Mental health	(Appelgren, 2022), (Stoker et al., 2022) (Subha, R, & Thomas, 2021), (Zapata-Garibay et al., 2021), (Prabowo et al., 2022)	16	International Journal of Sexual Health International Journal of Public Sector Management Journal of Academic Librarianship Transnational Marketing Journal Journal of Public Affairs Sustainability (Switzerland) Organizational Dynamics Indian Journal of Forensic Medicine and Toxicology Journal of International Women's Studies International Journal of Disaster Risk Reduction Humanities and Social Sciences Letters Asian Social Work and Policy Review
Yellow	Work-related outcomes	Work engagement Work stress Work-life balance	(Palumbo, 2020), (Albro & McElfresh, 2021; Negi, Pant, & Kishor, 2021), (Mehta, 2021). (Negi et al., 2021) (Molino et al., 2020), (George, Atwater, Maneethai, & Madera, 2022), (Joshi et al., 2020), (Wiradendi Wolor et al., 2021), (Subha et al., 2021; Syed et al., 2021) (Wiradendi Wolor et al., 2021), (Palumbo, 2020), (Jasrotia & Meena, 2021), (Subha et al., 2021)	263	International Journal of Sexual Health International Journal of Public Sector Management Journal of Academic Librarianship Transnational Marketing Journal Journal of Public Affairs Sustainability (Switzerland) Organizational Dynamics Indian Journal of Forensic Medicine and Toxicology Journal of International Women's Studies International Journal of Disaster Risk Reduction Humanities and Social Sciences Letters Asian Social Work and Policy Review
Purple	Mobility related outcomes	Travel behavior	(Rafiq, McNally, Sarwar Uddin, & Ahmed, 2022), (Wang et al., 2021)	20	Transportation Research Part A: Policy and Practice International Journal of Transportation Science and Technology

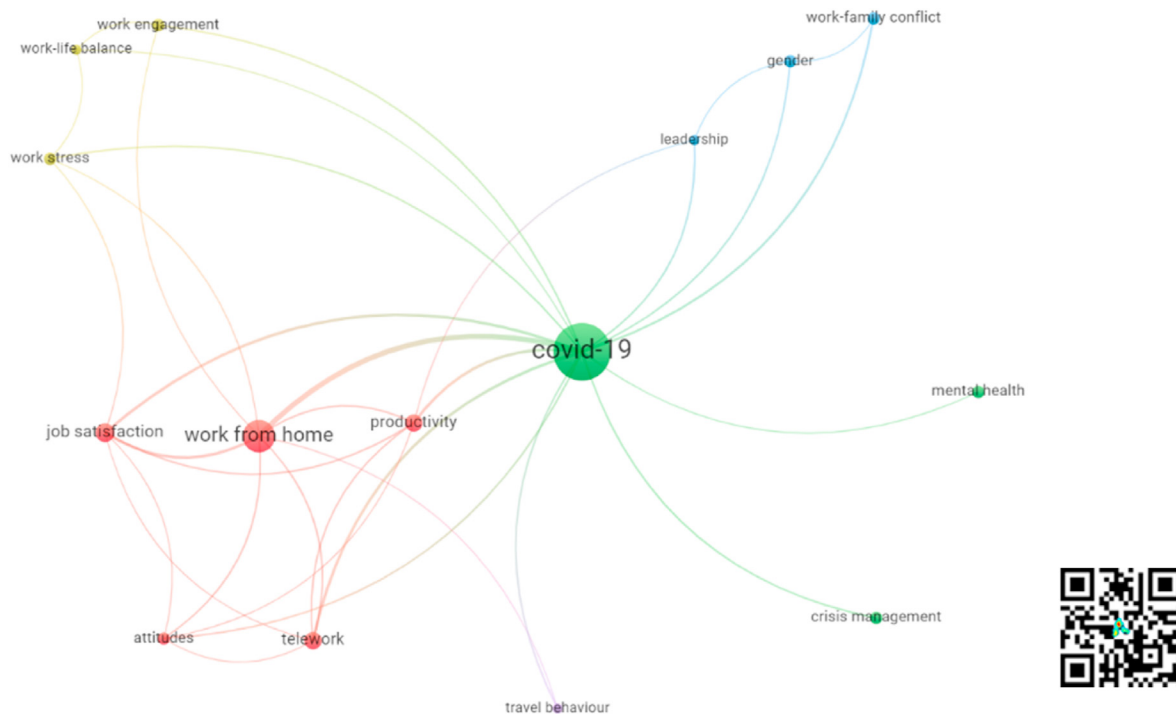


Fig. 6. The keywords co-occurrence network visualization.

3.3.1.2. *Gender-related outcomes - blue cluster.* Keywords such as “gender,” “leadership,” and “work-family conflict” are included in this cluster. Examining the citation and source journals regarding the cluster is crucial, as it should represent a common theme. Thus, Table 5 reports that 157 citations were received for the keywords in this cluster. Further, these keywords have appeared in 10 journals. The findings relating to the keywords are detailed below.

**Gender:** Due to WFH during COVID-19, it has been shown that there is a gender disparity in WFH outcomes (Singh et al., 2022). Thus, females are more vulnerable to stress at WFH (Syed et al., 2021) as the demand for housework increases women’s roles (Yaish et al., 2021) and decreases their share of time by compromising their work efficacy (Jasrotia & Meena, 2021). Besides, the daily mobility of females has also been impacted by COVID-19 (Long & Reuschke, 2021).

**Leadership:** COVID-19 results in supervisors’ leadership challenges as they attempt to manage “work from home” arrangements. Studies found that gender differences, particularly communal leader behaviors, positively impacted employees’ likability in WFH practices during the Pandemic (Eichenauer et al., 2022). However, it is shown that men have demonstrated more communal leadership behaviors than women (Eichenauer et al., 2022). Further, virtual leadership efficacy depends on previous experience working from home and the ability to use communication technologies (Bizilj et al., 2021; McGloin et al., 2022).

**Work-family conflict:** The work-family conflict is an outcome of WFH (Kuleto et al., 2021; Molino et al., 2020). This type of conflict is severe for women (Neo et al., 2022).

Considering all the findings reported under each keyword, they represent gender-related outcomes. Thus, gender-related outcomes were set as the common theme in this cluster.

3.3.1.3. *Leadership challenges and mental health outcomes - green cluster.* Three keywords, “COVID-19,” “crisis management,” and “mental health,” fell in this cluster. Since COVID-19 was the primary search term, we excluded that from the analysis. Besides, we

searched the articles that accommodated the other two keywords and found that five journals have published them. We noted that 16 studies cited these articles, and five journals published them. The information is summarized in Table 5. When considering the citations received to this cluster, this cluster has fewer citations than the other four clusters. The following explains the findings related to each keyword in the cluster.

**Crisis management:** As WFH is implemented in a virtual setting for pandemic management leaders during COVID-19, they stressed the difficulty of being an inspiring leader in a remote setting and the challenge of motivating creativity (Appelgren, 2022). Further, the effectiveness of pandemic-related crisis management through WFH is determined by the higher levels of delegation, lower control, and direction (Stoker et al., 2022).

**Mental health:** The occupational stress of women is an outcome of WFH as Workload, Job Insecurity, Poor Work Environment, Personal Problems, and Lack of Structure (Subha et al., 2021). Further, women demonstrated anxiety and depression (Zapata-Garibay et al., 2021) due to WFH. However, one study found that WFH does not aggravate the effect of the Pandemic on women’s mental and reproductive health (Prabowo et al., 2022).

Considering the findings related to the keywords in the cluster, leadership challenges and mental health outcomes can be given as the theme of this cluster.

3.3.1.4. *Work-related outcomes - yellow cluster.* The keywords “work engagement,” “work stress,” and “work-life balance” fall into this cluster. Table 5 shows that articles containing these keywords were published in 11 journals and received 263 citations. It seems that it is significantly more impactful than cluster 3. The sub-headings below explain the findings of each keyword falling into the cluster.

**Work engagement:** WFH positively impacts work engagement (Palumbo, 2020). Notably, the duration of work is a factor in work engagement (Albro & McElfresh, 2021; Negi et al., 2021). Additionally, the perceived happiness of workers in WFH increases



when employees are engaging with given autonomy, convenience, and psycho-social safety (Mehta, 2021). Further, during WFH, opportunities for employee voice, support for fun activities, practicing compassion, provision of training, emotional support, and supervision help work engagement (Negi et al., 2021).

**Work stress:** ICT tools (Molino et al., 2020) and intrusion of work into personal life (George et al., 2022; Joshi et al., 2020) are predictors of stress in WFH. The WFH creates work stress (Wiradendi Wolor et al., 2021), particularly for women (Subha et al., 2021; Syed et al., 2021).

**Work-life balance:** WFH affects the work-life balance (Wiradendi Wolor et al., 2021). Notably, work-family balance is reduced (Palumbo, 2020) for women as an extended period of work is conducted from home (Jasrotia & Meena, 2021; Subha et al., 2021).

Considering all the findings related to the keywords in this cluster, they are work-related outcomes.

**3.3.1.5. Mobility-related outcomes - purple cluster.** This cluster includes the keyword “travel behavior.” It has the highest citations of 20, and two journals published the articles that contained it. Travel behavior was highly impacted during COVID-19 due to the lockdowns. The following are the findings related to travel behavior.

**Travel behavior:** Studies found that WFH restricts travel behavior (Rafiq et al., 2022; Wang et al., 2021). Thus, it can be treated as an outcome of WFH.

Based on these findings, this cluster's theme can be developed as mobility-related outcomes.

### 3.3.2. Areas that are not common in WFH during COVID-19

This section addresses the second objective. To do that, we created two maps of keyword co-occurrences density visualization for more than four occurrences and more than one occurrence. Concerning more than four keyword occurrences, the map of

keyword co-occurrences density visualization is given in Fig. 7. The keywords in the red area denote extensive research on the findings represented by such keywords and indicate sufficient knowledge of the area (Priyashantha et al., 2021c; van Eck & Waltman, 2014). Thus, COVID-19 and WFH only fall red and indicate more research and knowledge. However, all the other keywords in Fig. 7 are in the green area. It indicates that the knowledge of the findings represented by such keywords is less as they have been researched on fewer occasions. We knew from section 3.3.1 that those keywords (shown in Fig. 6) created five clusters and hence five themes. Thus, the knowledge of these five themes can be treated as insufficient, as there needs to be more research.

Concerning less than four keyword co-occurrences, using VOSviewer, we excluded all 15 keywords with more than four occurrences, as explained in 3.3.1. This gave us less than four occurrences of keywords. Out of the remaining 370 keywords, we found that 14 were useable, creating 2 clusters of keywords. They are shown in Table 6. After finding out the results relating to those keywords, we found that the two clusters represent the common themes of “determinants” and “occupational health outcomes” of WFH. To determine the areas of less common research in WFH during covid 19, we created keyword co-occurrence density visualization for those keywords (less than four co-occurrences). We included all the useable keywords with more than and less than four co-occurrences, as shown in Fig. 8. All the keywords in Fig. 8 are displayed in green nodes except Covid-19 and WFH, indicating insufficient knowledge generated by these keywords. This means that all the keywords in the two clusters themed as “determinants” and “the occupational health outcomes” of WFH are in the green area in Fig. 8. Thus, future researchers must focus on these areas to generate more research for established knowledge. The findings related to the keywords of the determinants and the occupational health outcomes of WFH are explained below.

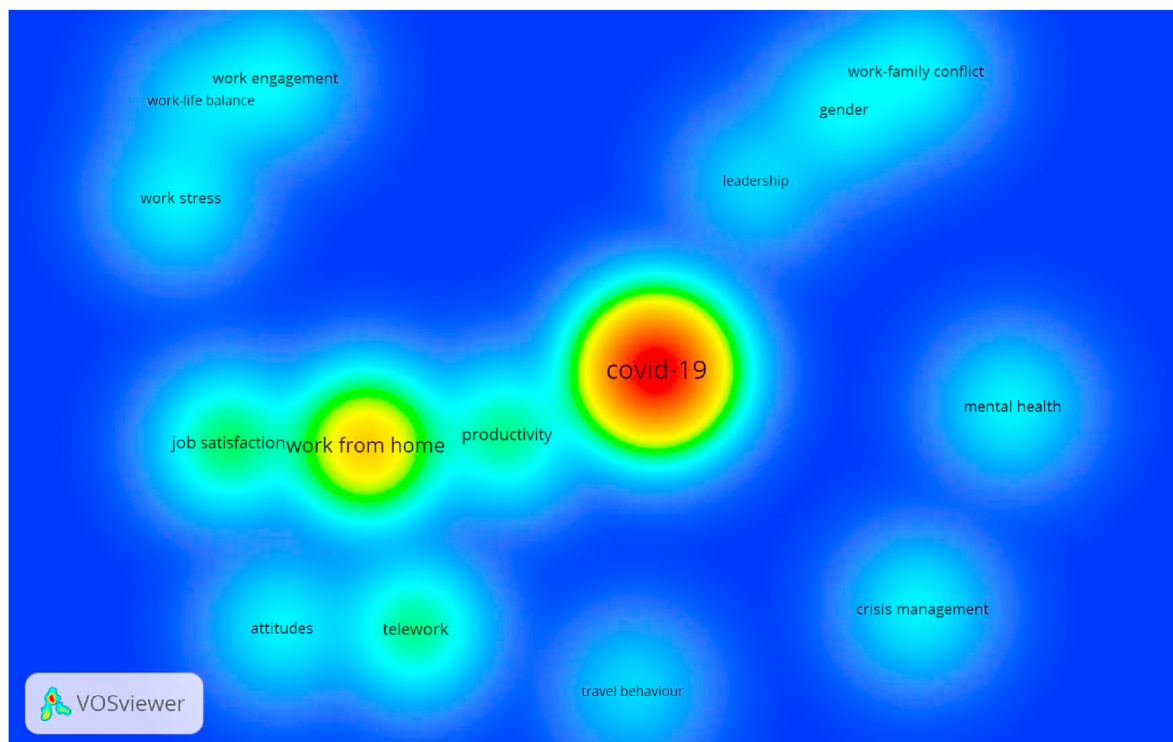


Fig. 7. Density visualization map of keywords.

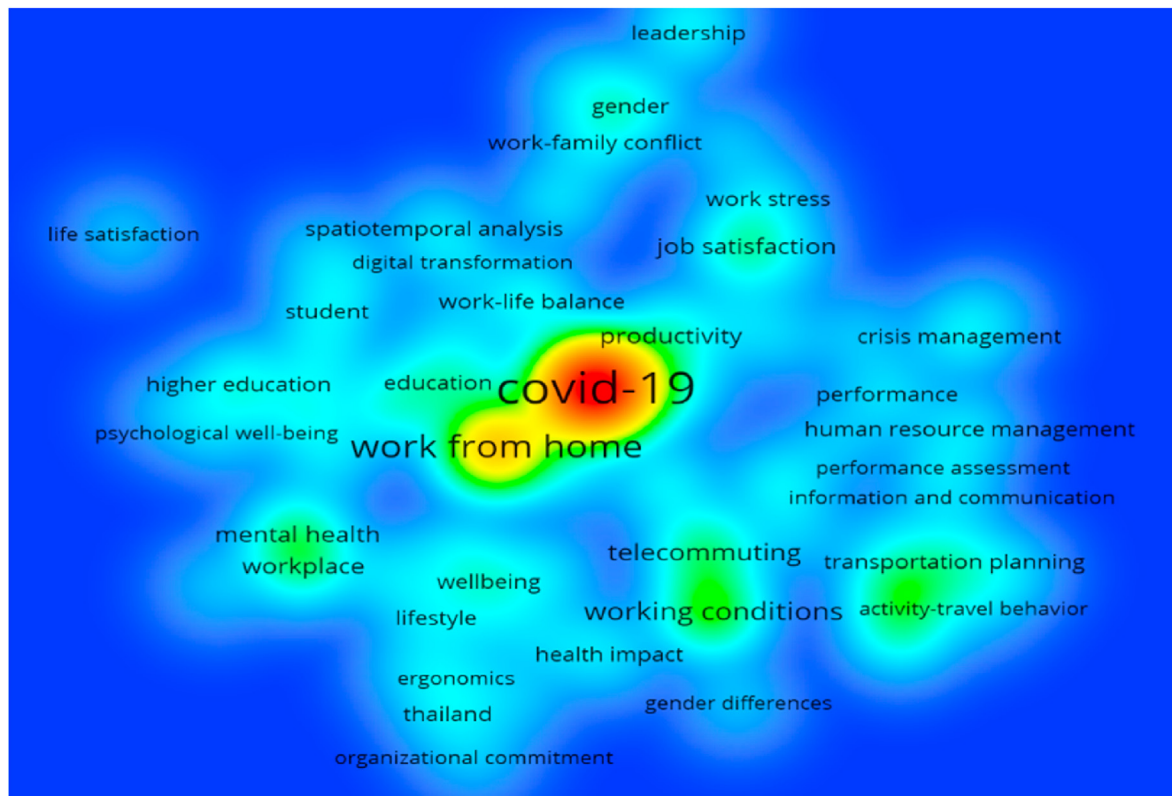


Fig. 8. Density visualization map of all useable keywords.

Table 6  
Keywords categorized with less than four occurrences.

Theme	Keyword and Author	Citation	Journal
<b>Determinants for WFH</b>	<b>ICT</b> (Dianat et al., 2022; Kuleto et al., 2021), <b>Learning</b> (Nuanmeesri, 2021), <b>Human Resource Management</b> (Raišienė et al., 2021), <b>Support</b> (Beck & Hensher, 2022; Tanpipat et al., 2021), <b>Work Motivation</b> : (Nuur et al., 2021), <b>Psychological safety</b> (Mehta, 2021), <b>Flexibility</b> (Glorin, 2021), <b>Employee-organization Relationship</b> (Albro & McElfresh, 2021), <b>OCB</b> (Thirapatsakun & Jarutirasarn, 2021)	144	Transportation Research Part A: Policy and Practice Sustainability (Switzerland) International Journal of Information and Education Technology Journal of Open Innovation: Technology, Market, and Complexity Transport Policy Review of International Geographical Education Online Journal of Public Affairs IBIMA Business Review Journal of Academic Librarianship International Journal of Management and Sustainability
<b>Occupational health outcomes of WFH</b>	<b>Ergonomics</b> (McAllister et al., 2022), <b>Emotional Exhaustion</b> (Bhumika, 2020), <b>occupational health</b> (Ekpanyaskul & Padungtod, 2022), <b>Consumption behavior</b> (Tyagi et al., 2021), <b>Perception</b> (Aslan et al., 2020; Palumbo, 2020; Reimann et al., 2022; Tahlyan et al., 2022; Țalnar-Naghi, 2021)	125	Applied Ergonomics Gender in Management Safety and Health at Work Technology in Society Economics and Sociology International Journal of Public Sector Management Frontiers in Sociology Transportation Research Part A: Policy and Practice Calitatea Vietii

3.3.2.1. *Determinants for WFH.* The theme of determinants of WFH represents nine keywords with 144 citations, and 11 journals have published articles with such keywords, as shown in Table 6 (cluster one). Considering the citations, it has the highest impact for the less than four keyword co-occurrences category. ICTavailability (Dianat,

Hawkins, & Habib, 2022; Kuleto et al., 2021), learning online (Nuanmeesri, 2021), the need for human resource management strategies (Raišienė, Rapuano, & Varkulevičiūtė, 2021), and different supports like organizational commitment and facility management (Beck & Hensher, 2022; Tanpipat et al., 2021) are

essential determinants for WFH performance. Additionally, employees' level of motivation (Nuur et al., 2021), perceived psychological safety (Mehta, 2021), flexibility received (Glorin, 2021), employee-organization relationship (Albro & McElfresh, 2021), and organizational citizenship behavior (Thirapatsakun & Jarutirasarn, 2021) are determinants of WFH performance.

**3.3.2.2. Occupational health outcomes of WFH.** The second cluster-themed occupational health outcomes contain five keywords with 125 citations. Nine journals have published the keywords, which are listed in Table 6. The outcomes include ergonomic discomfort (McAllister, Costigan, Davies, & Diesbourg, 2022), emotional exhaustion (Bhumika, 2020), body weight changes, indoor environment changes, psychological problems (Ekpanyaskul & Padungtod, 2022), lifestyle changes such as sleep habits, exercise (Ekpanyaskul & Padungtod, 2022), and increased food consumption (Tyagi, Prasad, & Bhatia, 2021). Concerning the perception of employees, work fatigue (Palumbo, 2020), family work conflicts perceptions (Reimann, Peters, & Diewald, 2022), lower benefits, and higher barriers for older workers (Tahlyan et al., 2022), better task performance and quality of work life (Aslan, Bakir, & Vis, 2020), are outcomes of WFH.

In sum, as sections 3.3.1 and 3.3.2 deal with the study's first and second objectives, two analysis methods were deployed with keywords. The first was the keywords with more than four occurrences, and the second was those with less than four occurrences. The first analyses found that outcomes of WFH include (1) Work attitudinal outcomes and means for WFH, (2) Gender-related outcomes, (3) Leadership challenges and Mental health outcomes, (4) Work-related outcomes, and (5) Mobility-related outcomes. The second analysis found the (1) Determinants and (2) Occupational health outcomes of WFH. Thus, both analyses found seven areas addressed in the empirical research landscape during the past two years. As shown in Fig. 7, the keywords clustered into those seven areas were displayed by the visualization of keyword co-occurrence density. Thus, the results were insufficient for general knowledge, and the seven areas listed above should be the focus of future researchers.

#### 3.4. Reporting the biases

The PRISMA guidelines mandated the evaluation of biases attributable to incomplete information in reporting. Although there was no comprehensive evaluation for this task; nonetheless, we have used systematic and objective software applications and PRISMA criteria for reporting to eliminate bias in the results reported.

## 4. Discussion

This study was designed based on the SLR attempting to synthesize the WFH practices in the COVID-19 empirical research published during 2020–2022. It was based on three objectives; (1) the common WFH practices during the COVID-19 2020–2022 period and (2) the areas that are not common in WFH practices in the research landscape during COVID-19 between 2020 and 2022, and (3) the areas that need attention in future research on WFH practices. The first objective was achieved by finding five outcomes of WFH, including (1) Work attitudinal outcomes meant for WFH, (2) Gender-related outcomes, (3) Leadership challenges and mental health outcomes, (4) Work-related outcomes, and (5) Mobility-related outcomes. The second objective was achieved by finding two areas as (1) Determinants and (2) Occupational health outcomes of WFH and all the five areas found in section 3.3.1. Thus, the seven areas for the second objective achieved the third objective.

The findings related to the first objective are clustered under five themes. In the red cluster, work attitudinal outcomes and means support the job-demand resource theory (Tanpipat et al., 2021; Toscano & Zappalà, 2020), linking telework and attitudes as work demands performing psychological capacities for achieving satisfaction and productivity. Gender-related outcomes in the blue cluster seem to support the gender role theory (Feng & Savani, 2020), amplifying “sexual division of labor” and work-life balance among working women giving caregiving duties (Jasrotia & Meena, 2021; Neo et al., 2022). Mental health and leadership challenges in green clusters are based on the social exchange theory ((Emerson, 1976), causing detrimental effects of telecommuting due to the deteriorated relationship between employers and employees (Stoker et al., 2022). Work-related outcomes in the yellow cluster and mobility-related behavior in the purple cluster support the psychological need theory or self-determination theory, which focuses on motivation and psychological needs to reduce stress and increase WLB and engagement (Molino et al., 2020).

All six outcomes and the determinants can be integrated into a holistic model and tested by future researchers. These could also be considered dimensions for each outcome and determinant since they were all based on different keywords. Thus, these keywords would help construct a measurement instrument to test the suggested holistic model. These are the study's main theoretical contributions.

Additionally, the study found gaps in applying the latest technology developments, such as disruptive HRM technologies (Priyashantha et al., 2022), impacting WFH performance. Moreover, gender stereotype change is the current reality in which more females tend to come to income-generating activities (Priyashantha, De Alwis, & Wilmilla, 2020; Priyashantha, Alwis, & Wilmilla, 2021; Priyashantha, De Alwis, & Wilmilla, 2021b), and WFH is a vehicle for them. The impact of gender stereotypes on WFH was not found in our investigation. This phenomenon can be investigated in other subject disciplines. Moreover, the family supports/hindrances or the impact of WFH on the family needs to be investigated. We found minimal findings, and the knowledge created by the findings is insufficient.

Almost all of the SLR requirements were met by this study; however, there were some limitations. Firstly, the articles were only taken from one database. If other databases had been selected, extracting more articles might have been possible. Secondly, the study only included empirical studies since they adhered to the systematic literature review technique and preserved the validity of the publications. The outcomes could have varied if different article types had been chosen. Other subject areas are required to be investigated in future studies. Finally, only journals were considered, and conference papers, book chapters, and reviews were not studied. Thus, future studies may focus on those.

## 5. Conclusion

This study synthesizes the empirical research on WFH during COVID-19 from 2020 to 2022. The objectives were to; (1) the common WFH practices during the COVID-19 2020–2022 period, (2) the areas that are not common in WFH practices in the empirical research landscape during COVID-19 between 2020 and 2022, and (3) the areas that need attention in future research on WFH practices. A systematic literature review methodology complying with PRISMA guidelines addressed the objectives. Following a pre-determined article selection criteria, 108 articles were included from Scopus for the review.

The study addressed the first objective and found five areas of outcomes which are; (1) Work attitudinal outcomes and means for WFH, (2) Gender-related outcomes, (3) Leadership challenges and



mental health outcomes, (4) Work-related outcomes, and (5) Mobility-related outcomes. Addressing the second objective, we found seven areas not common in WFH practices in the empirical research landscape during COVID-19 between 2020 and 2022. Regarding the third objective, the seven areas; (1) Work attitudinal outcomes and means for WFH, (2) Gender-related outcomes, (3) Leadership challenges and mental health outcomes, (4) Work-related outcomes, and (5) Mobility-related outcomes, (6) Determinants and (7) Occupational health outcomes of WFH should be taken into future research.

## 6. Implications to theory, practicality, and future research

Regarding the implications of the findings to theory, researchers can refer to the most prominent articles in the relevant literature included in this paper to better understand WFH research. Knowledge of included publications and their authors will aid in the inception of significant innovations through empirical, conceptual, or bibliometric analysis and boost the overall effectiveness of future analysis efforts. Moreover, a conceptual model can use the six outcomes and determinants. The hypothesis can be developed and tested for them as such outcomes and determinants were derived from empirical findings with theoretical underpinnings. Further, measuring instruments can be created for the variables in the model by incorporating the areas represented by the keywords categorized under those six outcomes and determinants.

When the practicality of the findings is concerned, the six outcomes and determinants of WFH imply that policymakers, decision-makers, or employees make informed decisions regarding WFH practices in post-pandemic situations. The findings motivate the WFH adoptions. Since technology can play a vehicle for these WFH practices, the vendor companies can plan more products aiding the WFH with the findings. Further, they can initiate innovations to overcome the adverse outcomes of WFH.

Regarding the research implications, the seven areas found in this study can be taken for future research. The areas include; (1) Work attitudinal outcomes and means for WFH, (2) Gender-related outcomes, (3) Leadership challenges and mental health outcomes, (4) Work-related outcomes, and (5) Mobility-related outcomes, (6) Determinants and (7) Occupational health outcomes of WFH should be taken into future research. Additionally, the researchers need to conduct more research to overcome the adverse outcomes of WFH in this study. Besides, the family supports/hindrances or the impact of WFH on family needs, impacts of disruptive HRM technologies (Priyashantha et al., 2022), and gender stereotypes (Priyashantha et al., 2020; Priyashantha et al., 2021; Priyashantha et al., 2021b) on WFH performance need to be investigated. We found minimal findings in those areas, and the knowledge of those areas is insufficient. They can be focused on for future research.

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No funding was available for this research.

### Data availability

Data collected during the current study are not publicly available. However, they can be available from the corresponding author upon reasonable request.

### Ethical statement

We confirm that this research paper meets the ethical requirements and that we have fully considered all foreseeable ethical implications of our research, both intended and unintended.

## Declaration of competing interest

There are no conflicts of interest.

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