

Socio-environmental damages of the Brazilian mining model: a qualitative study on the role of a social movement from the perspective of health promotion

Danos socioambientais do modelo minerador brasileiro: um estudo qualitativo sobre a atuação de um movimento social na perspectiva da promoção da saúde

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Abstract

The socio-environmental damages resulting from the Brazilian mining model profoundly impact populations living and working in mining regions. This study examines the actions of the *Movimento pela Soberania Popular na Mineração* (MAM)—the Movement for Popular Sovereignty in Mining—in response to these damages from a Health Promotion perspective. Through documentary analysis and interviews with key informants, this research highlights three core components of the movement's efforts: Organization, Training, and Struggle. A central focus of the movement is the advocacy for Mining-Free Territories, a struggle that can be understood through the frameworks of the Social Determinants of Health and the Social Determination of Health.

Keywords: Health Promotion, mining; Social Determinants of Health; Social Determination of Health Community; Participation.

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Resumo

As populações que vivem e trabalham em regiões mineradas são profundamente afetadas por danos socioambientais advindos do modelo mineral brasileiro. Buscou-se compreender a atuação do Movimento pela Soberania Popular na Mineração (MAM) em relação a tais danos, na perspectiva da Promoção da Saúde. Utilizou-se de pesquisa documental e entrevistas com informantes-chave. A atuação do MAM assenta-se na participação popular e estrutura-se na Organização, Formação e Luta, objetivando a Soberania Popular na Mineração, que tem como mais forte expressão a luta por Territórios Livres de Mineração. Essa atuação pode ser compreendida na perspectiva dos Determinantes e da Determinação Social da Saúde.

Palavras-chave: Promoção da Saúde; Mineração; Determinantes Sociais da Saúde; Determinação Social da Saúde e Participação da Comunidade.

Introduction

In the paradigm of economic development, based on the extraction of natural resources, which has been constructed throughout history in Latin American countries, a mineral model is in force, undertaken through mega-mining, aimed at large-scale production, export and causing perverse environmental, economic and social effects (Magno, 2017; Carvalho; Milanez; Guerra, 2018; Vilani et al., 2024).

This mining model calls into question the “[...] protection of water, the conservation of socio-biodiversity, food and nutritional security, the right to work and health, the strengthening of local economies, sociocultural heritage, and the access of future generations to natural resources” (Malerba; Wanderley; Coelho, 2022, p. 9). The Movement for Popular Sovereignty in Mining (MAM) is based on the need to discuss this mining model and its socioenvironmental repercussions.

Brazil mines approximately 70 minerals, including aluminum, iron, niobium, manganese, and gold, making it the world’s second-largest producer of iron ore. This mining status is likely to be accentuated by the exploration of mineral resources such as lithium, copper, nickel, and cobalt, considered strategic for the national energy transition, as demonstrated by Public Consultation N°180 of the Ministry of Mines and Energy on public incentives for the mineral processing sector (MME, 2025, 2022). The state of Pará is responsible for 50% of all national iron and aluminum production, while the state of Minas Gerais is responsible for one-third of the Brazilian mineral production (MME, 2022).

The spatial distribution of the Brazilian mining exploration, the socio-environmental impacts, and conflicts and threats to territories resulting from this activity are explained in bibliographic productions such as the *Map of Conflicts - Environmental Injustice and Health in Brazil* (Our free translation from Portuguese) from the National School of Public Health of the Oswaldo Cruz Foundation and the *Atlas of the Brazilian Mineral Problem from the Observatory of Mining Conflicts in Brazil* (Wanderley; Mansur; Cardoso, 2023).

The country has important mining companies, notably Vale S.A., a global leader in the production

of iron ore and nickel and owner of a complete transport logistics network, which includes pipelines, railways, and ports, responsible for connections between producing areas and national and international markets (Vale, 2024).

Vale S.A. is responsible for the two most enormous socio-environmental tragedies in Brazil related to the collapse of tailings dams, both in the state of Minas Gerais. These include the Fundão dam collapse in 2015, in Mariana, which caused the spill of approximately 56 million tons of tailings and the deaths of 20 people. The Córrego do Feijão dam collapse in 2019, in the city of Brumadinho, considered one of the most significant occupational accidents in the world, claiming 272 lives (Pinheiro; Silva, 2019).

MAM emerges as a popular, non-sequitur movement that aims to debate the appropriation and destination of mineral resources in society and, based on the ideology of Popular Sovereignty, build a new model for the use of these resources, in the form of social property and for the benefit of all Brazilian people (MAM, 2024). It is a recent movement, but it has become “[...] a reference in the debate on mining in Brazil and the organization of populations affected or threatened by mining projects” (Magno, 2017, p. 294).

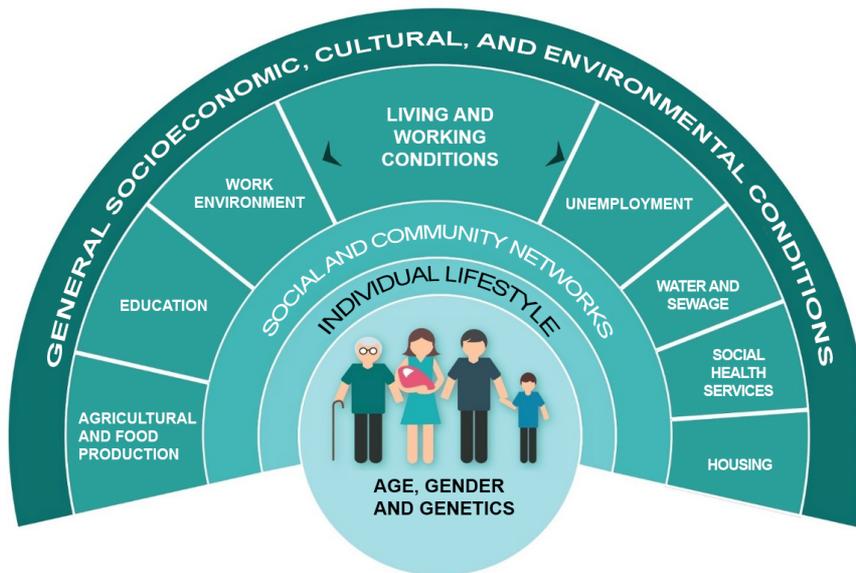
This article discusses MAM’s performance from the perspective of the theoretical field of health promotion, based on the constructs of Determinants and Social Determination of Health, admitting that “[...] the simultaneous expropriation of work, nature, territory and the set of reproductive activities that sustain life where mining projects are installed” (Montezuma, 2022, p. 17), determine the living and health conditions of the populations living in these territories.

1.1. Health promotion: conceptual approaches

Under the Social Determinants approach, Health should be understood as the “circumstances in which populations grow, live, work, and age, as well as the systems implemented to deal with disease” (CDSS, 2010, p. 1). These circumstances are shaped by “political, social, and economic forces” (CDSS, 2010, p. 1). This understanding is supported by different theoretical models, emphasizing the one proposed by Dahlgren and Whitehead, schematically represented by “[...] concentric and overlapping layers” (Melo, 2016, p. 10), as shown in Figure 1.

The central layer of the model includes individual factors such as age, gender, and genetics, followed by individual behavior and lifestyles. The next layer

Figure 1 — Dahlgren and Whitehead Model of Health Determinants (1991).



includes community and support networks, “[...] fundamental for the promotion and protection of individual and collective health” (Buss; Pellegrini Filho, 2007, p. 83). Subsequently, factors related to living and working conditions. Finally, the layer with the factors most distal to the individual, called economic and social macrodeterminants and referring to public policies in the fields of employment, land ownership and housing, education, water and sanitation, redistributive policies of security and social protection, cultural and environmental protection (Buss; Pellegrini Filho, 2007; Melo, 2016; Silva; Bicudo, 2022). This model gave rise to variations whose differences are “[...] in the arrangement of its constituent elements [...]” (Melo, 2016, p. 10), and, therefore, in the place of each determinant in the production of health inequities.

The Diderichsen, Evans, and Whitehead model emphasizes the social position of individuals understood as resulting from education, occupation, gender/race and income, as a cause of inequities related to differences in exposure to risks and vulnerability to health problems, as well as their physical and social consequences (Buss; Pellegrini Filho, 2007, Silva; Bicudo, 2022). In Solar and Irwin’s model, macrodeterminants occupy a less distal position to the individual, operating greater influence over the set of intermediate determinants, that is, over the behavioral and material conditions of their existence (Garbois; Sodr e; Ara ujo, 2017).

Notably, the World Health Organization (WHO) adopted the concept of social determinants, creating the Commission on Social Determinants of Health (CDSS) in 2001, with Brazil being the first WHO member country to establish this commission (Buss; Pellegrini Filho, 2007; Melo, 2016).

James Breilh, a scathing critic of the Social Determinants of Health model, claims that this model is shaped by a positivist, linear, and reductionist social epidemiology, whose analytical focus is on factors considered as living and working conditions and the “forces” that modulate them (Breilh, 2023; Garbois; Sodr e; Dalbello-Ara ujo, 2017; Silva; Bicudo, 2022). This understanding conceals that such forces concern the relations of production and reproduction of social life and the market economy, the core of capitalist accumulation, and

their impacts that refer to “[...] the exploitation of human and natural life [...]” (Silva; Bicudo, 2022, p. 119).

As an example of such exploitation, Breilh mentions the appropriation by large corporations of vital resources such as land and water, the monopoly on seeds, and the use of pesticides and antibiotics by agribusiness; this endangers the food sovereignty of a people, exposes workers to degrading working conditions, puts pressure on their incomes, and adversely affects the environment. All of this is done in the name of the relentless pursuit of increased productivity and profit. According to this author, it is necessary to act “[...] to control these structural processes that cause so much harm to nature and human beings.” (Breilh, 2011).

This author believes that the conception of the Social Determination of Health is based on a critical epidemiology, considering its socio-historical perspective crucial to “[...] understanding the relationship between space, time, life, productive ways of living and, subsequently, health [...]” (Breilh, 2023, p. 268). From this perspective, actions in the field of health promotion must exceed the structuring of universal health systems, immunization programs, and other prevention, rehabilitation, and recovery actions (Garbois; Sodr e; Dalbello-Ara ujo, 2017; Breilh, 2023). Breilh (2023) also affirms that one must think about the social determination of life in a healthy and sustainable Wellbeing, integrating human beings and nature, that is, in an economic life-protecting development.

Once popular participation is enshrined, its effectiveness requires overcoming some challenges, among them that of preventing its instrumentalization; that is, this participation cannot be “[...] administered or supervised by governments that prevent civil society from accessing central issues in the name of “technical complexity”, perhaps out of fear of losing the prerogatives of command and power” (Abreu; Melo; Silveira, 2016, p. 80).

In this backdrop, where “[...] the State cannot propose participation, because in that case it would already be, by definition, either co-opted or innocuous” (Demo, 1980, p. 24 apud Abreu; Melo; Silveira, 2016, p. 80), other possibilities arise, where “[...] the fight for the conquest of rights and improvements should

not follow institutional channels” (Mouffe, 2005 apud Abreu; Melo; Silveira, 2016, p. 80). However, we must not lose sight of the fact that dispensing with the search “[...] for the exercise of decision-making power in institutionalized spaces may neglect a real opportunity to bring about other legitimacies” (Mouffe, 2005 apud Abreu; Melo; Silveira, 2016, p. 80).

Along the same lines of thought, Antunes (2019) states that this struggle should not have “[...] all its oxygen focused on institutionality”. The author focuses on unions and political parties, but especially on social movements. Regarding these, he emphasizes their capacity “[...] to defend vital issues [...] to touch the roots of crucial issues [...]” and their potential in qualifying and bringing to light and faithfully representing the real societal demands. Therefore, we present the Movement for Popular Sovereignty in Mining.

1.2. The Movement for Popular Sovereignty in Mining (MAM)

MAM emerged in 2012, in a context marked by imminent disputes over land rights. Its historical roots are anchored in “[...] a social movement that emerged from localized struggles and mobilizations against agricultural and mining projects in the Amazon” (Magno, 2017, p. 281).

It is the struggle of populations with “[...] a close relationship with the natural resources of their territories” (Prata, 2019, p. 61); of “[...] subjects who depend on water, forests and land to reproduce their own existence with dignity socially” (Wanderley; Gonçalves, 2020, p. 136). Therefore, they are greatly affected by the mineral production chain (Malerba; Wanderley; Coelho, 2022), which includes activities and structures necessary for the extraction, processing, and distribution of production (Magno, 2017; Prata, 2019; Malerba; Wanderley; Coelho, 2022).

The Movement is in place in nine Brazilian states and the Federal District, forming, preparing, and integrating population bases living in regions affected and/or threatened by mining (MAM, 2024). In addition to its work in these regions, MAM conducts “[...] a broader public debate on the country’s current mining model, garnering support in several

locations that, in principle, have no direct connection to mining ventures” (Magno, 2017, p. 296).

Therefore, “[...] it has articulated a discourse of different social categories before companies, licensing bodies, public authorities, the press, and the State in general” (Magno, 2017, p. 294). Its slogans translate its intentions: “For a sovereign and serious country, against the looting of our minerals” (MAM, 2024, our emphasis) and “Mining for what and for whom” (Magno, 2017, p. 291, our emphasis).

MAM’s main political agenda is Popular Sovereignty, whose central idea is social participation (MAM, 2024). With regard to mining, it involves the democratic definition of “[...] where to mine, which mineral resources should be extracted, what are the socially and environmentally safest and fairest ways to do so, and for what purpose to allocate it” (Malerba; Wanderley; Coelho, 2022, p. 9).

In this context, another prominent political banner that is closely intertwined with the Popular Sovereignty agenda is the fight for Mining-Free Territories (TLM), which defends “[...] the right of peoples to say no and to participate in the definitions of their territories” (Malerba; Wanderley; Coelho, 2022, p. 9), considering these as “[...] spaces of a collective nature, which include land, nature, and other material and immaterial goods that support collective identities and are fundamental to the reproduction of life.” (Malerba; Wanderley; Coelho, 2022, p. 8).

Materials and Methods

This study is anchored in a qualitative approach, developed from documentary research and semi-structured interviews with key informants. The choice of this approach and these techniques is justified by their expectations of capturing the dynamism, beliefs, values, attitudes, and other aspects that offer the possibility of a detailed description of the object of study (Minayo, 2001).

For the documentary research, we selected documents in Portuguese available on the MAM website (2013-2020), considering the period from October 2013, when publications began, to December 2020. We retrieved 355 documents, 201 of which were authored by the Movement. Pre-analysis and analysis of these documents, which constitute the

corpus of analysis for this study, were carried out, according to Cellard (2008).

As Cellard (2008) recommends, five dimensions were observed in the pre-analysis: authenticity and reliability, authorship, nature, internal logic, key concepts, and context. The document analysis was conducted considering the articulation between the five dimensions of the pre-analysis, the research objective, and the theoretical framework (Cellard, 2008). No thematic axes of analysis were previously established.

The semi-structured interviews with key informants were guided by a semi-structured script developed to address the relevant issues (Poupard, 2008) and conducted via the Microsoft Teams platform. All respondents signed an Informed Consent Form (ICF). The Research Ethics Committee of the Federal University of Minas Gerais approved this study under protocol CAAE N° 42398721.5.0000.5149.

We should mention that the definition of key informants was guided by the following question: “Which social individuals have the most significant connection with the problem to be investigated?” (Deslandes, 2001, p. 43). Their response led us to the definition by MAM members, with representatives of the state coordination offices and the national management being interviewed, totaling eight interviews. Subsequently, the interviews were transcribed in full and their analysis followed the same logic used for the documentary study, that is: the combination of the objective and the theoretical framework of the research in question, without adopting a priori thematic categories. Notably, the documentary study guided the focus on the analysis of the interviews, while the analysis of the interviews led to a resumption of the documentary study. In other words, throughout the analysis of the collected empirical material, a constant dialogic movement was maintained between the findings of the documentary research and those of the interviews.

Results and Discussion

Regarding the dimensions of the pre-analysis process of documentary research, according

to Cellard (2008), authenticity, reliability, and authorship were recognized a priori, since MAM produced the 201 documents selected and analyzed. Regarding the nature and internal logic, Cellard (2008) explains that there are documents of theological, medical, legal, and historical nature. It can be inferred from this statement that the nature of a text is related to its object. Internal logic is structured around central ideas and key concepts (Cellard, 2008).

The documents analyzed focus on Brazil's primary mineral export model and its socio-environmental harm. The central idea highlighted was the MAM's primary objective: to debate this model within society, the appropriation and allocation of mineral resources, and, in particular, to propose and develop a new mining model that would benefit all Brazilians through social ownership. This intent brings with it the ideology of Popular Sovereignty in Mining, which is revealed to be the main political proposal of the Movement (Magno, 2017) and also a key concept in the documents analyzed. The analysis of the selected documents and the interviews conducted with the articulation between the objectives and the theoretical framework of this study resulted in the following analytical categories: The Brazilian mining model: Harms to ways of life, workers, and health; and MAM's fight for another mining model: The Popular Sovereignty in Mining ideology.

The Brazilian mining model: Harms to ways of life, workers, and health

Several types of harm, such as metal contamination of natural resources (water, soil, and air), their intensive consumption, the compromised livelihoods, and the illness of populations living and working in mining regions, were emphatically highlighted in the documents analyzed and interviews with key informants.

[...] because mining, from our experience, causes several health problems, right? [...] The health problems I see a lot are air pollution, the movement of particles that come out of the mine due to explosions or due to the transportation of minerals, and the like. This

mineral reaches people's homes, right? [...] And they develop lung diseases, eye diseases, skin diseases, and so on. (Key informant 5).

In addition to illness, contamination of natural resources also affects “[...] the daily lives and nutritional balance of women and their families who plant vegetable gardens, farms, and care for animals [...]” (MAM, 2018a).

In a series produced by MAM on mined regions in the states of Ceará (CE), Bahia (BA), Goiás (GO), and Minas Gerais (MG), it can be seen that rural communities are particularly affected by mining ventures. In Santa Quitéria (CE), uranium and phosphate mining has made “[...] the traditional way of life and peasant agriculture [...] unviable”; in Bahia, the implementation of a mining project planned for the municipality of Caetité “[...] will extinguish the springs that serve the municipality’s population”; in Goiás “[...] Anglo American’s activity has caused water shortages, the unviability of family farming, increasing poverty in the region and migration to urban areas”; and in Minas Gerais, the expansion of Vale’s exploration threatens water capture for the entire municipality of Catas Altas “[...] and further deteriorates the dust and respiratory problems in the community of Morro da Água Quente” (MAM, 2016a).

The Minas Rio Project, owned by the UK-based mining company Anglo American, includes a 529-km pipeline that crosses 33 municipalities. This pipeline is responsible for transporting iron ore. It connects the state of Minas Gerais, where iron ore is extracted and processed, to the port of Açú in Rio de Janeiro, from where it is exported (Anglo American, 2012). The following excerpt summarizes the harm caused by this project.

The affected rural communities have had their rights curtailed by Anglo since the mine and pipeline began operating in 2014. They suffer from silting and contamination of waterways, air pollution, increased violence in the municipality, and, since the collapse of Samarco’s Fundão dam, they have been plagued by heightened fear of a similar collapse to the Bento Rodrigues dam in Mariana. The communities live just a few kilometers downstream from the dam. In the event

of a collapse, they would have even less time to save themselves than the community destroyed by the Fundão dam (MAM, 2016b).

The fear of dam failure and the territorial dispossession caused by mining projects compromise the mental health of affected populations. Families in Conceição do Mato Dentro, Minas Gerais, were forced to leave their homes due to the risk of a tailings dam failure at the Minas Rio Project: “Depression was triggered by the deterritorialization and the rupture of family ties, a result of the forced and violent way in which the company established itself in the territory” (MAM, 2018a).

Traditional peoples are also severely affected. According to one of the respondents, in these groups, “[...] the Indigenous cannot be Indigenous, the Quilombola cannot be Quilombola, the peasant cannot be peasant. They become abstract mining workers or they are starving in the favela because they lost their lands [...]” (Key informant 6).

Violence, another thematized harm, appears to be related both to the aforementioned process of territorial dispossession and to population growth due to the migration of workers to mining. Population growth in these regions, particularly among men, leads to an increase in cases of sexual exploitation of adolescents and women, teenage pregnancy, prostitution, alcoholism, drug addiction, and, consequently, homicides and domestic and family violence. The passages below mention these, among other harms. They reveal how mining activity causes the social fabric of communities to fray, significantly affecting their women.

[...] So if you take a masculinized city, many men are involved in the mining process as well, although there are many women. These men, for various reasons, fall into drug and alcohol addiction, which is extremely violent. This situation leads to violence against women and increases the rate of rape, sexual harassment, and female body trivialization (Key informant 6).

The format of mining activity causes “[...] increased exploitation and poverty among

traditional and riverside peoples, alcoholism and drug use (which implies the co-optation of youth by drug trafficking), psychological and physical violence (prostitution) against women in the communities [...]” (MAM, 2018b).

Regarding mining work, both the documents analyzed and the reports of key informants report and discuss precarious work, outsourcing, non-compliance with labor laws, exhausting work hours, accidents and deaths, illness, moral harassment, disability removals, alcoholism, drug use, and metal exposure-derived contamination.

According to the MAM, Nova Lima, Raposos, and Sabará, located in Minas Gerais, have a significant number of current and former mining workers with silicosis, a lung disease caused by the inhalation of mineral dust particles containing silicon dioxide. In 2016, this number reached 500,000 cases in mining and mining companies (MAM, 2016c).

In Paracatu, Minas Gerais, home to the world’s largest open-pit gold mine, owned by the mining company Kinross, workers have arsenic contamination “[...] 25 times higher than the minimum tolerable arsenic level in the body, and the population has 5 to 10 times higher than the tolerable level” (MAM, 2015). According to one of the key informants, Catalão has the highest cancer rates among cities in the state of Goiás, due to the niobium mining process. Also, in the state of Goiás, asbestos mining exposes mining workers to the risk of illness.

[...] in Minaçu, also in the state of Goiás, asbestos mining causes mesothelioma (cancer in the mesothelial layers of the pleura, pericardium, peritoneum, and tunica vaginalis of the testicle) and lung cancer. International studies prove that there is no tolerable level of asbestos exposure to human health (MAM, 2015).

In Minas Gerais, the Anglo American mining company, through the Minas Rio project, is accused of subjecting workers to slavery-like conditions. Around 185 workers “[...] were found at the same construction site working exhausting hours, working for up to 88 days in a row and logging up to 18 daily hours” (MAM, 2017).

According to key informant 6, the daily workday for mining workers, including commuting, is around

13 to 14 hours: “[...] the pace of mining work is very intense and extensive.” As a result of the exhaustion experienced in daily work, the informant explained:

[...] this individual [...] when he’s off duty, he’s there to produce two things: violence and disease. Why? On his day off, he only drinks; he’s at a gigantic alcoholism and drug addiction level. He goes into town to the bar/pub, and then the number of trivial deaths by stabbing and everything else increases. (Key informant 6).

In summary, the socio-environmental harm discussed here concerns the circumstances in which populations affected by the Brazilian mining model “[...] are born, grow, live, work, and grow old” (CDSS, 2010, p. 1). These are factors that, according to the conception of determinants, hold an intermediate position in understanding and addressing health inequities. The socioeconomic position of individuals is understood in this same direction. We should underscore that the populations affected by mining ventures are mostly economically vulnerable, politically minorities, and predominantly Black (Milanez; Mansur; Wanderley, 2019).

MAM’s fight for another mining model: The Popular Sovereignty in Mining ideology

Reporting harm and violations of the rights of affected communities and workers is one of MAM’s means of communication in its regions of operation, as evidenced by document analysis and interviews. According to Key Informant 1, this work aims to “[...] encourage reflection on how mining impacts people’s quality of life [...]” and “[...] sensitize and empower communities and workers.” In the Movement’s view, as this harm negatively impacts the health of these communities and workers, this action is directly related to health promotion.

[...] discussing health, building a concept of health, is one of the central issues for us [...] We believe that a classic violation in mining locations is the violation of health rights! When we discuss water quality, dust, and air

pollution, we understand all of this as health. So, we can't discuss the impacts of mining without discussing health. So, many of our actions to guarantee the rights of communities that clash with mining also involve guaranteeing health [...] (Key informant 8).

Notably, health promotion exceeds ensuring access to health services and is linked to aspects related to a healthy environment.

[...] discussing health isn't about having a clinic or a doctor there. It's also about us working to ensure a balanced, healthy environment. It's about us thinking about other aspects that even relate to the preservation of the territory: water quality, air quality, right? It's also the quality of human relationships that makes that population sick or not [...] In medical care, you're often trying to remedy the situation, and you won't always succeed [...] (Key informant 8).

MAM's struggle is also significantly present in territories threatened by the mineral production chain. In these places, the Movement aims to safeguard and value traditional ways of life, family farming, and environmental conservation, which express forms of production and reproduction of life and the social importance of these territories: “[...] in the fight against the establishment of mining, we strongly advocate this interaction between human beings, nature, community life, the traditional way of life of these rural populations [...]” (Key Informant 1).

In this regard, MAM has expressed its support in several documents for movements focused on the fight for the right to land and water and the use of these natural resources as common goods, given that the Brazilian mining model intensively and extensively consumes these resources. For example, in 2020, the Movement joined the “*Periferia Viva*” (Living Suburb) Campaign, a national initiative developed by grassroots movements, unions, and pastoral groups to encourage and benefit family farming in regions threatened by mining and, at the same time, disadvantaged communities through food sales and donations (MAM, 2020).

Denunciation of the harm caused by the Brazilian mining model is also a driving force behind the Movement's actions, which are structured around the triad of Organization, Training, and Struggle. According to Key Informant 1, this cycle “[...] has no beginning or end; it is a continuous process.”

[...] there is no resistance without Organization [...] no one is politically educated without Organization. [...] So, Organization is important [...] from the moment we are organized, we seek knowledge about what mining is and produces in people's lives and what our rights are in the face of mining. Moreover, Education is a component of the Struggle, because we don't educate ourselves to become more knowledgeable. So, Education is for action [...] (Key informant 1).

Regarding Education, activities were conducted and training materials were developed, such as courses, discussion groups, assemblies, books, and booklets. Partnerships with universities were established to discuss the Brazilian mineral model, its relationship with the current and structural context of the Brazilian and global economy, and, thus, enable the construction of a critical position, especially of affected communities and workers.

[...] the courses we organized within the territories, the national courses, somehow raised the level of understanding of our base and our activists [...] regarding this, we also created critical material on mining [...] So, people also began to perceive MAM as an organization that elevated the critical mineral debate, explaining: look, here's a lead mine; this lead mine is connected to the international market, and the people behind this here, this exploration mine, are the financial market of bank X, bank Y, and Z. So there, we're doing work to raise awareness of this problem, right? In other words, to understand the size of the enemy. You'll only know the size of the dragon when you see the size of the dragon, right? So,

we work on these aspects [...] partnerships with universities, which have released critical material that has elucidated the Brazilian mineral problem [...] (Key informant 6).

This tripod, particularly with regard to Education, is essential to critical thinking and the exercise of Popular Sovereignty that aims to establish “[...] new rules for mineral coexistence in the country” [Key informant 6].

[...] So, for example, would we need to open the Carajás complex? Would we need to expand the Conceição do Mato Dentro dam? Would we need to reach a rate of mineral exploration that is incompatible with nature and the surrounding society? [...] So, sovereignty will have to be reorganized and, therefore, political and social education, that's why I mentioned the courses, which are a level of awareness of a society organized in its several aspects to create what would be a Brazilian mining ideal and new rules of mineral coexistence in the country (Key informant 6).

By conducting a critical debate on the Brazilian mining model, problematizing the reasons for its modulation and development, the MAM advances toward the structural cause of the living and working conditions of affected communities and workers: mining activity placed under the logic of the capitalist market economy, thus revealing the damages denounced as determinations of the “[...] exploitation of human and natural life [...]” resulting from such logic” (Silva; Bicudo, 2022, p. 119). The questioning inscribed in this debate led by the MAM is also core to the discussion of the Social Determinants of Health approach.

From this perspective, the Movement understands that promoting the health of affected communities and workers requires more than medical care and the structuring of health services. It is necessary to rebuild the Brazilian mining model and its “[...] pace of mineral exploration that is incompatible with nature and society [...]” [Key informant 6]. This understanding aligns with the

concept presented here that promoting health requires more than universal access to health services; it is necessary to seek a universal healthy living (Breilh, 2023) which refers to the “[...] right to life, which includes territory, health, ecosystems, culture and the construction of a more humane, healthy and democratic society.” (Mapa, 2010).

Final Considerations

The denunciation of the harm caused by the Brazilian mining model to the living and working conditions of the affected populations is emphatically addressed in the documents that comprise the corpus of analysis of the documentary research and the interviews with key informants. Committed to the immediate needs of affected communities and workers, the Movement works to combat illness caused by metal contamination of natural resources – water, soil, and air – and the intensive consumption of these resources, which, combined with their contamination, compromises subsistence and other economic activities – such as family farming, fishing, and pesticide-free food production. These traditional ways of life, when not modified, are destroyed by the territorial dispossession of communities. Furthermore, it also combats precarious work in the mining sector.

By addressing the living conditions and aspects related to the wellbeing and illness of affected populations and working conditions in the mining sector, MAM addresses factors intermediately associated with health promotion, considering the theoretical framework of the Social Determinants of Health. However, within this framework, MAM promotes critical debate about the Brazilian mining model, discussing the cause of its formation and development – namely, mining activity under the aegis of the capitalist logic of production – and thus advances toward the structural reason for these living conditions. This logic is also at the heart of the health promotion paradigm from the perspective of Social Determinants.

MAM's work in both perspectives is based on popular participation structured around the tripod of Organization, Education, and Struggle, pursuing what has emerged as the Movement's main mobilizing political agenda: Popular Sovereignty in

Mining. One of the strongest expressions of this agenda is the struggle for Mining-Free Territories.

Popular Sovereignty in Mining, based on this relational tripod, proves to be a robust tool for promoting health. It fosters the potential of individuals and communities affected and threatened by the mineral production chain in the fight for their rights. It enables more consistent analysis and positioning. Thus, it represents the possibility of acting on the social determinants of health as well as its determination.

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Contribution of the authors

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