



A GEOGRAPHICAL APPRAISAL ON THE SOCIO-ENVIRONMENTAL CONSEQUENCES OF STONE MINING ON THE LIVELIHOODS IN THE PACHAMI STONE FIELD AREA, MD BAZAR, BIRBHUM DISTRICT

Sujay Dutta ¹ & Dr. Jagannath Mondal ² 

RESEARCH ARTICLE



Author Details:

¹ Research Scholar, Sona Devi University, Ghatshila, Jharkhand & State Aided College Teacher, Turku Hansda Lapsa Hemram Mahavidyalay, Mallarpur, Birbhum, West Bengal, India;

² Assistant Professor in Geography, Turku Hansda Lapsa Hemram Mahavidyalay, Mallarpur, Birbhum, West Bengal, India

Corresponding Author:

Dr. Jagannath Mondal

DOI:

<https://doi.org/10.70096/tssr.260402021>

Abstract

The stone mining industry is an important industry in the country that producing crushed stone of various sizes as raw material for various construction works of our civil society. These industries play a vital role in the socio-economic development and livelihoods of the inhabitants in the country and abroad. The major objective of this research is to evaluate the socio-environmental impacts of stone mining in the context of the Pachami Stone Field of MD Bazar, Birbhum District, West Bengal. The research aims to evaluate the impacts of the stone mining on livelihoods, through using the field surveys and qualitative interviews with the local inhabitants. The research examines the complex connection between stone mining activities and socio-economic factors to reveal the impacts on land use, water resources, and air quality of the study area. The assessment underlines the importance of sustainable stone mining practices to avoid negative impacts on livelihoods of local people especially for tribal people lived in this area. This research investigation is significant in that way to the larger discourse on stone resource management for the welfare of the greater society.

Keywords: *Stone mining industry, Livelihoods, Socio-environmental impacts, Local inhabitants, Stone resource management*

Introduction

The extraction of stone and other mineral resources through open-cast mining and quarrying is an extremely transformative and impactful form of land use change in rural India that has socio-environmental implications on local communities that may be complex and contradictory in nature (Goswami, 2019). Stone mining, though providing employment and fueling local economic growth, also generates substantial environmental pressures on local ecosystems, including dust pollution, groundwater contamination, and loss of biodiversity, with adverse socio-environmental implications on the most vulnerable sections of local stone-mining-dependent populations (Mahapatra, 2023). The Pachami Stone Field Area is found to be an important location to study this phenomenon of stone mining with reference to its socio-environmental implications on local ecosystems and human populations, as it is found to host one of the most active stone mining areas of the lateritic plateau of southwestern Birbhum. The social and environmental effects of the mining of stones in the area can be fully appreciated if one considers the bigger picture of the lives of the people in the Birbhum District (Hazra, 2021). A significant segment of the population, particularly the tribal communities such as the Santals, adopt natural resource-based livelihood strategies, which are becoming more vulnerable to the degradation of the environment and marginalization (Awoke *et. al.* 2019). The study synthesizes the existing information on three important issues: the location of stone mining and its impact on land use, the environmental impact of mining activities such as dust, noise, water, habitat, and soil, and the social and economic impact on the local community and traditional way of life (Omosanya & Ajibade, 2011).

The Pachami Stone Field Area as Study Area

The crushing zone of Pachami, located in the Birbhum district of eastern India (see the fig. 1) and 250 km north of Kolkata, the capital of West Bengal, has witnessed significant change from being an unremarkable rock-crushing area with a daily output of a few tons. It has emerged as a vibrant area where latest technology is being utilized to increase productivity. Located in the Birbhum district, this vibrant area is catering to a significant portion of the demand for aggregates in West Bengal, a state that is witnessing massive growth in road and infrastructure construction (Pal & Mandal, 2017). Moreover, depending on the resolution

of stockpiling problems in the railway sidings of Suri and Pakur located near Pachami, it also has the potential to emerge as a major exporter of aggregates to Bangladesh, a country that is in significant demand of aggregates to meet ongoing railway and bridge construction works. Pachami Stone Quarry (PSQ) is one of the oldest quarries and crushing operation owners in the region, with a 25-tonnes-per-hour plant operating in the 1960s. It then became the first quarry and crushing operation in the region to buy the 3-tonne payload Indian Hindustan wheeled loader in 2011, replacing the use of backhoe loaders with the expansion of its plant operating capacity from 100 tons per hour to 200 tons per hour (Hazra, 2021).

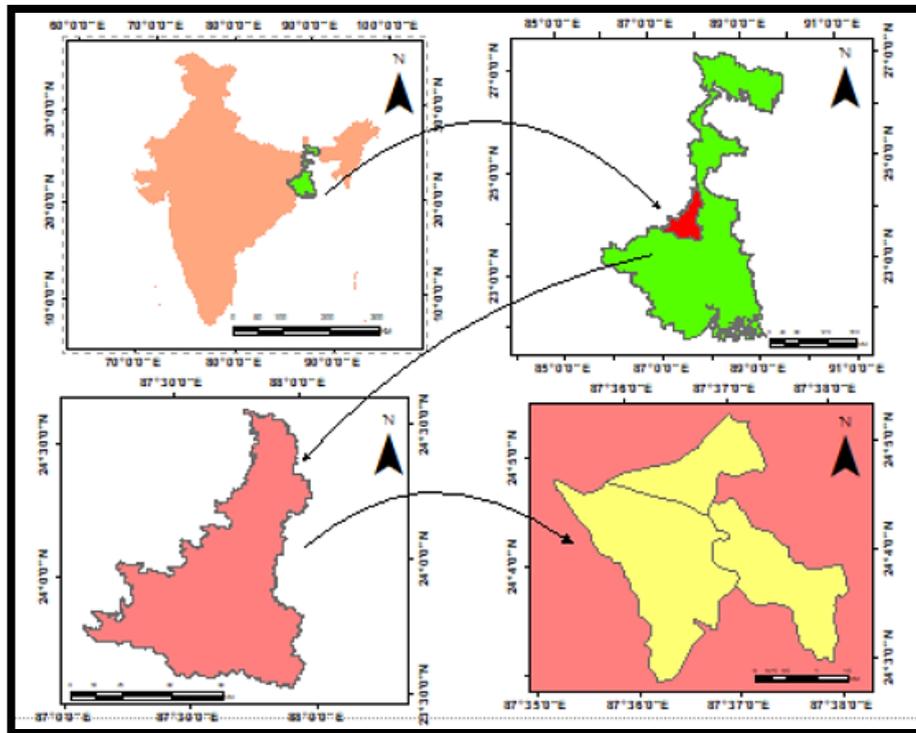


Figure-1: Location map of the study area

Research Objectives

The objectives of the present research entitled '*A Geographical Appraisal on the Socio-Environmental Consequences of Stone Mining on Livelihoods in the Pachami Stone Field Area, MD Bazar, Birbhum District*' are the followings:

- To analyze the environmental degradation of the Pachami Stone Field Area.
- To highlight the health and social Impacts of the study area.
- To find out the livelihood vulnerability of the local inhabitants.
- To explore the geographical phenomena related to the sustainability of this area.

Database and Methodology

For this study, it is intended to use both primary and secondary data sources. The primary data collection methods adopted are structured questionnaires, scheduled questionnaires, in-depth interviews, case studies and systematic observation. The qualitative and quantitative data were collected using scheduled questionnaires and interviews. The case studies are based on individuals who have issues related to eye injury, housing issues, and employment related to stone quarry work (Dasgupta, Sastry & Dhinwa, 2012). Purposive sampling is adopted as a sampling technique to select individuals as subjects. Photographic methods are also adopted to collect data on environmental conditions and patterns of living (see the fig. 2 & 3). In some instances, the telephone method is adopted to collect data from individuals and obtain necessary information. The secondary data sources adopted are social media, journals, books, and related materials (Javed & Mahroof, 2020). All data are analyzed using Microsoft Excel.



Figure-2: Stone Quarry

Development of Pachami Stone Mine Area

The study is conducted to assess the contribution of the Pachami stone industry to the economic and social development of the local population. The Pachami area is known for its black basalt stone, which is utilized in several sectors in the building industry, such as residential buildings, road development, bridges, and railway lines.



Figure-3: Stone Crusher

According to both government and private sector sources, there are approximately 170 to 190 industrial units and over 80 stone quarries in the area. Daily, over two thousand trucks transport around 90,000 tons of black stone to different areas of the country (Nasrin & Sekh, 2016). This study aims to examine the complex association that exists between industrial extraction and local livelihoods in the Pachami Stone Field, which is in Md. Bazar Block in Birbhum District, West Bengal. This industrial zone has around 38,000 employees, which is much more than the number of employees recorded in the all-India stone mining roster compiled by the Director General of Mines Safety (DGMS). Besides locals, people are coming from all over the state to work here due to the availability of jobs. The advantages are many, including steady jobs, good communication, affordable accommodations, and cheap food (Hazra, 2021). Many are attracted to this place because of these advantages. The scope of work is wide, including extraction of stones

from the mine, breaking and sorting stones, blasting in the mine, driving trucks, operating machines, overseeing stone crushers, data entry operators, and many more, which provide scope for direct earnings for both skilled and unskilled workers (see the fig. 2 & 3). This increases the standard of living of people and helps them come out of poverty. As a major industrial extraction site in this area, it plays a vital economic role yet simultaneously creates a 'resource curse' in the Indigenous and rural population.

Environmental Consequences of Stone Mining

Dust Pollution and Air Quality: Dust pollution is perhaps the most immediate and dangerous environmental impact of stone mining in Pachami. In fact, at the busiest hours of the day, dust particles are predominant in the air, ranging from 101 to 298 nanometers in dimension, which is easily inhaled by human beings and is far less than 2500 nanometers, which is considered safe for respiration. This dust is not limited to the mining area; it extends to farmlands, rivers and other water resources, and residential areas. The dust from mining does not stay in one place; it travels beyond the mining area and leaves a footprint in terms of environmental impacts beyond the lease boundaries (Hoque & Aktar, 2022). This indicates that communities around the mining areas, whether they benefit from job opportunities in mining or not, are still subjected to environmental impacts from mining.

Impacts on Groundwater: The stone mining in the study area is modifying the groundwater scenario of the region in subtle but significant ways. It is not only the stones that are being mined; it is the aquifers beneath that are being altered with the change in the way rainwater is being absorbed into the earth. When vegetation and earth give way to mined spoil and patches of bare earth, rainwater cannot penetrate the earth in as many ways as it used to, and this is detrimental to the groundwater recharge capacity of this region, which is not too high to begin with. In Pachami, the blasting and digging involved in the mining of stones disturb the groundwater at levels close to the surface of the earth in ways that may impact people's water needs (Edwards, Hobbs & Smart, 1991).

Land Degradation and Geomorphological Consequences: Land acquisition in the Pachami area, where stones are being mined, is changing the landscape in a big way. Overburden is being skimmed off, pits and waste dumps are appearing on the landscape, and water tables are being affected. Such a change in the landscape is causing a ripple effect on farming yields, water is being polluted, and there is a threat to the ecological balance of the area. Sediments entering water bodies are making water turbid and less reliable for human and agricultural use. When agricultural land is being grabbed in the name of mining, there is also a social and economic impact in that agricultural livelihoods are being affected, human settlement is being displaced, and agricultural resources, which are essential to sustain agricultural livelihoods, are also being affected. According to this study, there is a growing coerciveness in land acquisition due to mining, which is showing little concern for human impact and is leaving a mark on human life in a difficult state (Javed & Mahroof, 2020).

Impacts on Ecosystem Services and Biodiversity: The stone mining around Pachami is not simply a local activity, but a process that is changing the local ecosystem and services it provides. The local economy has traditionally relied upon natural resource-based livelihoods that are dependent upon a healthy and undisturbed natural environment. The traditional way of living in Pachami, i.e., farming and a forest-based economy, is disappearing in favor of a deteriorating natural environment. Purified air and water are becoming luxuries of the past, wood and non-wood forest products are dwindling, and the water table is falling. In all of this, the stone mining in Pachami is part of a larger trend of natural resource degradation that is eroding the natural foundations upon which rural livelihoods in neighboring communities are built (Lameed & Ayodele, 2010).

Occupational Health Consequences

Dust-Related Health Hazards: The impact of stone mining in Pachami is severe for the workers' health conditions, with respiratory diseases caused by dust and silicosis being at the top of the list. These health conditions of workers are compounded by their socio-economic conditions; most of the workers in this area belong to marginalized groups and have low access to healthcare and social protection services (Vats, 2022).

Broader Health Impacts on Surrounding Communities: The health impact of stone mining in Pachami is not only limited to the miners but also affects the community at large residing in its vicinity. Dust pollution is not only confined to the miners but also includes residents of the area; the dust particles spread all over the place during peak hours of mining (Singh & Mina, 2024).

Socio-Economic Consequences for Livelihoods

Obstacles to Livelihood Security: The obstacles to livelihood security in the context of stone mining pose significant challenges to the workers and communities associated with the stone mining industry. As the natural environment deteriorates, traditional forms of livelihood, such as agriculture and forest-based activities are becoming less viable. This has resulted in more people moving towards non-farm employment (Sati, 2014).

Employment and Income Generation: Stone mining in the Pachami region is providing employment for many local workers, and these jobs are helping the local population earn money, which is remarkable because there are few other avenues for earning money in the region (see the table-1). However, these jobs provided by mining come with low wages, hard and unsafe working conditions, no social security, and many health hazards, which are all outcomes of unorganized and informal working conditions (Bhattacharjee, Siddique & Roy, 2018).

Table-1: Distribution of the Workers and Daily Wages

<i>Sl. No.</i>	<i>Nature of Works</i>	<i>Daily wages</i>
1	Banker Manson	300
2	Fixer Mason	300
3	Memorial Mason	350
4	Rubble Mason	350
5	Stone Driller	400
6	Stone Crushing Operator	400
7	Track Driver	500
8	JCB Operator	800
9	Stone Crusher Manager	500
10	Data Entry Operator	600

Source: Primary Data

Tribal Communities and Mining-Induced Vulnerability: The Santals tribal groups in Pachami Block of Birbhum district are among the worst-affected groups by stone mining activities. Traditionally, in and around MD Bazar, the Santals tribal groups have made use of forest and agricultural resources for their livelihood. Stone mining is another activity that is more recent and has expanded over time. As stone mining activity increases in the region, many of those who traditionally depend on forest and agricultural resources end up working in wage employment in the stone mining industry, which is associated with considerable health risks and vulnerability (Pramanik & Das, 2023; Tripathi, 2016).

Land Acquisition and Displacement: The development of stone mining in Pachami has been accompanied by the development of land acquisitions, which have resulted in the displacement of farmers and their disconnection from the land and the traditional way of making a living on the land. This development has undoubtedly resulted in the loss of land for the nearby communities. The loss of land means the loss of the main means of livelihood for the communities, as well as the loss of food security, social, and cultural connections with the land (Goswami, 2019).

Case Study – Stone Mining in Pachami Village

The stone industry is seen to have a marked impact on the economic and social development of Panchami village in Varkata panchayat under Mohammad Bazar block. From the survey of 55 households in the area, it is seen that most of the population is directly involved in the stone industry (See the table-2). Out of the total workforce in the area, 5% of the people are involved in agriculture and animal husbandry. The per capita monthly income of people working in the stone industry ranges between Rs. 6,000 to Rs. 10,000. Marginal workers constitute 57% of the workforce in the industrial region of Panchami. They have a per capita income between Rs. 9,000 and Rs. 15,000 (see the table-1). Around 20% of the population in Panchami is involved in various occupations in the stone industry area. They have earnings between Rs. 8,000 and Rs. 12,000. The rest of the population is involved in forest resource extraction and animal husbandry. These figures highlight the importance of Pachami Industrial Area in the economic development of the region (Based on primary data that collected during field observations).

Table-2: Population Data of Panchami Village (2011)

Village Name	Area (Acres)	Number of House Holds	Total Population		Age Group 0-6		SC Population	
			Male	Female	Male	Female	Male	Female
Pachami	438.72	55	138	142	26	16	120	128

Total Worker			Cultivator			Industries Marginal Workers		
Person	Male	Female	Person	Male	Female	Person	Male	Female
160	78	82	14	4	10	56	11	45

Sources: Census Data 2011

Major Finding

- Land cover change and fragmentation have been substantial in the stone field in Pachami, thereby affecting the ecosystem services in agriculture, forestry, and human labor and mining.
- Mining in stones is an activity that requires substantial land usage, thereby displacing people living in those areas and those who practice agriculture.
- Social and financial exclusion also contributes to the marginalization of vulnerable groups in areas of stone mining.
- Reckless mining in stones results in environmental degradation, including habitat destruction, soil erosion, and water pollution.
- There are inadequate awareness and implementation of regulations on the rights of labor in stone mining.
- Labor, dust, and harmful materials, and heavy equipment and explosives in stone mining are exposed to the danger of accidents, injuries, and diseases.
- There is also an aspect of Livelihood Diversification and Adaptive Strategies in the case of stone mining.

Conclusion

Stone extraction over time has contributed significantly to the socio-economic development of human societies. From ancient times to modern times, stones have remained essential materials in building, trade, and artistic expressions. The main concern in this appraisal is that the changing dimensions of a traditional agrarian and forest-based economy to a mining-based economy and its impact on the socio-environmental equilibrium. While there are immediate monetary gain and employment in stone crushing and quarrying, but there is a spate of negative externalities which are threatening long-term livelihood security. Despite of this, there are some issues associated with this industry to be need thorough analysis and strategic planning to ensure that the industry is harnessed as an opportunity to promote positive economic development without compromising environmental sustainability and the lives of nearby human societies. By using scientific planning and promoting effective cooperation among all stakeholders, this mining industry can be made economically beneficial to the human society and more opportunities for diverse livelihoods.

Acknowledgment: No

Author's Contribution: *Sujay Dutta:* Data Collection, Literature Review, Drafting, Referencing; *Dr. Jagannath Mondal:* Data Collection, Methodology, Analysis, Referencing

Funding: No

Declaration: All the authors have given consent for the publication.

Competing Interest: No

References

1. Awoke, E., Endalew, T., & Solomon, T. (2019). Environment and social impacts of stone quarrying: Southwestern Ethiopia, in case of Bahir Dar Zuria Wereda Zenzelma Kebele. *International Journal of Research in Environmental Science*, 5(2), Pp. 29-38. <http://dx.doi.org/10.20431/2454-9444.0502005>.
2. Bhattacharjee, S., Siddique, G., & Roy, A. (2018). Economic importance of stone quarrying in rural livelihood and its impact on environment: A case study of Saltora Block, Bankura, West Bengal. *International Journal of Scientific Research and Reviews*, 7(3), Pp. 1045-1062. Retrieved from: https://www.researchgate.net/publication/346654556_Economic_Importance_of_Stone_Quarrying_in_Rural_Livelihood_and_Its_Impact_on_Environment_A_Case_Study_of_Saltora_Block_Bankura_West_Bengal.
3. Dasgupta, A., Sastry, K. L. N. & Dhinwa, P. S. (2012). Impact of Mining on Rural Environment and Economy - A Case Study, Kota District, Rajasthan. Sinha, B.K and Choudhary. *International Journal of Remote Sensing & Geoscience (IJRSG)*, 2(3), Pp. 21-26. Retrieved from:

- https://www.researchgate.net/publication/301295146_IMPACT_OF_MINING_ON_RURAL_ENVIRONMENT_AND_ECONOMY_-_A_CASE_STUDY_KOTA_DISTRICT_RAJASTHAN.
4. Edwards, A. J., Hobbs, S. L., & Smart, P. L. (1991). Effects of quarry dewatering on a karstified limestone aquifer; a case study from the Mendip Hills, England. *Water Well Journal Publishing Company*, Pp. 77-92, ISSN 1047-9023.
 5. Goswami, S. (2019). Land Acquisition and Involuntary Displacement: A Study of Changing State Society Relations. *European Researcher*, 10(3), Pp. 148-155. <https://doi.org/10.13187/er.2019.3.148>.
 6. Hazra, B. (2021). Problem and Prospect of Rural Life and Livelihood with Special Reference to Tribal Community: Perspective from Pachami Stone Quarry Belt (Rampurhat Block in Birbhum District). *IOSR Journal of Humanities and Social Science (IOSR-JHSS)*, 26(01), Pp. 25-36. <https://doi.org/10.9790/0837-2601122536>.
 7. Hoque, M.J. & Aktar, H. (2022). Environmental and Social Effects of Stone Quarrying in Bangladesh: A Study in the Khasi People Area in Sylhet. *Space and Culture India*, 10(2), Pp. 28-41. <https://doi.org/10.20896/saci.v10i2.1279>.
 8. Javed, M., & Mahroof, K. (2020). Environmental perspective of stone crushing and quarrying: A case study from Poonch District of Jammu and Kashmir, India. *Current World Environment*, 15(1), Pp. 68-74. Retrieved from: https://www.cwejournal.org/pdf/vol15no1/Vol15_No1_p_68-74.pdf.
 9. Lameed, G. A., & Ayodele, A. E. (2010). Effect of quarrying activity on biodiversity: Case study of Ogbere site, Ogun State, Nigeria. *African Journal of Environmental Science and Technology*, 4(11), Pp. 740-750. Retrieved from: https://academicjournals.org/article/article1380276104_Lameed%20and%20Ayomide.pdf.
 10. Mahapatra, T. (2023). Environmental, social and health impacts of stone quarrying in Mitrapur panchayat of Balasore district, Odisha. *International Journal of Science and Research Archive*, 8(1), Pp. 678-688. <https://doi.org/10.30574/ijrsra.2023.8.1.0142>.
 11. Nasrin, S. & Sekh, N. (2016). Life and Condition of the people of Salbadra Stone mine and Stone-chips Crusher Belt: Before and after the Advent of Stone-chips Crusher. *International Research Journal of Management Sociology and Humanity*, Vol. 7(5), Pp. 08-14. <https://doi.org/10.32804/IRJMSH>.
 12. Omosanya, K. O., & Ajibade, O. M. (2011). Environmental impact of quarrying on Otere Village, Odeda, Southwestern Nigeria. *Ozean Journal of Applied Sciences*, 4(1), Pp. 76-82. ISSN 1943-2429. Retrieved from: https://www.researchgate.net/publication/273336764_ENVIRONMENTAL_IMPACT_OF_QUARRYING_ON_OTERE_VILLAGE_O_DEDA_SOUTHWESTERN_NIGERIA.
 13. Pal, S., & Mandal, I. (2017). Impacts of Stone Mining and Crushing on Stream Characters and Vegetation Health of Dwarka River Basin of Jharkhand and West Bengal, Eastern India. *Journal of Environmental Geography*, 10(1-2), Pp. 11-21. <https://doi.org/10.1515/jengeo-2017-0002>.
 14. Pramanik, S. & Das, B. (2023). Natural and socio-economic impacts of stone quarrying: A study on tribal forest fringe village, Jamtoria Forest Beat (JFB), Purulia District, West Bengal, India. *Humanities and Social Science Studies*, 12(1), Pp. 107-116. Retrieved from: <https://hsssjournal.com/wp-content/uploads/2024/06/11.-2023-Vol-12-Issue-1-Samir-Pramanik-Bela-Das.pdf>.
 15. Sati, V. P. (2014). Socio-economic and Environmental Impacts of Stone Mining in Shivpuri District, Madhya Pradesh, India. *Journal of Scientific Research and Reports*, 4(1), Pp. 47-54. <https://doi.org/10.9734/JSRR/2015/12972>.
 16. Singh, A. & Mina, U. (2024). Stone Mining Industry: Assessing the Socioeconomic Importance and Livelihood Security for Economic Development. In: Sharma, G.K., Rashmi, I., Ali, S., Kala, S., Kumar, A., Madhu, M. (eds) *Ecological Impacts of Stone Mining*. Springer, Singapore, Pp. 17-44. https://doi.org/10.1007/978-981-97-4746-7_2.
 17. Tripathi, P. (2016). Tribes and forest: A critical appraisal of the tribal forest right in India. *Research Journal of Social Science and Management*, 6(6), Pp. 6-6. Retrieved from: https://www.researchgate.net/publication/308794288_Tribes_and_Forest_A_critical_appraisal_of_the_tribal_forest_right_in_India.
 18. Vats, S. (2022). Impact of Stone Mining on the Health and Environment: A Study of the Village of Mewat, India. *Journal of Earth and Environmental Science Research*, 4(5), Pp. 1-4. DOI: [doi.org/10.47363/JEESR/2022\(4\)185](https://doi.org/10.47363/JEESR/2022(4)185).

Publisher's Note

The Social Science Review A Multidisciplinary Journal remains neutral with regard to jurisdictional claims in published data, map and institutional affiliations.

©The Author(s) 2026. Open Access.

This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>