Critical Public Health

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/ccph20

Mining through pandemic crisis: a systematic review of the impacts of COVID-19 management strategies on mining industries in West Africa and Western Australia

Esther Ayaaba, Kwadwo Adusei-Asante, Victor Fannam Nunfam, Krassi Rumchev & Samuel Kofi Amponsah

To cite this article: Esther Ayaaba, Kwadwo Adusei-Asante, Victor Fannam Nunfam, Krassi Rumchev & Samuel Kofi Amponsah (2024) Mining through pandemic crisis: a systematic review of the impacts of COVID-19 management strategies on mining industries in West Africa and Western Australia, Critical Public Health, 34:1, 1-23, DOI: 10.1080/09581596.2024.2438654

To link to this article: https://doi.org/10.1080/09581596.2024.2438654

Published online: 15 Dec 2024.

Elevate Series

CRITICAL PUBLIC HEALTH
2024, VOL. 34, NO. 1, 2438654
https://doi.org/10.1080/09581596.2024.2438654

Mining through pandemic crisis: a systematic review of the impacts of COVID-19 management strategies on mining industries in West Africa and Western Australia

Esther Ayaaba[a], Kwadwo Adusei-Asante[b], Victor Fannam Nunfam[c], Krassi Rumchev[d] and Samuel Kofi Amponsah[e]

[a]School of Medical and Health Sciences, Edith Cowan University, Joondalup, Australia; [b]School of Arts & Humanities, Edith Cowan University, Joondalup, Australia; [c]Faculty of Health and Allied Sciences, Takoradi Technical University, Takoradi, Ghana; [d]School of Population Health, Curtin University, Perth, Australia; [e]Department of Health Information Management, Health Information Management Christian Health Association of Ghana, Accra, Ghana

ABSTRACT

The mining sector plays a crucial role in the economies of West Africa and Western Australia, contributing to GDP, employment, and foreign exchange earnings. However, the sector also faces environmental, social, and health challenges, including land and water degradation, human rights violations, and occupational hazards. The COVID-19 pandemic worsened these challenges, affecting aspects of the mining industry. This systematic review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for literature search and selection. PubMed and Google Scholar were searched for relevant articles published from 2019 to 2023. Inclusion criteria encompassed studies focusing on COVID-19 management strategies in West Africa and Western Australia mining sectors. Mining industries in both regions adopted a spectrum of strategies. These included lockdowns and movement restrictions, extensive testing and contact tracing, quarantine protocols, stringent health and safety measures, support for vulnerable artisanal miners, technology integration to reduce human interaction, flexible work arrangements, and mental health support. Some companies diversified their supply chains, and community engagement programmes aimed to inform and support local populations. However, these strategies often led to disruptions, work stoppages, and reduced production. Lockdowns affected mining community mobility and COVID-19 cases among miners. Mental health concerns arose, particularly in Western Australia, due to isolation measures and job insecurity. The COVID-19 pandemic had profound effects on mining industries in both regions. We have provided insights for future research and industry practices, emphasising the necessity of resilient strategies to protect both well-being and economic stability during pandemics.

ARTICLE HISTORY
Received 5 September 2024
Accepted 1 December 2024

KEYWORDS
COVID-19 management strategies; mining response; West Africa; Western Australia; emergency preparedness policies

1. Introduction

The global mining industry is a significant economic driver, generating $711 billion in revenue from the top 40 companies in 2022 (Demeubayeva, 2023; Dou et al., 2023; Hodge et al., 2022) It significantly contributes to the GDP, employment, and foreign exchange earnings of many countries

CONTACT Esther Ayaaba eayaaba@our.ecu.edu.au

worldwide (Ahadjie et al., 2021; Kabore et al., 2021). The sector's influence spans various economies, underpinning both local and global economic stability. For example, Western Australia plays a pivotal role, contributing over 40% of Australia's total export revenue from minerals like iron ore and gold (Department of Mines, Industry Regulation and Safety, Western Australia, 2021). Meanwhile, West Africa is responsible for approximately 30% of global gold production (African Development Bank, 2021) (Africa & Bank, 2022; Takyi et al., 2021). These regions are vital to the global mining sector and its resilience, particularly during disruptions like the COVID-19 pandemic.

Notwithstanding its significance, mining activities also give rise to a range of environmental, social, and health concerns, including but not limited to, land degradation, water contamination, human rights violations, and occupational safety and health hazards (S. Hoban et al., 2021; Maul et al., 2024; World Health Organization [WHO], 2020; Y. Zhao et al., 2022). The outbreak of the COVID-19 pandemic further compounded these challenges, affecting millions worldwide and causing disruptions across various facets of life and work (Bonnet et al., 2021). The mining industry, grappling with the multifaceted impacts of the pandemic, faced an unparalleled conundrum: the imperative to safeguard the health and safety of its workforce and communities while simultaneously ensuring the economic viability and sustainability of its operations (Fernandes, 2020; Hamisi et al., 2023; Haule, 2021; Thomas et al., 2022).

Globally, different regions, countries and industries have adopted a diverse array of strategies to manage the pandemic, encompassing measures such as lockdowns, travel restrictions, testing, contact tracing, isolation, quarantine, vaccination campaigns, information, communication and digital technologies and public health interventions (Ahadjie et al., 2021; Hamisi et al., 2023; Kekeç et al., 2022; Susanto et al., 2022) as well as corporate social responsibilities (CSR). During the COVID-19 pandemic, mining companies expanded their CSR initiatives to support local communities, providing critical resources such as medical supplies, food relief, and financial aid to help mitigate the crisis's socio-economic impacts. These efforts aimed to strengthen community resilience while addressing urgent public health and economic needs (Asibor & Moru; Frederiksen, 2019; Kubiczek & Hadasik, 2022; Singh & Sharma, 2024; J. Zhao, 2021). These efforts not only addressed immediate needs but also reinforced long-term community resilience, aligning with broader ESG and sustainable development goals (Hilson, 2012; Hilson et al., 2023). Additionally, the pandemic highlighted the challenges of resource enclavity, underscoring the limited economic linkages between mining operations and local economies, particularly in developing regions (Hilson et al., 2024). These strategies wield disparate impacts on the mining sector, contingent upon the local context, the nature and scale of mining activities, resource availability, infrastructure capabilities, and levels of preparedness and resilience.

The COVID-19 pandemic significantly disrupted the global mining industry from 2019 to 2022 in particular, causing production slowdowns, supply chain issues, workforce reductions, and price volatility (Jowitt, 2020; Laing, 2020). For instance, mining output dropped by 5–10%, though gold prices rose by 40%, and by 2021, demand for critical minerals like copper and lithium drove recovery (E. C. Giese, 2022; Marimuthu et al., 2022). In sub-Saharan Africa, post-pandemic demand for green energy minerals positioned the sector for growth (G Hilson et al., 2021; Saha et al., 2022; Signé & Johnson, 2021). Aside from its significant social, economic and health impacts the COVID-19 pandemic also provided a unique opportunity to observe potential environmental benefits within the mining industry, particularly regarding air quality improvements. Studies have shown significant reductions in pollution from industrial activities. For instance (Arregocés et al., 2021), noted air quality improvements at a major Latin American coal mine during lockdowns (Arregocés et al., 2021; Naqvi et al., 2021; Saha et al., 2022), similarly observed global declines in emissions, suggesting valuable insights for sustainable practices in mining (Saha et al., Naqvi et al., 2021; 2022).

The rationale and exigency for a systematic review of the impacts of COVID-19 management strategies on mining industries in West Africa and Western Australia stems from their similarities and contrasts in mining landscapes, development and pandemic responses (Belinga & Marque, 2022; Sims et al., 2022). Western Australia, rich in iron ore and gold, is characterized by strong regulatory

and technological systems that support sustainability and effective COVID-19 measures, including strict border controls and testing to minimize disruptions (Smith et al., 2021), but high dependence on external markets and labour mobility (Committee et al., 2022; Ganguli, 2022; E. Hoban et al., 2021). In contrast, West Africa, with abundant resources like gold and bauxite, but low human development indicators, weak governance structures, and limited health systems (Alimi et al., 2021; Waya et al., 2021) operates within diverse regulatory environments impacting community and environmental sustainability. Despite limited resources, public health strategies such as travel restrictions and testing helped contain the virus and sustain mining activities in West Africa (Brown & Zhang, 2023). This contrast offers valuable insights into the pandemic's effects on mining regions with differing infrastructures and resource management approaches (Adam et al., 2021; H. Lee et al., 2023; P. Lee et al., 2023). Except for a few studies (e.g. Arregocés et al., 2021; Naqvi et al., 2021; Saha et al., 2022), there seems to be no specific empirical studies, systematic review or synthesis that have assessed the impacts of COVID-19 management strategies on mining industries in West Africa and Western Australia. Available systematic reviews have tended to focus on the role of digital technologies in coping with the COVID-19 pandemic across various industries, including manufacturing, SMEs, hospitals, construction, creative sectors, and resilience strategies for business survival during crises (Alfadil et al., 2024; Ardolino & Leoni; Atighechian et al., 2024; Biyela & Utete, 2024; Hossain et al., 2022; Khlystova et al., 2022).

Given the critical role of systematic reviews in shaping evidence-based policy, this review aims to synthesize findings from published and unpublished studies. The socio-economic, occupational safety, and health implications of COVID-19's impacts on the mining sector underscore the timeliness of this effort. It also seeks to update and expand the literature on COVID-19 management strategies in the mining industries of West Africa and Western Australia, informing safety protocols, resilience planning, post-pandemic discourse, and future research needs. Thus, this study's overarching aim was to evaluate and synthesizes the available body of evidence concerning the effects of COVID-19 management strategies on various facets of mining industries in these regions (Apedo-Amah et al., 2020; Jowitt, 2020), while focusing on research design, study settings, significant findings, and the central question: What are the impacts of COVID-19 management strategies on mining industries in West Africa and Western Australia?

The substantial contribution of this research endeavour lies in its potential to offer a comprehensive assessment of the current state of knowledge on this subject matter. Additionally, it enhances the existing literature by offering a focused comparison of COVID-19's impact on the mining sector in West Africa and Western Australia, two regions with contrasting regulatory and technological frameworks. While previous research addresses COVID-19's global environmental effects, few studies investigate how pandemic management shaped mining practices in resource-rich areas. Our findings highlight how varied regulatory environments influenced operational resilience, occupational health, and safety responses, revealing practical insights into industry adaptability and community health outcomes. This research also advances discussions on ESG frameworks, sustainability, and corporate social responsibility in mining, providing a foundation for future crisis management and sustainability strategies.

2. Materials and methods

2.1. Research philosophy and design

The updated version of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for conducting systematic reviews and meta-analyses, PRISMA (Page et al., 2021) were strictly followed in this review (Supplementary File 1). The 2020 PRISMA guideline was used because it has 27-item checklists for submitting high-quality systematic reviews that are transparent, straightforward, address poor reporting requirements, and have enough information to enable replication and evaluate the applicability of the methodologies (Page et al., 2021).

2.2. Information sources and search strategy

The PubMed bibliographic database and Google Scholar were searched for published literature. PubMed was chosen because of its ability to link to full-text articles and its advanced search features, such as filters, Boolean operators, and specific queries. Additionally, PubMed has connections to Medline and the NLM collection, making it an appropriate database for searching the literature. Google Scholar was used to find high-quality publications that are not listed in the PubMed database (Williamson & Minter, 2019). The Western Australia and West African Chambers of Mines and local repositories were also searched for grey literature to supplement the materials collected from internet databases and periodicals. Medical Subject Headings (MeSH) terms and predefined search terms were used to locate pertinent material on the control of COVID-19 in mining sectors in West Africa and Western Australia. In Supplementary File 2, the search phrases and MeSH terms that were used to locate the relevant literature are reported.

2.3. Inclusion criteria

The following inclusion criteria guided literature selection:

(i) The article must meet the objective of the systematic review and must review the management of COVID-19 in mining sectors.
(ii) Studies conducted or set in West Africa or Western Australia.
(iii) Articles written and published in English.
(iv) Peer-reviewed journal articles published from 2019 to 2023.

2.4. Exclusion criteria

To ensure relevance, the following exclusion criteria were applied:

(i) Anonymous and abstract-only documents
(ii) Excerpts from conferences, book chapters and letters to editors.
(iii) Historical articles, editorial reports, preprints, and commentaries.

2.5. Data extraction and characteristics

Data extraction was conducted on literature that was retrieved from literature searches and that met the selection criteria. A prepared form in the Microsoft Excel program was used for data extraction. Three researchers conducted independent assessments on the quality of included studies, and any disparities were reconciled through consensus. The data extraction process for the identified studies was undertaken by the lead author, under the guidance and supervision of one of the co-authors well-versed in systematic review methodologies. The descriptive characteristics of the included studies were illustrated by authors, publication year, study setting (where the study was conducted), study design, study population, detailed methods, major findings, and conclusions. These were among the important data that were retrieved from the included studies. The lead author extracted the data under the supervision of one of the co-authors.

2.6. Risk of bias assessment

Utilising the National Institutes of Health (NIH) Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies (Daraz et al., 2019; Fihn et al., 2014; Wirsching et al., 2018; Zeng et al., 2015) the quantitative studies were evaluated for their quality. The research's internal validity was

evaluated by testing for potential methodological errors and the rationale for choosing it (National Heart et al., 2014).

The reliability, validity, and generalizability of all studies part of the review were evaluated by the NIH assessment tool (National Heart & Institute, 2014). Thirteen criteria were used by this tool to evaluate, rank, and grade the quality of various investigations. These criteria include the study population, sample size estimation, exposure and outcome evaluation, loss to follow-up, and statistical analysis. They also include the research question. The lead author graded each study independently, and one of the co-authors reviewed the work. The reviewer and the lead author resolved any discrepancies in the grades.

The Critical Appraisal Skill Programme (CASP) Tool (CASP, 2017) was applied to evaluate the qualitative research. The CASP tool was chosen because it includes 10 criteria to assess the applicability and clarity of research objectives, the appropriateness of design and methodology in answering a research question, recruitment tactics, data collection and analysis, findings, ethical consideration, and the worth of the research. The questions for these items encourage critical self-reflection on biases and help evaluate the quality of the qualitative study.

2.7. Synthesis of data

The reviews of the quantitative and qualitative publications were combined using the multi-source synthesis technique. This analytical technique ensures transparency and enables study comparison (A. B. Pedersen & Babayan, 2011; T. Pedersen et al., 2011). Following analytical themes or when study findings were given on the same topic, findings from both qualitative and quantitative studies were combined. The papers were not combined to perform a meta-analysis due to the heterogeneity of the results.

3. Results

3.1. Identification and abstraction of included studies

Out of the 4,892 titles from the various sources, including electronic and bibliographic databases, the researchers removed 121 records because they were duplicates. Rayyan software (Cleo et al., 2019; Couban, 2016; Haritsa et al., 2021; H. Harrison et al., 2020; R. L. Harrison et al., 2020; Johnson & Phillips, 2018) was used to screen the remaining 4,771 titles and abstracts and excluded 4,734 that were unrelated to the topic. The remaining 44 full-text articles were evaluated for eligibility based on the selection criteria (E. C. Giese, 2022; J. Giese & Haldane, 2020):

(1) The study focused on COVID-19 and not other respiratory disorders like SARS-CoV or MERS, (Atif et al., 2020)
(2) The study was conducted in West Africa or Western Australia, and (Saalim et al., 2021).
(3) The study focused on the mining industry or sector.

Out of the 44 full-text articles, there is a paucity of research on the topic. However, we rejected nine articles that focused on other respiratory disorders, two articles that were not conducted in West Africa or Western Australia, and 17 articles that did not focus on the mining industry or sector. In the final selection process, 17 articles were included in the systematic literature review. Figure 1 shows the flow chart of the process of selecting the articles.

3.2. Overview of included studies

Nine studies and eight grey literatures from a report by the Chamber of Mines and Energy were included in the systematic review. Out of the nineteen studies, five (Asare et al., 2021; J. M. Dixon

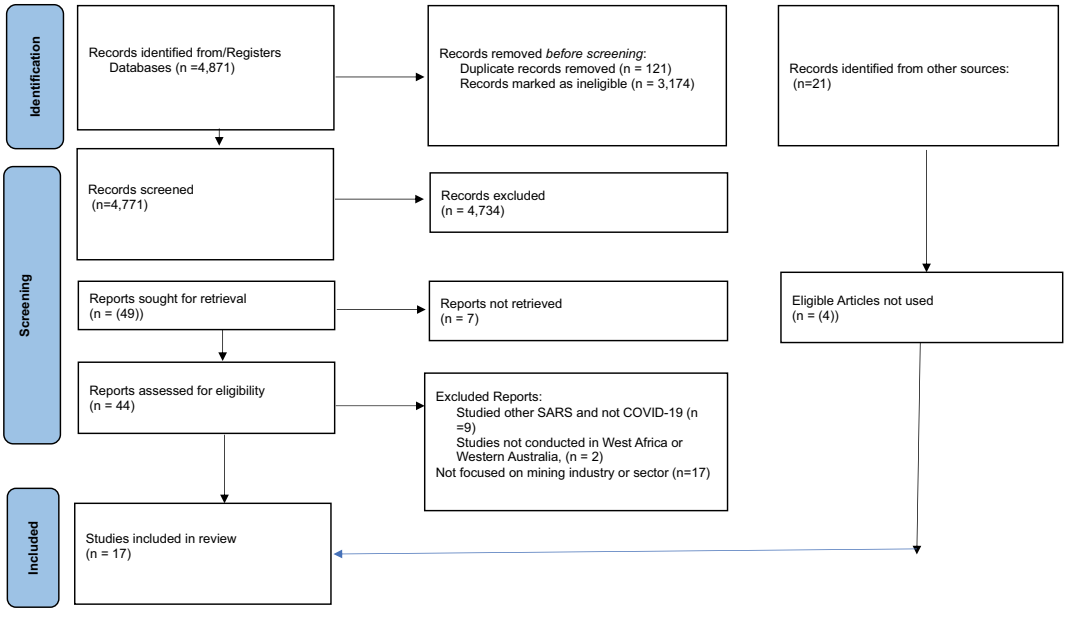

Figure 1. PRISMA

et al., 2021; Haji, 2021; Milleliri et al., 2021; F. O. Olaniyi, 2022) were quantitative, while the other four (Akrofi & Antwi, 2020; E. C. Giese, 2022; J. Giese & Haldane, 2020; Milleliri et al., 2021; Muthuri et al., 2021; Pijpers & Luning, 2021; Thierens & Mawala, 2020) were qualitative. Cross-sectional study designs (Asare et al., 2021; J. M. Dixon et al., 2021; Haji, 2021; Milleliri et al., 2021), exploratory study designs (Akrofi & Antwi, 2020; Muthuri et al., 2021; Pijpers & Luning, 2021; Thierens & Mawala, 2020) and a mixed-methods approach (Olaniyi, 2022) were used in four studies. Various locations, including Ghana, Cote d'Ivoire, Burkina Faso, and Nigeria, (West Africa) and Western Australia, were used to perform these investigations. Seven investigations (Akrofi & Antwi, 2020; Haji, 2021; Milleliri et al., 2021; Olaniyi et al.; Pijpers & Luning, 2021; Thierens & Mawala, 2020) were carried out in West Africa, while two included papers (Asare et al., 2021; Bonnet et al., 2021; J. M. Dixon et al., 2021; M. G. Dixon et al., 2022) were carried out in Western Australia. The study recruited participants from small- and large-scale mining sectors or industries in West Africa and Western Australia. Participants' ages ranged from 18 and above. Sample sizes reported in four investigations (Asare et al., 2021; Milleliri et al., 2021; Muthuri et al., 2021; Pijpers & Luning, 2021) ranged from 29 in qualitative studies to 1,687 in quantitative studies. Over 2,595 made up the total sample size for all nine studies. Regarding publication dates, all papers were published between 2020–2023, or ever since the COVID-19 epidemic began. Table 1 provides a synoptic overview of the characteristics of all journal articles included the study.

3.3. Quality of the included studies

The methodological quality and risk of bias assessment of each of the nine studies included in the systematic review were evaluated. The prescription or standards given by the researcher's quality evaluation tools served as the foundation for the criteria used to evaluate the body of literature. Two of the six quantitative studies received a 'good' rating. The studies received a high evaluation based on a comprehensive assessment of their methodology, design, and techniques. Factors such as the appropriateness and explanation of the sample size, the relevance of the study environment, and the clarity and detail in presenting findings contributed to their favorable grading. This rigorous

Table 1. Characteristics of studies included in the review.

Author(s), Year	Study aim/objective	Country	Study population/sample size	age [mean, range]	Study design [Quant, Quant, cross-sectional and others	Data source (primary, secondary, and document review)	Sampling techniques	Type of analysis	Key findings/results	Impact/effect
Pijpers and Luning (2021)	Determining the difficulties small-scale mining faces in West Africa	Ghana	small scale miner	not reported	Qualitative	primary data	not reported	not reported	The study revealed that, according to the miners, COVID-19 materializes as 'just' another interruption to lives and operations that are marked by constant interruptions of various kinds. The miners stopped working for a while and returned to normal. Upon returning to work, miners reduced the number of teams in order to prevent spread of COVID-19	COVID-19 really disturbed the mining sectors in Ghana especially the small-scale mining and they had to stop working. However, they later on returned to work.
Muthuri et al. (2021)	Impact of COVID-19 on gold and gemstone on artisanal and small-scale mining	Ghana and Kenya	Gold and gemstone stakeholders ($n = 29$)	not reported	Qualitative exploratory design	primary and secondary	document review and purposive sampling	not reported	COVID-19 disrupted both gold and gemstones production, trade and investment and had devastating impacts on livelihood, occupational health, safety and wellbeing	COVID-19 really disrupted the mining sectors in Ghana and Kenya and affected occupational health and livelihood.
Akrofi and Antwi (2020)	Response to COVID-19 in Energy sector	Ghana, Burkina Faso, Cote d'Ivoire and Nigeria	not reported	not reported	Qualitative exploratory design	secondary data	document review	not reported	The government responded to the COVID-19 by implementing total and partial lockdowns as well as governments sought to ease the resultant burden that fell on their citizens, especially poor and marginalized groups through suspension of bill payments, electricity and water bill waivers for citizens	not applicable
Olaniyi et al., 2022	To evaluate the impacts of COVID-19 on Nigeria's economy	Nigeria	workers who operate oil drilling platforms and gold miners	not reported	mixed-method approach	Both primary and secondary data	Document review, qualitative interview and stratified sampling techniques	Descriptive statistics and review	COVID-19 resulted in a fall in demand for most minerals and metals with the exception of gold. On the supply side most mining and drilling sites were either shut down or operated at minimum capacity in line with COVID-19 measures hence output reduced even where demand did not decline like in the market for gold. Artisanal miners also had challenges mining during the pandemic. The Governments provided regulation for artisanal miners to ensure their safety and provided some financial assistance to them	COVID-19 resulted in fall in demand for mineral as well as low production as majority of miners were unable to mine
J. M. Dixon et al. (2021)	The impacts of COVID-19 containment on the Australian economy and its agricultural and mining industries	Western Australia	not reported	not reported	Quantitative cross-sectional study	primary data	not reported	VURM, a detailed computable general equilibrium model for Australia.	The study revealed that at the peak of economic impacts, gold mining declines by about 6% relative to a no-COVID baseline. Compared to the economy-wide average, the decline in agriculture and mining output is small.	The COVID-19 led to some decline in gold and other mining in Australia even though the decline was not significant.

(*Continued*)

Table 1. (Continued).

Author(s), Year	Study aim/objective	Country	Study population/sample size	age [mean, range]	Study design [Quant, Quant, cross-sectional and others	Data source (primary, secondary, and document review)	Sampling techniques	Type of analysis	Key findings/results	Impact/effect
Asare et al. (2021)	To examine the mental wellbeing of Fly-in Fly-out (FIFO) workers in the mining industry during COVID-19 restrictions in Western Australia	Western Australia	FIFO workers who underwent COVID-19 screening at a large mining company ($n = 842$)	18 and over [mean age = 44.1 ± 11.8 years]	Cross-sectional study	primary data	convenient sampling technique	ANOVA and linear regression model	The study revealed positive/better mental well-being during COVID-19 related restrictions in the FIFO workers in Australia. However, workers who were younger, placed under travel quarantine and experienced symptoms consistent with the common symptoms of COVID-19 had poor mental well-being.	Some of the FIFO workers experienced some form of mental disruption. However, they coped with the disruption and stress of COVID-19 and related early restrictions
Milleliri et al. (2021)	The study was to evaluate the seroprevalence of SARS-CoV-2 infection in Ivory Coast mine workers	Cote d'Ivoire	A total of 1,687 mine workers; 91% were male ($n = 1,536$) and 9% were females	18 years and older mean age = 37 years and range (18–66) years	Cross-sectional study	primary data	census method	Logistic regression model	The overall seroprevalence was 25.1% ($n = 422$), ranging between 13.6% (11.2–16.1%), 34.4% (31.1–37.7%), and 34.7% (26.2–43.2%) in mine A, in mine B, and in Abidjan, respectively. Among the 422 seropositive subjects, 74 reported mild symptoms in the three previous months and one was hospitalized for severe COVID-19 infection. SARS-CoV-2 seroprevalence is high in both gold miners and administrative staff working in Ivory Coast.	not reported
Asare et al. (2023)	The mining industry's FIFO workers' health-related behaviours during the COVID-19 pandemic were investigated in this study.	Western Australia	768 Workers at FIFO mining industry (633 males and 135 females)	Their age ranges from 19–73	Descriptive cross-sectional study	secondary and primary data	Convenient sampling	Descriptive Analysis (The independent sample t-test, Pearson's chisquare test and Spearman's rank test)	Smoking was highly prevalent (32%). Males smoked more cigarettes each day (15.27.0 vs. 13.17.1, $p = .174$) than females. The majority of participants (74.7%) used alcohol more than twice a week. Males consumed more alcohol at short-term hazardous levels than females (20.2% vs. 8.0%; $p = .010$). A third (34.4%) of the workers (33.5% of men and 38.5% of women, $p = .264$) did not perform enough moderate-to-vigorous exercise. A third (33.1%) of workers showed multiple risk behaviours (33.7% of males and 30.4% of females; $p = .699$).	not reported

(*Continued*)

Table 1. (Continued).

Author(s), Year	Study aim/objective	Country	Study population/sample size	age [mean, range]	Study design [Quant, Quant, cross-sectional and others	Data source (primary, secondary, and document review)	Sampling techniques	Type of analysis	Key findings/results	Impact/effect
D'Antoine Emma et al. (2023)	The goal of the study was to uncover potential risks for mental health in the offshore oil and gas business as well as how the Five Factor Model (FFM) personality types fit into coping mechanisms.	Western Australia	A sample size of 8 officers (7 males, 1 female) from the oil and gas industry were used	Age 26 to 55 years	Qualitative exploratory design	Primary data	Purposive sampling	Thematic analysis using NVivo software	Results indicated that a number of stressors, including COVID-19 and its detrimental impacts on rosters, working hours, job security, and time away from home, are already prevalent for Australian offshore oil and gas workers. Other pressures mentioned by participants included a lack of space, working in a dangerous area, stigma, travelling by helicopter, and the need to meet production demands. Risk avoidance seems to be connected with agreeableness and conscientiousness, but poor safety practices were associated with neuroticism, extraversion, and openness. Shift job tolerance was favourably correlated with extraversion and adversely correlated with neuroticism. Additionally, neuroticism was negatively linked to help-seeking, productivity, and degrees of worry about COVID-19 and job insecurity.	Covid-19 negatively affected employees job security coupled with poor mental health outcomes due to interventions like compacted and extended rosters, quarantine, and isolation requirements during travel
Hilson, Bockstael, et al. (2021)	This article sought to evaluate the COVID-19 pandemic's possible effects on artisanal and small-scale mining (ASM) operations in sub-Saharan Africa, with a focus on labour-intensive, low-tech mineral extraction and processing.	Sub -Saharan Africa (Ghana inclusive)	Small scale mining workers	Not stated	Not stated	Not stated	Not stated	Not stated	Despite its demonstrated ability to stabilise and catalyse development in the region's rural economies, findings from ongoing research in Mali, Liberia, and Ghana show that the locations of three of the biggest and most dynamic ASM economies in sub-Saharan Africa show that even this sector has been impacted by COVID-19. They more importantly provide insight into how the pandemic has affected communities that depend on ASM and, more critically, point out how to strengthen the industry and better position it to help rural communities navigate crises.	It was proven through discussions with key sources that, despite the operators in the country not being subject to lock-down measures, their productivity has decreased as a result of restricted mobility of personnel, money, and equipment. The lock-downs in Ghana for example brought about hunger, affected pricing of gold
Australian Chamber of Mines & Energy Report	To understand the impacts of the disruptions caused by COVID-19 on the WA resources sector	Western Australia	Study population ranges from Chief Executive Officers, Chief Financial Officers, Chief Operating Officers, Managing Directors, Directors, General Managers and Operational Leads and a sample size of top 30 CME producing members	Not stated	Mixed methods	Primary data	Not stated	Not stated	According to the survey, COVID-19 has affected 98% of businesses, causing disruptions in the workforce, financial systems, and supply networks. Compared to the initial level of unpreparedness, 89% were ready for a second wave. Despite obstacles, the resources industry in WA showed an increase in GVA and sales and provided over $9 million in aid to the community.	Disrupted businesses, but with increased GVA and sales and aid to communities.

(*Continued*)

Table 1. (Continued).

Author(s), Year	Study aim/objective	Country	Study population/sample size	age [mean, range]	Study design [Quant, Quant, cross-sectional and others	Data source (primary, secondary, and document review)	Sampling techniques	Type of analysis	Key findings/results	Impact/effect
Kumi (2020)	Annual report	Ghana	Not stated	Not stated	Not stated	Secondary data	Not stated	Not stated	Covid-19 had negatively impacted the mining sectors. The year 2020 witnessed the highest (12.1%) decline in production since 2004. The Ghana manganese also saw 56.2% decline in production due to government directive to stop company's operations. The report continued that the purchase of diamond dropped by 25.1%. However, Ghana's producer of bauxite saw improvement of 4.1%, whiles proceeds of minerals from export saw a percentage growth of 4.8. The chamber of mines reported 2,067 per ounce on increase in price of gold as at 6th August.	Covid-19 though disrupted the mining industry in Ghana. However, there were some positive impacts chocked by the industry in the area of bauxite production and the pricing of diamond and gold
Munday et al. (2021)	Case report	Australia	Not stated	Not stated	Not stated	Not stated	Not stated	Not stated	The COVID-19 pandemic has accelerated mining companies' adoption of technology, requiring cost reduction, restricted movement, and rapid remote working to meet operational demands.	COVID-19 has spurred significant innovation and positive change in key industries, bringing significant benefits to customers, communities, and the industries themselves.
Thomasm et al. (2020)	This publication sought to explore the major issues affecting participants in the Australian mining industry as a result of the COVID-19 pandemic.	Australia	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Finding revealed that the mining industry was faced with travel restrictions, fieldwork interruptions, and difficulties in navigating contractual or joint venture obligations.	COVID-19 has had a global impact, including restrictions, fieldwork interruptions, and difficulties in navigating contractual or joint venture obligations.
Gonçalves & Moro (2023)	The study sought to provide insight into the state of the art on relevant dimensions and hot topics to understand the economic impacts of COVID-19.	Australia	Not stated	Not states	Text mining analysis of 301 articles published during 2020	Secondary data	By defining a set of relevant dimensions grounded on existing literature,	Not stated	The study revealed that financial markets' impact is extensively studied, particularly in Asia, while Europe's focus is more diverse, with less attention given to America and other pandemics.	Covid-19 impacted the financial market

(*Continued*)

Table 1. (Continued).

Author(s), Year	Study aim/objective	Country	Study population/sample size	age [mean, range]	Study design [Quant, Quant, cross-sectional and others	Data source (primary, secondary, and document review)	Sampling techniques	Type of analysis	Key findings/results	Impact/effect
Mireku-Gyimah et al. (2021)	The study assessed the effect of COVID-19 on Ghana's oil and gas and mining sectors	Ghana	Extractive companies' royalty receiving MMDAs, regulators and civil society organizations operating in the extractive sector,	Not reported	Qualitative and documentary analysis	Primary data	Not stated	Thematic and documentary analysis	The COVID-19 pandemic has significantly impacted Ghana's extractive sector, affecting governance, regulation, civil society activism, and sub-national revenues. Companies were unable to engage with community members, local authorities, and NGOs due to suspensions in governance mechanisms. Government measures, such as movement restrictions and the closure of regulatory agency offices, hindered the effective discharge of their duties. Civil society activism was reduced due to delays in program implementation and unplanned expenditures. The pandemic also affected the revenue mobilization efforts of sub-national governments, with mineral royalties being the most consistent government revenue stream. The pandemic disproportionately affected female-owned businesses, with wages and salaries impacted. The long closure of borders disrupted supply-chain networks and impacted the core operations of companies.	The overall effect of the COVID-19 pandemic on Ghana's extractive sector was a multifaceted disruption that hindered governance, community engagement, regulatory efficiency, revenue generation, civil society activism, and supply chain operations, amplifying gender disparities and impeding the sector's functionality.
Kumar and Nafi (2020)	To summarize the evolving situation with respect to the pandemic and its economic impacts.	Ghana	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	The coronavirus pandemic has significantly impacted Ghana's oil and gas sector, with negotiations delayed and projects less economically viable. Gold dominates the mining sector, with small-scale operators conducting a significant portion. Gold prices have increased by 14% since 2020, but global travel restrictions affect trading. The government proposes amending the Petroleum Revenue Management Act to use the Ghana Heritage Fund and Ghana Stabilization Fund to address budget challenges, but civil society groups have raised concerns about these proposals.	The implication of COVID-19 on Ghana's oil, gas, and mining sectors has resulted in stalled negotiations, diminished project viability, disrupted trade, increased gold prices, and proposed amendments to utilize national funds, generating concerns from civil society regarding budgetary solutions.

(*Continued*)

Table 1. (Continued).

Author(s), Year	Study aim/objective	Country	Study population/sample size	age [mean, range]	Study design [Quant, Quant, cross-sectional and others	Data source (primary, secondary, and document review)	Sampling techniques	Type of analysis	Key findings/results	Impact/effect
Darkwah (2022)	To assess COVID-19 measures and impacts	Ghana	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	The first COVID case in 2020 led to expanded programs and containment measures. The state passed legislative instruments for public health, providing basic services and protective equipment. The healthcare system faced challenges, but incentives were provided. The pandemic impacted the economy, making the poor more vulnerable. Non-state actors funded the COVID-19 Recovery and Resilience program, and banks cut policy rates to make loans more accessible.	The CAP BuSS and CARES efforts in Ghana have been criticized for their inadvertent discrimination against women and those with less formal business operations. The rebates on basic services assume universal access, but this is not always the case. Many citizens were in dire straits, and the state's efforts to alleviate hardships are inadequate or even worse with the draconian punishment attached to executive instruments.

evaluation reflects the robustness and reliability of the research outcomes. Additionally, two of the studies received 'poor' ratings, while one received 'fair' ratings. Studies that failed to adequately explain the participant recruitment process, including the inclusion criteria and sampling strategies, as well as studies that lacked the justification of sample size and other problems that could translate into a high risk of bias, which would undermine the generalizability of the study, were graded as fair or poor. The same grading standards were applied in the review of qualitative studies. Two of the four qualitative studies received 'good' ratings, while two received 'fair' ratings. In Supplementary File 3, the specific criteria utilised to evaluate and grade the methodological quality are presented.

3.4. Management strategies and impact of COVID-19 on mining sector in West Africa and Western Australia

Studies conducted a preliminary analysis in sub-Saharan African countries, including Ghana, Burkina Faso, Mali, and Liberia (Hilson et al., 2021). Their findings revealed that, following several interventions, such as lockdowns, specific restrictions, and increased support for mining artisans, there was a notable reduction in the spread of COVID-19 and a decrease in mortality rates. However, the studies in question also highlighted the disruptive consequences of these lockdowns and restrictions within the mining sector including hunger, a significant drop in gold prices, and diminished production. Understanding how the COVID-19 pandemic affected artisanal and small-scale mining communities in Ghana was the main objective of separate studies (Pijpers & Luning, 2021). Pijpers (2021) study unveiled the extensive disruptions caused by COVID-19, notably affecting production and leading to a significant decline in gold prices. Additionally, the closure of mining sites, implemented to curtail the spread of the disease, resulted in reduced mobility for these communities.

Similarly, a qualitative study undertaken in Western Australia (D'Antoine Emma et al., 2023) investigated the potential risks for mental health in the offshore oil and gas industry during the COVID-19 pandemic. The research explored how the Five Factor Model (FFM) personality types aligned with coping mechanisms for depression, anxiety and stress. Within their study, the researchers illuminated key management strategies employed by the mining sector, including compacted and extended work rosters, as well as quarantine and isolation measures during the pandemic. The findings underscored the adverse effects on employees applied by these strategies, including concerns about job security and the manifestation of poor mental health symptoms such as depression, anxiety, and stress. Collectively, these studies offer insights into the multifaceted impact of the COVID-19 pandemic on mining communities and underscore the importance of balancing health measures with the socio-economic well-being of those involved in the sector.

In West Africa and Western Australia, respectively, the mining industries have been significantly impacted by the COVID-19 pandemic. According to three studies (Akrofi & Antwi, 2020; Montalti et al., 2021; O. Olaniyi et al., 2021; Pijpers & Luning, 2021) COVID-19 halted mining activities in West Africa, forcing the majority of mining enterprises to either cease operations or abandon work and resume it at a suitable time. This was necessary since the majority of West African nations enacted restrictions and lockdown measures to slow the infection's rapid and erratic spread. According to COVID-19 regulations, the majority of mining and drilling sites in Nigeria were either closed down or operated at a minimal capacity (Montalti et al., 2021; F. O. Olaniyi, 2022). Thus, output drastically decreased even in markets where demand remained stable, like the gold market. Miners in Ghana temporarily halted work before operations were back to normal. When the miners returned to work, mining companies considerably reduced the size of their teams in order to stop the spread of infection, which indirectly affected output and production (Pijpers & Luning, 2021). The governments of Ghana, Burkina Faso, Cote d'Ivoire, and Nigeria, on the other hand, enacted partial and entire lockdowns in the effort to stop the spread of COVID-19, according to cross-national research done in those countries (Akrofi & Antwi, 2020). Additionally, as described in previous studies (Haji, 2021; Milleliri et al., 2021), mine personnel acquired COVID-19, which impacted their ability to use human resources and their productivity. High seroprevalence (25.1%) among miners was reported in a study

from Cote d'Ivoire, with some miners exhibiting minor symptoms and others hospitalised for severe COVID-19 infection (Milleliri et al., 2021). Due to the high prevalence of COVID-19 infection, this had a significant impact on the mining industry's ability to manage human resources and produce gold.

These results were consistent with the findings for Western Australia. Some mining workers were isolated after exhibiting COVID-19 symptoms, which negatively impacted their mental health. According to a cross-national study (Muthuri et al., 2021), COVID-19 significantly disturbed the mining industries in Ghana and Kenya, having a considerable impact on occupational health and livelihoods. COVID-19 had a severe effect on the livelihood of mine workers as well as on their occupational health, safety, and wellbeing. It also affected the production of gold and gemstones, as well as trade and investment. Further to this, studies conducted in West Africa and Western Australia (Brown et al., 2021; Casp, 2017; Williamson & Minter, 2019) found declines in demand for the majority of minerals, a decrease in gold production, as well as disruptions in gold prices. Tanzania saw a sharp decline in mineral production during COVID-19, which affected gold production (Casp, 2017). Compared to a non-COVID baseline, gold mining in Australia decreased by roughly 6% during the pandemic (Williamson & Minter, 2019). Another study by the Chamber of Mines and Energy in 2020 found that COVID-19 affected 98% of businesses, causing disruptions in the workforce, financial systems, and supply networks. Compared to the initial level of unpreparedness, 89% were ready for a second wave. Despite obstacles, the resources industry in Western Australia showed an increase in Gross value added and sales and provided over $9 million in aid to the community.

In addition, the pandemic has had a significant impact on various sectors, including the mining industry in Ghana, Australia, and Ghana's oil and gas sector. In 2020, Ghana experienced the highest decline in production since 2004, with a 12.1% decline in production for manganese and a 56.2% decline for diamond. Ghana's bauxite production experienced a 4.1% increase, while the price of gold rose to $2,067 per ounce (Dauda, 2020). In Australia, the pandemic has accelerated the adoption of technology by mining companies, requiring cost reduction, restricted movement, and rapid remote working. However, it has also spurred significant innovation and positive change in key industries, bringing benefits to customers, communities, and the industries themselves according to the Economic Intelligence Unit (Gonçalves & Moro, 2023; Mathieu et al., 2021; Milne et al., 2020).

In Ghana, the pandemic has affected governance, regulation, civil society activism, and sub-national revenues. Companies have been unable to engage with community members, local authorities, and non-governmental organizations due to suspensions in governance mechanisms. Government measures, such as movement restrictions and closure of regulatory agency offices, have hindered the effective discharge of their duties (Mireku-Gyimah et al., 2021). The pandemic has also disproportionately affected female-owned businesses, with wages and salaries impacted. The long closure of borders disrupted supply-chain networks and impacted the core operations of companies (Baye et al., 2021; Okyere et al., 2022). The pandemic has also resulted in stalled negotiations, diminished project viability, disrupted trade, increased gold prices, and proposed amendments to utilize national funds. Critics argue that the state's efforts to alleviate hardships are inadequate or worse, with draconian punishment attached to executive instruments (Chinery, 2020).

4. Discussion

This study is perhaps the first systematic review and narrative synthesis to examine the impacts of COVID-19 management strategies on mining industries in West Africa and Western Australia. The review identified six key findings, reflecting patterns of significant similarities and differences between the two regions. The study aimed to provide evidence-based answers to the research question: how COVID-19 management strategies affected mining operations, socio-economic resilience, and industry adaptation in these contexts.

4.1. Effective strategies and their disruptive consequences

Our findings showed that the COVID-19 pandemic emphasized the need for effective crisis management strategies in the mining sector while revealing unintended socio-economic and operational disruptions. For example, the lockdowns and targeted restrictions in sub-Saharan Africa successfully curbed virus transmission but caused food insecurity and economic instability, exacerbated by declining gold prices and disrupted supply chains (Hilson et al., 2021). Regulatory office closures in Ghana hindered governance, complicating engagement between companies and communities (Mireku-Gyimah et al., 2021). Conversely, Australia employed technology to sustain operations via remote work and automation but faced workforce exclusion due to limited digital skills (Munday et al., 2021; Ouédraogo & Nassè, 2020). These findings align with several studies (e.g. Alfadil et al., 2024; Hossain et al., 2022) emphasizing governance continuity and balanced interventions. The policy implication of our finding is that, effective crisis management in mining requires balancing public health measures with socio-economic resilience to protect livelihoods. Also, inclusive technological adoption demands workforce training, while governance continuity is vital through digital solutions and contingency plans. These strategies bolster resilience, foster sustainability, and prepare the mining sector for future global disruptions.

4.2. Impact on small-scale and artisanal mining

Our findings that artisanal and small-scale mining (ASM) particularly in West Africa was interrupted by the COVID-19 outbreak are consistent several studies (Biyela & Utete, 2024; Khlystova et al., 2022; Thierens & Mawala, 2020) which confirm disruptive impact of the pandemic the construction and creative industries. This resulted in containment measures like site closures restricted ASM mobility, impacting livelihoods and triggering a sharp drop in gold prices, destabilizing the sector (Chaolin et al., 2023; Fisher et al., 2023). This revealed ASM communities' vulnerability to external shocks and the need for robust safety nets. Conversely, as the study (Atif et al., 2020; Ardolino et al., 2020) showed, Australia's advanced technologies ensured operational continuity for large enterprises, but smaller miners struggled with high costs and technological complexities, emphasizing disparities in resource access and technological integration (Klein et al., 2023; Milne et al., 2020). The pandemic underscored inequities in the mining sector and the necessity of tailored support mechanisms. Therefore, effective crisis management requires balanced public health policies and measures to develop frameworks that enhance ASM resilience by incorporating financial assistance, targeted health interventions, and accessible technological solutions. Similarly, integrating ASM into pandemic policies and fostering collaborations among governments, private sectors, and local organizations could ensure inclusive growth and safeguard smaller operations during future crises.

4.3. Mental well-being and coping strategies

The study showed that the COVID-19 pandemic significantly impacted the mental well-being of workers in the mining and offshore oil and gas sectors. In alignment with several studies (De Kock et al., 2021; Gilleen et al., 2021; Vanhaecht et al., 2021), our findings in Western Australia revealed that pandemic management strategies, such as extended rosters, isolation, and quarantine, led to increased stress, anxiety, and depression (D'Antoine Emma et al., 2023). Individual resilience varied, influenced by personality traits from the Five Factor Model (Chaolin et al., 2023). Key drivers of these challenges included isolation, job insecurity, and economic uncertainties (Gonçalves & Moro, 2023; Vieira dos Santos et al., 2022). Long-term isolation and workplace modifications have been linked to increased vulnerability to psychological distress in multiple sectors like healthcare industry (De Kock et al., 2021). These findings underscore the need to integrate psychological support into emergency response strategies, ensuring holistic crisis management that protects employees' mental health during prolonged disruptions. To address mental health challenges from pandemic-related

disruptions, policies should emphasize resilience-building and support systems. Employers can implement counselling, stress management workshops, and peer support programs. Tailored interventions aligned with personality traits, shorter work rosters, regular mental health check-ins, and transparent job security communication can alleviate worker stress and enhance well-being.

4.4. Impact on the economy and industry resilience

The COVID-19 pandemic exposed vulnerabilities in the mining sector, particularly in West Africa and Western Australia, where temporary shutdowns disrupted operations, reduced production, and strained global supply chains. Declining demand and fluctuating gold prices heightened economic instability for producers and communities dependent on mining (Ahadjie et al., 2021; Hilson etal., 2020). These findings align with studies showing how supply chain interruptions and demand shocks affect industries globally (Klein et al., 2023; Kumi, 2020). Despite challenges, the mining sector showed resilience, employing safety measures, adapting protocols, and leveraging innovations like digitalization to sustain operations (Milne et al., 2020). The findings underscore the need for crisis response frameworks prioritizing economic stability, employee safety, and community welfare. Policymakers should invest in digital technologies, workforce training, and financial safety nets for mining communities. Transparent communication and market diversification can reduce commodity reliance, enhance resilience, and ensure coordinated responses during future disruptions.

4.5. Effects on production and employment

Consistent with earlier studies (Jowitt, 2020; Laing, 2020), the COVID-19 pandemic significantly disrupted various industries, including mining. Our findings confirm that production and employment, especially in artisanal and small-scale mining (ASM) in sub-Saharan Africa, were adversely affected. Site closures, workforce reductions, and decreased corporate social responsibility initiatives such as lower taxes and royalties dampened sectoral growth and community benefits (Thorp, 2023). Investments in exploration and technology stalled, and in Ghana, decreased manganese and diamond production reduced job opportunities (Winifred et al., 2022). In Australia, technology mitigated productivity losses but reshaped employment dynamics, favouring skilled workers (Klein et al., 2023; Milne et al., 2020). This highlights the need for balanced technological adoption policies to address disparities. These findings highlight the need for inclusive policies that combine technological progress with equitable job opportunities. Governments and stakeholders should prioritize workforce re-skilling to mitigate displacement risks. Emergency funds and incentives for sustainable practices can stabilize artisanal mining. Collaboration between governments and mining firms is crucial for resilience, safeguarding livelihoods, and fostering economic stability.

4.6. Impact on world mineral prices and demand

The global pandemic disrupted mineral markets, significantly reducing demand and prices for key commodities. For instance, lockdowns and halted operations led to higher production costs and financial instability for mining firms, with some ceasing operations entirely (A. Gruzd & Mai, 2020; S. Gruzd et al., 2020). Demand for platinum, silver, and base metals fell, and most mineral prices, except iron ore, stabilized only by late 2020 (Ahadjie et al., 2021; Muthuri et al., 2021). While studies emphasize these short-term effects on resource availability (World Health Organization, 2020), Western Australia demonstrated resilience, reporting increased gross value added (GVA) and community aid (Andrews et al., 2022; Olayele & Samy, 2022), Ghana's challenges highlight the interplay between global markets and local production capacities (S. Kumar & Nafi, 2020; A. Kumar et al., 2020). To enhance the mining sector's resilience, policies should prioritize market stability through financial safety nets and

price stabilization mechanisms. Governments can mitigate vulnerabilities by diversifying resource-dependent economies and promoting regional collaboration to align crisis responses. Investments in digitalization and workforce training address disruptions, while integrating risk management frameworks ensures preparedness for future economic, health, and environmental crises.

4.7. Strengths and limitations of the study

This study has a number of noteworthy strengths. The influence of COVID-19 management techniques on the mining industry in West Africa and Western Australia is first and foremost examined through the use of a systematic review approach that adheres to the PRISMA principles. In addition, the study incorporated quantitative and qualitative research, which provides a well-rounded and thorough understanding of the subject, which is another significant strength. This mixed-methods approach expands the analysis's breadth by enabling the investigation of subtleties and complexity in the data. The study also thoroughly evaluates the research that is included for quality using recognised evaluation methodologies, adding to the validity of the results. Furthermore, the comparison of two distinct regions (West Africa and Western Australia) adds complexity to the research and makes it possible to pinpoint opportunities and challenges unique to each area. Finally, the study outcomes offer useful insights that might help governments, mining firms, and researchers to address problems caused by the epidemic in the mining industry.

Despite its benefits, this study has limitations which are acknowledged by the authors. The study's geographic focus is limited to West Africa and Western Australia, which may affect its generalizability to other mining regions throughout the world. Similarly, the study's temporal restriction to publications released from 2019 to 2023 May also have prevented it from completely capturing the pandemic's long-term effects. Additionally, the analysis solely considers English-language literature, thus omitting pertinent research that has been published in other languages. Finally, although the study refers to a multi-source synthesis technique for fusing quantitative and qualitative data, it lacks particular information on the synthesis procedure and analytical topics, which may affect the analysis's clarity and reproducibility.

5. Conclusions and implications

5.1. Conclusions

This systematic review provides valuable insights into the impacts of COVID-19 on mining industries in West Africa and Western Australia, highlighting both the challenges faced and the resilience shown by the sector. While the pandemic disrupted production, trade, and employment, particularly affecting small-scale miners, the sector's capacity for adaptation – such as through technology adoption and improved crisis management strategies – mitigated some of the operational and economic losses. However, issues such as vulnerabilities in artisanal mining, mental health challenges among workers, and disruptions to global mineral markets call for comprehensive policies that balance immediate health measures with long-term sectoral resilience. Governments and companies must prioritize measures that address the socio-economic needs of the most vulnerable and support sectoral sustainability beyond the pandemic.

5.2. Implications

The findings underscore several key policy implications. First, crisis management strategies in mining should balance investments in health and safety interventions with efforts to protect livelihoods,

particularly for artisanal miners (Hilson et al., 2021; Thierens & Mawala, 2020). Second, there is a critical need for inclusive technological adoption, which requires investing in digital skills training to ensure that workers at all levels benefit from innovations for enhancing operational efficiency and resilience (Milne et al., 2020; Munday et al., 2021). The study also emphasizes the importance of mental health support, suggesting that mining companies implement programmes to address stress and isolation among workers, particularly in the context of FIFO arrangements (D'Antoine Emma et al., 2023; Gonçalves & Moro, 2023). Finally, to reduce vulnerabilities to market fluctuations, mining-dependent economies should diversify their revenue sources and invest in financial safety nets, stabilising mineral prices and enhancing resilience against future global disruptions (Ahadjie et al., 2021).

Acknowledgements

We would like to express our sincere gratitude to Esther Adama (School of Nursing and Midwifery) and Abdul-Razak Suleman (School of Business and Law), Edith Cowan University, Joondalup Australia, for their valuable contributions and insightful guidance throughout this research.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This research received funding from the Australian Government Research Training Program (RTP) Scholarship.

Author contributions

The study conception and design were led by Esther Ayaaba. Data search, extraction, synthesis, and interpretation were conducted by Esther Ayaaba and Samuel Kofi Amponsah. The original manuscript draft was prepared by Esther Ayaaba. The manuscript was reviewed for critical inputs by Kwadwo Adusei Asante, Victor Fannam Nunfam, and Krassi Rumchev. All authors participated in the final editing and approved the manuscript for submission.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ORCID

Esther Ayaaba http://orcid.org/0000-0002-9697-5990
Kwadwo Adusei-Asante http://orcid.org/0000-0002-1343-8234
Victor Fannam Nunfam http://orcid.org/0000-0002-4572-0904
Samuel Kofi Amponsah http://orcid.org/0000-0001-6204-3063

References

Adam, J. N., Adams, T., Gerber, J.-D., & Haller, T. (2021). Decentralization for increased sustainability in natural resource management? Two cautionary cases from Ghana. *Sustainability*, *13*(12), 6885. https://doi.org/10.3390/su13126885

Africa, U. N. E. C. F., & Bank, A. D. (2022). *West African studies Africa's urbanisation dynamics 2022 the economic power of Africa's cities*. OECD Publishing.

Ahadjie, J., Gajigo, O., Gomwalk, D., & Kabanda, F. (2021). *Working paper 357-impact of COVID-19 on mining case studies of four African countries*.

Akrofi, M. M., & Antwi, S. H. (2020). COVID-19 energy sector responses in Africa: A review of preliminary government interventions. *Energy Research & Social Science*, *68*, 101681. https://doi.org/10.1016/j.erss.2020.101681

Alfadil, S., Rauzana, A., & Bulba, A. T. (2024). The influence of knowledge and awareness on compliance with occupational safety and health (OSH) among the workers at Sigli-Banda Aceh toll road construction project. *AIP Conference Proceedings*, October 25–26, 2024, Hyderabad, Telangana, India.

Alimi, Y., Oppong-Otoo, J. M., Waya, C. B., Abdulaziz, M., Craig, J. M., Kalanxhi, E. P., Gopal, G. M., & Sriram, A. M. (2021). Knowledge, attitudes, and practices on antimicrobial use, resistance, and stewardship in Africa.

Andrews, N., Grant, J. A., & Ovadia, J. S. (2022). *Natural resource-based development in Africa: Panacea or Pandora's box?* University of Toronto Press.

Apedo-Amah, M. C., Avdiu, B., Cirera, X., Cruz, M., Davies, E., Grover, A., Iacovone, L., Kilinc, U., Medvedev, D., & Maduko, F. O. (2020). *Unmasking the impact of COVID-19 on businesses: Firm level evidence from across the world*. The World Bank.

Ardolino, M., & Leoni, L. (2020). Special Issue on: Unveiling Myths and Misconceptions about Human-Technology Interaction.

Arregocés, H. A., Rojano, R., & Restrepo, G. (2021). Effects of lockdown due to the COVID-19 Pandemic on air quality at Latin America's largest open-pit coal mine. *Aerosol & Air Quality Research*, *21*(8), 200664. https://doi.org/10.4209/aaqr.200664

Asare, A., Thodsen, H., Antwi, M., Opuni-Frimpong, E., & Sanful, P. O. (2021). Land use and land cover changes in Lake Bosumtwi watershed, Ghana (West Africa). *Remote Sensing Applications: Society & Environment*, *23*, 100536. https://doi.org/10.1016/j.rsase.2021.100536

Asare, B. Y. A., Robinson, S., Powell, D., & Kwasnicka, D. (2023). Health and related behaviours of fly-in, fly-out workers in the mining industry in Australia: A cross-sectional study. *International Archives of Occupational and Environmental Health*, *96*(1), 105–120.

Asibor, G., & Moru, J. M. (2024). Impact of covid-19 Pandemic on the health and well-being of offshore oil workers in Nigeria. *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, *6*(8), 206–214.

Atif, I., Cawood, F. T., & Mahboob, M. A. (2020). The role of digital technologies that could be applied for prescreening in the mining industry during the COVID-19 pandemic. *Transactions of the Indian National Academy of Engineering*, *5*(4), 663–674. https://doi.org/10.1007/s41403-020-00164-0

Atighechian, G., Rahimi, A., Sattari, M., & Mohammadi, M. (2024). Dimensions of hospital resilience emphasized during the COVID-19 pandemic response: A systematic review. *Health Science Reports*, *7*(8), e2300. https://doi.org/10.1002/hsr2.2300

Baye, R. S., Olper, A., Ahenkan, A., Musah-Surugu, I. J., Anuga, S. W., & Darkwah, S. (2021). Renewable energy consumption in Africa: Evidence from a bias corrected dynamic panel. *Science of the Total Environment*, *766*, 142583. https://doi.org/10.1016/j.scitotenv.2020.142583

Belinga, J., & Marque, E. (2022). The "social license to operate" in the OHADA zone: The imperative of further substantiating an emerging and elusive concept in a post-COVID-19 pandemic world. In *The palgrave handbook of social license to operate and energy transitions* (pp. 1–46). Springer. https://doi.org/10.1007/978-3-030-74725-1_11-1

Biyela, N. Y., & Utete, R. (2024). Agenda for future business resilience and survival avenues in crisis times: A systematic literature review of the effects of COVID-19 on SMEs' productivity in South Africa. *Social Sciences & Humanities Open*, *10*, 100982. https://doi.org/10.1016/j.ssaho.2024.100982

Bonnet, E., Bodson, O., Le Marcis, F., Faye, A., Sambieni, N., Fournet, F., Boyer, F., Coulibaly, A., Kadio, K., Diongue, F. B., & Ridde, V. (2021). The COVID-19 pandemic in francophone West Africa: From the first cases to responses in seven countries. *BMC Public Health*, *21*(1), 1–17. https://doi.org/10.1186/s12889-021-11529-7

Brown, D. B., & Zhang, J. (2023). *Fluid policies, reoptimization, and performance guarantees in dynamic resource allocation*. Operations Research.

Brown, K. K., Boateng, G. O., Ossom-Williamson, P., & Haygood, L. (2021). Defining, conceptualizing, and measuring perceived maternal care quality in low-to high-income countries: A scoping review protocol. *Systematic Reviews*, *10*(1), 1–8. https://doi.org/10.1186/s13643-021-01608-6

Casp, U. (2017). Critical appraisal skills programme (CASP). *Qualitative Research Checklist*, *31*(13), 449.

Chaolin, H., Huang, L., Wang, Y., Li, X., Ren, L., Gu, X., Kang, L., Guo, L., Liu, M., Zhou, X., Luo, J., Huang, Z., Tu, S., Zhao, Y., Chen, L., Xu, D., Li, Y., Li, C. . . . Zhang, D. (2023). 6-month consequences of COVID-19 in patients discharged from hospital: A cohort study. *Lancet*, *401*(10393), e21–e33. https://doi.org/10.1016/S0140-6736(23)00810-3

Chinery, N. (2020). Ghana: Initial assessment of the impact of the coronavirus pandemic on the extractive sector and resource governance. *The International Monetary Fund (IMF)*.

Cleo, G., Scott, A. M., Islam, F., Julien, B., & Beller, E. (2019). Usability and acceptability of four systematic review automation software packages: A mixed method design. *Systematic Reviews*, *8*(1), 1–5. https://doi.org/10.1186/s13643-019-1069-6

Committee, W., Kontos, M. C., de Lemos, J. A., Deitelzweig, S. B., Diercks, D. B., Gore, M. O., Hess, E. P., McCarthy, C. P., McCord, J. K., Musey, P. I., Jr., & Wright, L. J. (2022). 2022 ACC expert consensus decision pathway on the evaluation and disposition of acute chest pain in the emergency department. *Journal of the American College of Cardiology*, *80*(20), 1925–1960. https://doi.org/10.1016/j.jacc.2022.08.750

Couban, R. (2016). Covidence and rayyan. *Journal of the Canadian Health Libraries Association / Journal de l'Association des bibliothèques de la santé du Canada*, *37*(3). https://doi.org/10.5596/c16-025

D'Antoine Emma, C., Jansz, C., Barifcani, J., Shaw-Mills, A., Harris, S. M., & Lagat, C. (2023). Psychosocial safety and health hazards and their impacts on offshore oil and gas installations. *Safety*, *9*, 56. https://doi.org/10.3390/safety9030056 .

Daraz, L., Morrow, A. S., Ponce, O. J., Beuschel, B., Farah, M. H., Katabi, A., Alsawas, M., Majzoub, A. M., Benkhadra, R., Seisa, M. O., Ding, J. (., Prokop, L., & Murad, M. H. (2019). Can patients trust online health information? A meta-narrative systematic review addressing the quality of health information on the internet. *Journal of General Internal Medicine*, *34*(9), 1884–1891. https://doi.org/10.1007/s11606-019-05109-0

Darkwah, A. K. (2022). *Key workers in Ghana during the COVID-19 pandemic. No. 61*. ILO Working Paper.

Dauda, S. (2020). Operationalising the "Africa mining vision": Critical reflections from Ghana. *Canadian Journal of Development Studies/Revue canadienne d'études du développement*, *41*(3), 504–524.

De Kock, J. H., Latham, H. A., Leslie, S. J., Grindle, M., Munoz, S.-A., Ellis, L., Polson, R., & O'Malley, C. M. (2021). A rapid review of the impact of COVID-19 on the mental health of healthcare workers: Implications for supporting psychological well-being. *BMC Public Health*, *21*(1), 1–18. https://doi.org/10.1186/s12889-020-10070-3

Demeubayeva, A. (2023). Impact of innovation and management performance on corporate financial returns exemplified by the US research and development sector firms before and during the COVID-19 pandemic. *Economic & Political Thought/Mysl Ekonomiczna & Polityczna*, *77*(2). https://doi.org/10.26399/meip.2(77).2023.08/a.demeubayeva

Dixon, J. M., Adams, P. D., & Sheard, N. (2021). The impacts of COVID-19 containment on the Australian economy and its agricultural and mining industries. *The Australian Journal of Agricultural and Resource Economics*, *65*(4), 776–801. https://doi.org/10.1111/1467-8489.12459

Dixon, M. G., Reef, S. E., Zimmerman, L. A., & Grant, G. B. (2022). Past as prologue—use of rubella vaccination program lessons to inform COVID-19 vaccination. *Emerging Infectious Diseases*, *28*(Suppl 1), S225–231. https://doi.org/10.3201/eid2813.220604

Dou, S., Xu, D., & Keenan, R. J. (2023). Effect of income, industry structure and environmental regulation on the ecological impacts of mining: An analysis for Guangxi Province in China. *Journal of Cleaner Production*, *400*, 136654. https://doi.org/10.1016/j.jclepro.2023.136654

Fernandes, N. (2020). Economic effects of coronavirus outbreak (COVID-19) on the world economy. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3557504

Fihn, S. D., Blankenship, J. C., Alexander, K. P., Bittl, J. A., Byrne, J. G., Fletcher, B. J., Fonarow, G. C., Lange, R. A., Levine, G. N., Maddox, T. M., Naidu, S. S., Ohman, E. M., & Smith, P. K. (2014). 2014 ACC/AHA/AATS/PCNA/SCAI/STS focused update of the guideline for the diagnosis and management of patients with stable ischemic heart disease: A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines, and the American Association for Thoracic Surgery, Preventive Cardiovascular Nurses Association, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons. *Circulation*, *130*(19), 1749–1767. https://doi.org/10.1161/CIR.0000000000000095

Fisher, E., de Theije, M., Araujo, C. H., Calvimontes, J., van de Camp, E., D'Angelo, L., Lanzano, C., Luning, S., Massaro, L., Mello, J., Ouédraogo, A., Pijpers, R. J., de Moraes, R. R., Sawadogo, C., Tuhumwire, M., & Twongyirwe, R. (2023). The lifeways of small-scale gold miners: Addressing sustainability transformations. *Global Environmental Change*, *82*, 102724. https://doi.org/10.1016/j.gloenvcha.2023.102724

Frederiksen, T. (2019). Political settlements, the mining industry and corporate social responsibility in developing countries. *Extractive Industries and Society*, *6*(1), 162–170. https://doi.org/10.1016/j.exis.2018.07.007

Ganguli, R. (2022). *Chameleons in the city: An institutional analysis of sales agents in Sydney's new apartment market*. UNSW Sydney.

Giese, E. C. (2022). Strategic minerals: Global challenges post-COVID-19. *Extractive Industries and Society*, *12*, 101113. https://doi.org/10.1016/j.exis.2022.101113

Giese, J., & Haldane, A. (2020). COVID-19 and the financial system: A tale of two crises. *Oxford Review of Economic Policy*, *36*(Supplement_1), S200–S214. https://doi.org/10.1093/oxrep/graa035

Gilleen, J., Santaolalla, A., Valdearenas, L., Salice, C., & Fusté, M. (2021). Impact of the COVID-19 pandemic on the mental health and well-being of UK healthcare workers. *British Journal of Psychiatry Open*, *7*(3), e88. https://doi.org/10.1192/bjo.2021.42

Gonçalves, H. S., & Moro, S. (2023). On the economic impacts of COVID-19: A text mining literature analysis. *Review of Development Economics*, *27*(1), 375–394. https://doi.org/10.1111/rode.12931

Gruzd, A., & Mai, P. (2020). Going viral: How a single tweet spawned a COVID-19 conspiracy theory on twitter. *Big Data & Society*, *7*(2), 2053951720938405. https://doi.org/10.1177/2053951720938405

Gruzd, S., Bosman, I., & Zikalala, N. M. (2020). *Regions apart: How South Africa and Nigeria responded to COVID-19* Occasional Paper 314 Issue.

Haji, S. H. H. (2021). The effects of COVID-19 pandemic on the government revenue in the extractive industry in Tanzania. *Journal of Economics, Management and Trade*, *27*(3), 12–29. https://doi.org/10.9734/jemt/2021/v27i330332

Hamisi, N. M., Dai, B., & Ibrahim, M. (2023). Global health security amid COVID-19: Tanzanian government's response to the COVID-19 pandemic. *BMC Public Health*, *23*(1), 1–10. https://doi.org/10.1186/s12889-023-14991-7

Haritsa, S. V., Reddy, K. J., Rafiq, A., & Gupta, M. (2021). Randomized trials of psychotherapeutic treatment for psychogenic seizures: Scoping review. *Indian Journal of Psychological Medicine*, *43*(6), 469–472. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8826192/pdf/10.1177_02537176211047392.pdf

Harrison, H., Griffin, S. J., Kuhn, I., & Usher-Smith, J. A. (2020). Software tools to support title and abstract screening for systematic reviews in healthcare: An evaluation. *BMC Medical Research Methodology*, *20*(1), 1–12. https://doi.org/10.1186/s12874-020-0897-3

Harrison, R. L., Reilly, T. M., & Creswell, J. W. (2020). Methodological rigor in mixed methods: An application in management studies. *Journal of Mixed Methods Research*, *14*(4), 473–495. https://doi.org/10.1177/1558689819900585

Haule, L. (2021). *Democratization reversal and its impact on poverty in Tanzania: Fifth phase government*. In.

Hilson, G. (2012). Poverty traps in small-scale mining communities: The case of sub-saharan Africa. *Canadian Journal of Development Studies/Revue canadienne d'études du développement*, *33*(2), 180–197. https://doi.org/10.1080/02255189.2012.687352

Hilson, G., Bockstael, S. V., Sauerwein, T., Hilson, A., & McQuilken, J. (2021). Artisanal and small-scale mining, and COVID-19 in sub-saharan Africa: A preliminary analysis.(special section: Pandemics and sustainability.). *World Development*, 139–139. https://doi.org/10.1016/j.worlddev.2020.105315

Hilson, G., Hu, Y., Hilson, A., Owen, J. R., Lèbre, É., & Sauerwein, T. (2023). Rethinking resource enclavity in developing countries: Embedding global production networks in gold mining regions. *Journal of Economic Geography*, *24*(1), 95–116. https://doi.org/10.1093/jeg/lbad028

Hilson, G., Laing, T., Hilson, A., Arnall, A., & Mondlane, S. (2024). How does small-scale mining stabilize rural livelihoods in Sub-Saharan Africa? the case of Mozambique. *World Development*, *185*, 106761. https://doi.org/10.1016/j.worlddev.2024.106761

Hoban, E., Haddock, R., & Woolcock, K. (2021). Transforming the health system for sustainability: Environmental leadership through a value-based health care strategy. *Biological Conservation*, *261*(2021), 109233.

Hoban, S., Campbell, C. D., da Silva, J. M., Ekblom, R., Funk, W. C., Garner, B. A., Godoy, J. A., Kershaw, F., MacDonald, A. J., Mergeay, J., Minter, M., O'Brien, D., Vinas, I. P., Pearson, S. K., Pérez-Espona, S., Potter, K. M., Russo, I. R. M., Segelbacher, G., Vernesi, C., & Hunter, M. E. (2021). Genetic diversity is considered important but interpreted narrowly in country reports to the convention on biological diversity: Current actions and indicators are insufficient. *Biological Conservation*, *261*, 109233. https://doi.org/10.1016/j.biocon.2021.109233

Hodge, R. A., Ericsson, M., Löf, O., Löf, A., & Semkowich, P. (2022). The global mining industry: Corporate profile, complexity, and change. *Mineral Economics*, *35*(3), 587–606. https://doi.org/10.1007/s13563-022-00343-1

Hossain, M. M., Abdulla, F., & Rahman, A. (2022). Challenges and difficulties faced in low-and middle-income countries during COVID-19. *Health Policy OPEN*, *3*, 100082. https://doi.org/10.1016/j.hpopen.2022.100082

Johnson, N., & Phillips, M. (2018). Rayyan for systematic reviews. *Journal of Electronic Resources Librarianship*, *30*(1), 46–48. https://doi.org/10.1080/1941126X.2018.1444339

Jowitt, S. M. (2020). COVID-19 and the global mining industry. *SEG Newsletter*, *122*(122), 33–41. https://doi.org/10.5382/SEGnews.2020-122.fea-02

Kabore, Y., Ahai, C. L. S., Cathy, R., & Ijimbere, G. S. (2021). African Development Bank.

Kekeç, B., Bilim, N., & Ghiloufi, D. (2022). An insight on the impact of COVID-19 on the global and Turkish mining industry. *Work*, *72*(4), 1163–1174.

Khlystova, O., Kalyuzhnova, Y., & Belitski, M. (2022). The impact of the COVID-19 pandemic on the creative industries: A literature review and future research agenda. *Journal of Business Research*, *139*, 1192–1210. https://doi.org/10.1016/j.jbusres.2021.09.062

Klein, E., Cook, K., Maury, S., & Bowey, K. (2023). Understanding covid-19 emergency social security measures as a from of basic income: Lessons from Australia. *Journal of Sociology*, *59*(4), 879–893. https://doi.org/10.1177/14407833221106242

Kubiczek, J., & Hadasik, B. (2022). Corporate social responsibility (CSR) and sustainable development during the covid-19 pandemic. *Nierówności Społeczne a Wzrost Gospodarczy*, *69*(1), 127–144. https://doi.org/10.15584/nsawg.2022.1.8

Kumar, A., Luthra, S., Mangla, S. K., & Kazançoğlu, Y. (2020). COVID-19 impact on sustainable production and operations management. *Sustainable Operations and Computers*, *1*, 1–7. https://doi.org/10.1016/j.susoc.2020.06.001

Kumar, S., & Nafi, S. M. (2020). Impact of COVID-19 pandemic on tourism: Recovery proposal for future tourism. *GeoJournal of Tourism and Geosites, Year XIIII Vol*, *33*(4), 1486–1492. https://doi.org/10.30892/gtg.334spl06-597

Kumi, E. (2020). *Country report, 2020*:

Laing, T. (2020). The economic impact of the coronavirus 2019 (covid-2019): Implications for the mining industry. *Extractive Industries and Society*, *7*(2), 580–582. https://doi.org/10.1016/j.exis.2020.04.003

Lee, H., Calvin, K., Dasgupta, D., Krinner, G., Mukherji, A., Thorne, P., Trisos, C., Romero, J., Aldunce, P., & Barrett, K. (2023). *Climate change 2023: Synthesis report. Contribution of working groups I, II and III to the sixth assessment report of the intergovernmental panel on climate change*. The Australian National University.

Lee, P., Bubeck, S., Petro, J., Drazen, J. M., Kohane, I. S., & Leong, T.-Y. (2023). Benefits, limits, and risks of GPT-4 as an AI chatbot for medicine. *New England Journal of Medicine*, *388*(13), 1233–1239. https://doi.org/10.1056/NEJMsr2214184

Marimuthu, R., Sankaranarayanan, B., Ali, S. M., & Karuppiah, K. (2022). Green recovery strategies for the mining industry of India: Lessons learned from the COVID-19 pandemic. *Journal of Asia Business Studies*, *16*(3), 428–447. https://doi.org/10.1108/JABS-05-2021-0179

Mathieu, S. L., Uddin, R., Brady, M., Batchelor, S., Ross, V., Spence, S. H., Watling, D., & Kõlves, K. (2021). Systematic review: The state of research into youth helplines. *Journal of the American Academy of Child and Adolescent Psychiatry*, *60*(10), 1190–1233. https://doi.org/10.1016/j.jaac.2020.12.028

Maul, L. V., Jamiolkowski, D., Lapides, R. A., Mueller, A. M., Hauschild, A., Garbe, C., Lorigan, P., Gershenwald, J. E., Ascierto, P. A., Long, G. V., Wang-Evers, M., Scolyer, R. A., Saravi, B., Augustin, M., Navarini, A. A., Legge, S., Németh, I. B., Jánosi, Á. J. … Adhikari, K. (2024). Health economic consequences associated with COVID-19–related delay in melanoma diagnosis in Europe. *JAMA Network Open*, *7*(2), e2356479–e2356479. https://doi.org/10.1001/jamanetworkopen.2023.56479

Milleliri, J. M., Coulibaly, D., Nyobe, B., Rey, J.-L., Lamontagne, F., Hocqueloux, L., Giaché, S., Valery, A., & Prazuck, T. (2021). SARS-CoV-2 infection in Ivory Coast: A serosurveillance survey among gold mine workers. *The American Journal of Tropical Medicine and Hygiene*, *104*(5), 1709. https://doi.org/10.4269/ajtmh.21-0081

Milne, G., Xie, S., Poklepovich, D., O'Halloran, D., Yap, M., & Whyatt, D. (2020). Effectiveness of second wave COVID-19 response strategies in Australia. *medRxiv*. 2020.11. 16.20232843.

Mireku-Gyimah, N. A., Donkor, P. O., Kitcher, C., Sarkodie, J. A., Bekoe, E. O., & Boateng, O. K. (2021). Response to covid-19 disease in Ghana: A review of the herbs. *Journal of Natural Remedies*, *21*(4), 283–290. https://doi.org/10.18311/jnr/2021/26515

Mireku-Gyimah, N. A., Donkor, P. O., Kitcher, C., Sarkodie, J. A., Bekoe, E. O., & Boateng, O. K. (2021). Response to covid-19 disease in Ghana: A review of the herbs. *Journal of Natural Remedies*, 283–290.

Montalti, M., Rallo, F., Guaraldi, F., Bartoli, L., Po, G., Stillo, M., Perrone, P., Squillace, L., Dallolio, L., Pandolfi, P., Resi, D., Fantini, M. P., Reno, C., & Gori, D. (2021). Would parents get their children vaccinated against SARS-CoV-2? Rate and predictors of vaccine hesitancy according to a survey over 5000 families from bologna, Italy. *Vaccines*, *9*(4), 366. https://doi.org/10.3390/vaccines9040366

Munday, M., Roberts, A., & Kapitsinis, N. (2021). *Economic intelligence wales annual report August 2021*.

Muthuri, J. N., Jain, A., Ndegwa, A. A. O., Mwagandi, S. M., & Tagoe, N. D. (2021). The impact of COVID-19 on gold and gemstone artisanal and small-scale mining in sub-saharan Africa: The case of Ghana and Kenya. *Africa Journal of Management*, *7*(1), 121–147. https://doi.org/10.1080/23322373.2021.1878808

Naqvi, H. R., Datta, M., Mutreja, G., Siddiqui, M. A., Naqvi, D. F., & Naqvi, A. R. (2021). Improved air quality and associated mortalities in India under COVID-19 lockdown. *Environmental Pollution*, *268*, 115691. https://doi.org/10.1016/j.envpol.2020.115691

National Heart, Lung, and Blood Institute. (2014). *Managing blood pressure: A guideline for clinicians*. U.S. Department of Health and Human Services. Retrieved from https://www.nhlbi.nih.gov.

Okyere, S., Ackora-Prah, J., Bonyah, E., & Darkwah, K. F. (2022). An optimal control Model of transmission dynamics of COVID-19 in Ghana. *arXiv preprint arXiv: 2202.06413*.

Olaniyi, F. O. (2022). Reshaping the educational system for post-COVID-19 schooling in a developing country. In *Socioeconomic shocks and Africa's development agenda* (1st ed., pp. 12). Routledge.

Olaniyi, O., Tanko, N., Muibi, B., John, R., Okafor, T., & Olusola, O. (2021). *COVID 19 impact studies on the natural resources sector of five anglophone countries in west* africa. https://www.researchgate.net/profile/Oyinlola-Olaniyi/publication/357934619_COVID_19_IMPACT_STUDIES_ON_THE_NATURAL_RESOURCES_SECTOR_OF_FIVE_ANGLOPHONE_COUNTRIES_IN_WEST_AFRICA_THE_NIGERIA_REPORT_FORD_FOUNDATION/links/61e843519a753545e2e0f4b3/COVID-19-IMPACT-STUDIES-ON-THE-NATURAL-RESOURCES-SECTOR-OF-FIVE-ANGLOPHONE-COUNTRIES-IN-WEST-AFRICA-THE-NIGERIA-REPORT-FORD-FOUNDATION.pdf

Olayele, F., & Samy, Y. (2022). *Sustainable development in post-pandemic Africa: Effective strategies for resource mobilization*. Taylor & Francis.

Ouédraogo, H., & Nassè, T. B. (2020). Emergence of economic intelligence approach in West Africa: Case of a telco in Burkina Faso. *International Journal of Management & Entrepreneurship Research*, *2*(5), 391–400. https://doi.org/10.51594/ijmer.v2i5.181

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., & Chou, R. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *372*.

Pedersen, A. B., & Babayan, S. A. (2011). Wild immunology. *Molecular Ecology*, *20*(5), 872–880. https://doi.org/10.1111/j.1365-294X.2010.04938.x

Pedersen, T., Friman, M., & Kristensson, P. (2011). The role of predicted, on-line experienced and remembered satisfaction in current choice to use public transport services. *Journal of Retailing & Consumer Services*, *18*(5), 471–475. https://doi.org/10.1016/j.jretconser.2011.06.013

Pijpers, R. J., & Luning, S. (2021). 'We have so many challenges': Small-scale mining, covid-19 and constant interruptions in West Africa. *Anthropology Today*, *37*(2), 10–14. https://doi.org/10.1111/1467-8322.12641

Saalim, K., Sakyi, K. S., Morrison, F. T. Z., Morrison, E., Owusu, P., Dalglish, S. L., & Kanyangarara, M. (2021). Reported health and social consequences of the COVID-19 pandemic on vulnerable populations and implemented solutions in six West African countries: A media content analysis. *PLoS One*, *16*(6), e0252890. https://doi.org/10.1371/journal.pone.0252890

Saha, T., Dash, C., Jayabalan, R., Khiste, S., Kulkarni, A., Kurmi, K., Mondal, J., Majumder, P. K., Bardia, A., Jang, H. L., & Sengupta, S. (2022). Intercellular nanotubes mediate mitochondrial trafficking between cancer and immune cells. *Nature Nanotechnology*, *17*(1), 98–106. https://doi.org/10.1038/s41565-021-01000-4

Signé, L., & Johnson, C. (2021). *Africa's mining potential: Trends, opportunities, challenges and strategies*. *Policy paper (21/10)*.

Sims, K., Banks, N., Engel, S., Hodge, P., Makuwira, J., Nakamura, N., Rigg, J., Salamanca, A., & Yeophantong, P. (2022). *The routledge handbook of global development*. Routledge London.

Singh, P., & Sharma, A. P. (2024). Corporate social responsibility and COVID-19 pandemic: An analytical view of community attitude. *IIMT Journal of Management*, *1*(2), 242–263. https://doi.org/10.1108/IIMTJM-12-2023-0068

Siswanto, D. J., Tegor, T., Haqiqi, F., Yusmalina, Y., & Susanto, A. (2022). Human resources management in the Country's border region faces industry 4.0 and the Covid-19 Pandemic. *Al-Tanzim: Jurnal Manajemen Pendidikan Islam*, *6*(1), 228–242.

Smith, N., Goncalves, P., Charbit, B., Grzelak, L., Beretta, M., Planchais, C., Bruel, T., Rouilly, V., Bondet, V., Hadjadj, J., Yatim, N., Pere, H., Merkling, S. H., Ghozlane, A., Kernéis, S., Rieux-Laucat, F., Terrier, B., Schwartz, O. . . . Duffy, D. (2021). Distinct systemic and mucosal immune responses during acute SARS-CoV-2 infection. *Nature Immunology*, *22*(11), 1428–1439. https://doi.org/10.1038/s41590-021-01028-7

Takyi, R., Hassan, R., El Mahrad, B., & Adade, R. (2021). Socio-ecological analysis of artisanal gold mining in west Africa: A case study of Ghana. *Journal of Sustainable Mining*, *20*(3), 206–219. https://doi.org/10.46873/2300-3960.1322

Thierens, M., & Mawala, E. (2020). *The impact of covid-19 on artisanal mining communities in northern Tanzania*. IPIS vzw.

Thomas, H., Runions, K., Lester, L., Lombardi, K., Epstein, M., Mandzufas, J., Barrow, T., Ang, S., Leahy, A., Mullane, M., Whelan, A., Coffin, J., Mitrou, F., Zubrick, S. R., Bowen, A. C., Gething, P. W., & Cross, D. (2022). Western Australian adolescent emotional wellbeing during the COVID-19 pandemic in 2020. *Child and Adolescent Psychiatry and Mental Health*, *16*(1), 1–11. https://doi.org/10.1186/s13034-021-00433-y

Thomas, T., Wilson, A., Tonkin, E., Miller, E. R., & Ward, P. R. (2020). How the media places responsibility for the COVID-19 pandemic—an Australian media analysis. *Frontiers in Public Health*, *8*, 483.

Thorp, H. H. (2023). ChatGPT is fun, but not an author. *Science*, *379*(6630), 313–313.

Vanhaecht, K., Seys, D., Bruyneel, L., Cox, B., Kaesemans, G., Cloet, M., van Den Broeck, K., Cools, O., de Witte, A., Lowet, K., Hellings, J., Bilsen, J., Lemmens, G., & Claes, S. (2021). COVID-19 is having a destructive impact on health-care workers' mental well-being. *International Journal for Quality in Health Care*, *33*(1), mzaa158. https://doi.org/10.1093/intqhc/mzaa158

Vieira dos Santos, J., Gonçalves, S. P., Silva, I. S., Veloso, A., Moura, R., & Brandão, C. (2022). Organizational and job resources on employees' job insecurity during the first wave of COVID-19: The mediating effect of work engagement. *Frontiers in Psychology*, *12*, 733050. https://doi.org/10.3389/fpsyg.2021.733050

Waya, J. L. L., Ameh, D., Mogga, J. L. K., Wamala, J. F., & Olu, O. O. (2021). COVID-19 case management strategies: What are the options for Africa? *Infectious Diseases of Poverty*, *10*(1), 38–43. https://doi.org/10.1186/s40249-021-00795-7

Williamson, P. O., & Minter, C. I. (2019). Exploring PubMed as a reliable resource for scholarly communications services. *Journal of the Medical Library Association: JMLA*, *107*(1), 16. https://doi.org/10.5195/jmla.2019.433

Winifred, A. D., Jane, R. L., Brian, K., Amponsah-Tawiah, K., & Carole, J. (2022). Mental health and workplace factors: Comparison of the Ghanaian and Australian mining industry. *BMC Health Services Research*, *22*(1), 322.

Wirsching, J., Graßmann, S., Eichelmann, F., Harms, L. M., Schenk, M., Barth, E., Berndzen, A., Olalekan, M., Sarmini, L., Zuberer, H., & Aleksandrova, K. (2018). Development and reliability assessment of a new quality appraisal tool for cross-sectional studies using biomarker data (BIOCROSS). *BMC Medical Research Methodology*, *18*(1), 1–8. https://doi.org/10.1186/s12874-018-0583-x

World Health Organization. (2020). *Institutionalizing integrated community case management (iCCM) to end preventable child deaths: A technical consultation and country action planning*. Addis Ababa. 22-26 July.

World Health Organization. (2020). Investing in and building longer-term health emergency preparedness during COVID-19 pandemic: Interim guidance for WHO member states. *PLOS ONE*, *15*(7), e0235654. https://doi.org/10.1371/journal.pone.0235654

Zeng, X., Zhang, Y., Kwong, J. S., Zhang, C., Li, S., Sun, F., Niu, Y., & du, L. (2015). The methodological quality assessment tools for preclinical and clinical studies, systematic review and meta-analysis, and clinical practice guideline: A systematic review. *Journal of Evidence-Based Medicine*, *8*(1), 2–10. https://doi.org/10.1111/jebm.12141

Zhao, J. (2021). Reimagining corporate social responsibility in the era of COVID-19: Embedding resilience and promoting corporate social competence. *Sustainability*, *13*(12), 6548. https://doi.org/10.3390/su13126548

Zhao, Y., Leach, L. S., Walsh, E., Batterham, P. J., Calear, A. L., Phillips, C., Olsen, A., Doan, T., LaBond, C., & Banwell, C. (2022). COVID-19 and mental health in Australia - a scoping review. *BMC Public Health*, *22*(1), 1200. https://doi.org/10.1186/s12889-022-13527-9