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CHARACTERIZATION OF ENVIRONMENTAL INEQUALITIES AMONG A MINING TOWN'S NEIGHBORHOODS CASE STUDY: OUENZA – EAST OF ALGERIA

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ABSTRACT

The waste resulting from mining can contaminate waterways or seep into soils and seriously pollute the environment; therefore it can impact the health of residents. However, these impacts are often deemed differently by this population. This difference is commonly called: "Environmental inequalities". This article spots the light on characterizing environmental inequalities in the mining town: Ouenza, which is located in the extreme east of Algeria. Through a questionnaire conducted in five areas of the town and using sphinx software to analyze results by CFA, we attempted to identify the impact of the extraction activity in this town and to determine the inequalities among the different zones and the factors behind them such as the proximity or the direction of wind.

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Introduction.

The waste produced by mining can contaminate waterways or seep into the soil and therefore it pollutes the environment. Many dumps (or soil heaps) are not arranged, they are simply accumulated by residues (tailings) and by mining products. Depending on the type of extraction process, these dumps may contain acidic, or caustic compounds, heavy metals or cyanide, which generally will make the soil unsuitable for any future use. Quarries may be contaminated with acidic water, which may contain high concentrations of dissolved heavy metals and seep underground. Without extensive rehabilitation measures, these areas will remain polluted and unsuitable for any future use.

Mining can also threaten biodiversity. The amputation of the fauna and flora of mining sites leads to gaps in the food chain for the remaining animals, as well as problems of re-colonization by plants by the end of mining.

Extractive industries have been presented very often as an economic necessity, or even a godsend for deprived areas. However, this is not the case in other many areas. These industries have created sometimes persistent structural inequalities for the communities. Through a study in a mining town, this article attempts to characterize one form of inequality that Ouenza's residents suffer from. This is the environmental inequality associated with the proximity of mining facilities.

Environmental inequality: a concept in need of clarification.

- Attempts have been made to define environmental inequalities, both in research and some official documents. [1]

According to Laigle and Oehler (2004) [2], these inequalities can be characterized by:

- Inequalities linked to heritage and the marking of urban areas,
- Inequalities in access to urbanity and the living environment (housing, facilities, services, transportation, green spaces and the urban environment of good quality),
- Inequalities in exposure to urban disturbances (noise, pollution, insecurity, etc.) and risks (natural, technological, industrial, etc),
- Inequalities in the ability to act on the environment and to call on public authorities to transform the living environment.

This vision leads us to consider the notion of environmental inequalities not only in terms of unequal exposure to risks and unequal access to means of comfort but also takes into account the territory and the population's capacity to change its local environment.

Cyria Emelianoff believes that "environmental inequality can be defined as unequal exposure to risks and environmental disturbance and unequal access to resources and environmental means of comfort (amenities). Exposure is a complex variable that depends, of course, on the proximity and nature of the resources, and also on the perception of disturbance or risk, risk avoidance and protection of residents" [3]. The notion of environmental inequalities, which expresses the fact that individuals and social groups are not equal either in terms of exposure to environmental pollution and risks or in terms of access to environmental resources and amenities, is here associated with the proximity and nature of the pollution source.

The term environmental inequality is often associated with ecological inequality, and although the two terms are often used interchangeably, they are not equivalent. In our view, ecological inequality has a broader scope than environmental inequality [4].

Environmental inequality refers to social inequalities in access to environmental goods and services, whereas ecological inequality refers to the pollutant emissions and unequal distribution of pollution levels.

To make a clear distinction between environment and ecology, we need first to define the two concepts. Robert's Dictionary defines environment: as all natural and cultural conditions that can affect living organisms and human activities. Ecology, on the other hand, is the science that studies the environments in which living organisms live as well as the relationships between organisms and their environment.

Thus, the notion of ecological inequalities goes beyond that of environmental inequalities, thus it proposes to study the behavior of communities concerning the natural environment by looking at the causes of disorders nature is suffering from and their intensity, and characterizing the unequal capacity of living beings in causing such disorders.

Health inequalities as a consequence of environmental inequalities.

The concept of environmental inequality echoes environmental justice, which emerged in the United States in the early 1980s and spread again in England in the second half of the 1990s. Several components of these inequalities raise questions about the links between environment and health. Therefore, it is essential to associate environmental degradation with poor health in order to define its impact on health. [5]

This concept calls to question the definitions given to environment and health, bearing in mind that the relationship between the two is still under construction and is also based on a semantic vagueness interpreted by hesitant translation of the English term "environmental health", which is seen cautious

and not very aesthetic. Indeed, the concept of health inequalities is often demoted to the background. It remains ambiguous and little used, particularly in developing countries. [6]

Research objectives.

According to (l'Aigle and Oehler, 2004) [7], four ecological inequalities can be identified:

Inequalities in exposure to urban disturbance (noise, pollution, etc.) and risks (natural, technological, industrial, health risks, etc).

Inequalities in access to the urban environment and to a living environment of good quality.

Inequalities linked to the heritage and development of urban areas.

Inequalities in the ability to act on the environment and to call on public authorities to improve the living environment.

This article aims is to characterize the inequalities in exposure to urban pollution caused by mining activities in urban areas. It is furthermore to determine the causes and forms of these inequalities in order to define well a public policy that mitigates the imbalances in the development and management of environmental problems .

This analysis will help to identify the core obstacles that hinder local authority policies in the process of addressing the issue of environmental inequalities, which will make it possible to outline paths for corrective local public action .

Case study:

Ouenza is a medium-sized town in eastern Algeria whose origins can be traced back to the discovery of a major iron and copper deposit in the far north of Tébessa province, 15 km from the Algerian-Tunisian borders. In fact, at the end of the 19th century, and more precisely in 1875, the engineer Tissot discovered a major iron and copper deposit in the Chagoura Mountain. Prospecting work began immediately; it confirmed the existence of Algeria's largest iron deposit. At that time, Ouenza was inhabited by a few nomadic farming families whose main activity was pastoralism.

In 1901, the prospector Pascal obtained the Djebel Ouenza (Ouenza Mountain) grant. After long negotiations in 1913, Ouenza Company with a share capital of 114 million Francs was set up to take charge of exploiting the mine. It did not start working until the early 1920s after the First World War, and the region was once again colonized by an inflow of French and other Europeans. When the Algerian workforce was no longer sufficient, and just before the Second World War, the doors were open to Tunisians, Libyans, and Moroccans, who took an active part not only in exploiting the mine but also in creating a diverse social unit that would have a very positive impact on the behavior of future generations⁸. To retain its workforce, Ouenza Company built houses for European managers and local miners at the foot of Djebel Ouenza.

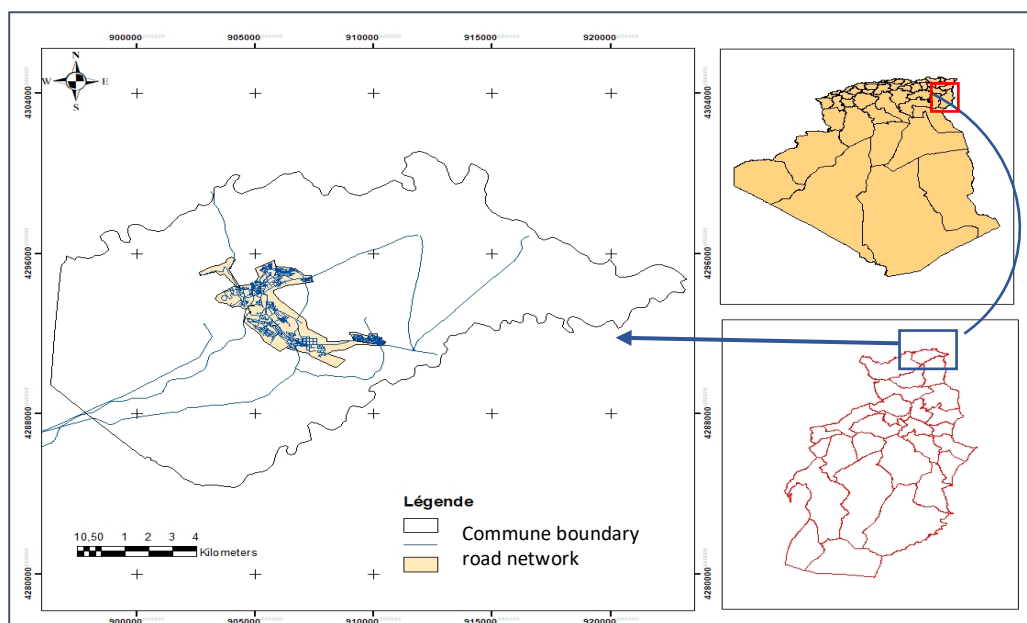


Figure 1. Geographical location of the city of Ouenza.

Located 120 km south-south-east of Annaba, Ouenza town has borders in the east with Tunisia, in the north with Taoura and Sidi Fredj communes of Souk-Ahras Province, and with El Aouinet commune in the west, and with Boukhadra and El Meridj communes in the south. It also borders with Oued Mellegue and Oued Kseub. It is linked to Annaba by the national road No. 82B and a railway line, which carries all production from Ouenza to the gateway facility, where it is shipped to the El-Hadjar Steel Complex.



Figure 2. Photo of the city of Ouenza during the colonial period.

Methodology.

Data collection.

In order to have a better understanding of the mining impact on people, we decided to conduct a questionnaire and distribute it to inhabitants of Ouenza after several field trips and establishing an observation network that came out with five selected areas. The selection was stimulated by the location of the areas in relation to the mining installations and the period in which they were created.

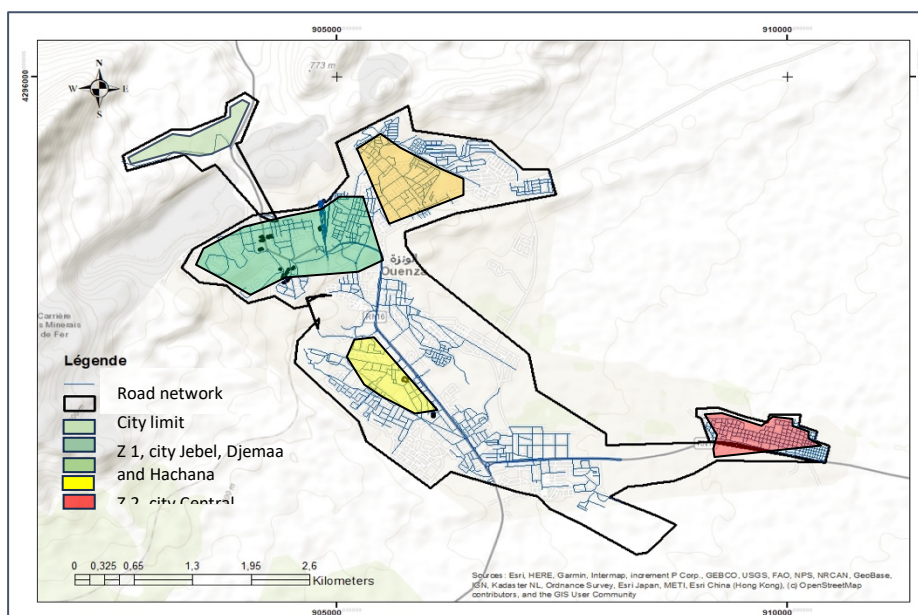


Figure 3. Maps of survey areas.

We chose three areas belonging to the former village that formed the colonial core of the town, namely the Hachenna, Djemaa and Djebel neighborhoods for zone 1, The Central Neighborhood for zone 2, and Ben Badis neighborhood for zone 3. Recently, two other areas were built relatively as part of the expansion of the town, namely the 06 Mai district for Area No. 1 and the El Amel district for Area No. 2 on Map No. 3.

The survey was conducted from June 8th to July 30th, 2020, and involved 300 participants, of whom only 271 responded to the questionnaire. [8]

Table 1. Number of respondents by sex, age group and level of education.

	Waist Sample			Age				Educational attainment				
		masculine	Feminine	18-30	31-50	51-60	60+	Prim	Avg	dry	Univ	Post grad
Zone 1	67	46	21	21	17	16	13	3	10	28	26	0
Zone 2	60	49	11	24	17	13	6	8	25	9	6	2
Zone 3	35	32	03	21	14	0	0	2	22	11	0	0
Zone 4	51	35	16	18	19	11	3	6	22	18	5	0
Zone 5	58	28	30	24	9	13	12	19	8	17	14	0

The design of the questionnaire as well as the findings analysis was conducted by sphinx software which integrates all the functions of the survey from conception to data collection to end up with the qualitative and quantitative analysis.

Responses differ according to the zone. The houses in Z1, which includes Hachanna, Cité Djemaa and Cité Djebel housing estates, were built by the mining company to retain the local workforce, who were initially unwilling to work in the mine.

These houses have become precarious and require renovation or even demolition in some cases.

On the other hand, there is some satisfaction among inhabitants of zones Z2 and Z4 regarding their houses. These areas concern mining housing of villa type, and detached houses (separate houses) with garden precisely in Z2 which represents the first core of the city consisting of houses and villas for Europeans (mining company framework) with all amenities (cinema, bursar's office, laundry, bank, post office, nursery, miners circle, etc.)

- Z4 represents a relatively new district (06 May Neighborhood) which was built as part of the extension of the city, and the inhabitants of this district have demonstrated a certain acceptability of their living environment.

Zone 3 (Z3) is the second zone that contains aboriginal mining dwellings and was built in the late 1950s; therefore they are more recent than Z1. The inhabitants have an average standard of living and the houses' conditions are moderately acceptable.

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Source of pollutioz: Physical environment; housing condition.

The achievement of factorial analysis of correspondences (FCA), the classification of lines (neighborhoods) and columns (on the physical environment of the neighborhood), and the current housing evaluation make it possible to correlate and synthesize the criteria. This allows the elements to be categorized into three groups:

The answers are widely different from one zone to another, the reasons given are in zone 1 (Z1) are; houses are precarious and require a total demolition. [9]

On the contrary, the evaluation of zones 2 and 4 is dominated by an acceptable satisfaction of the respondents with their detached houses and performing functions; minor, free trade, in addition to a high level of education (post-graduation).

The third group is characterized by a type of mining houses that require renovations and are dominated by a secondary level.

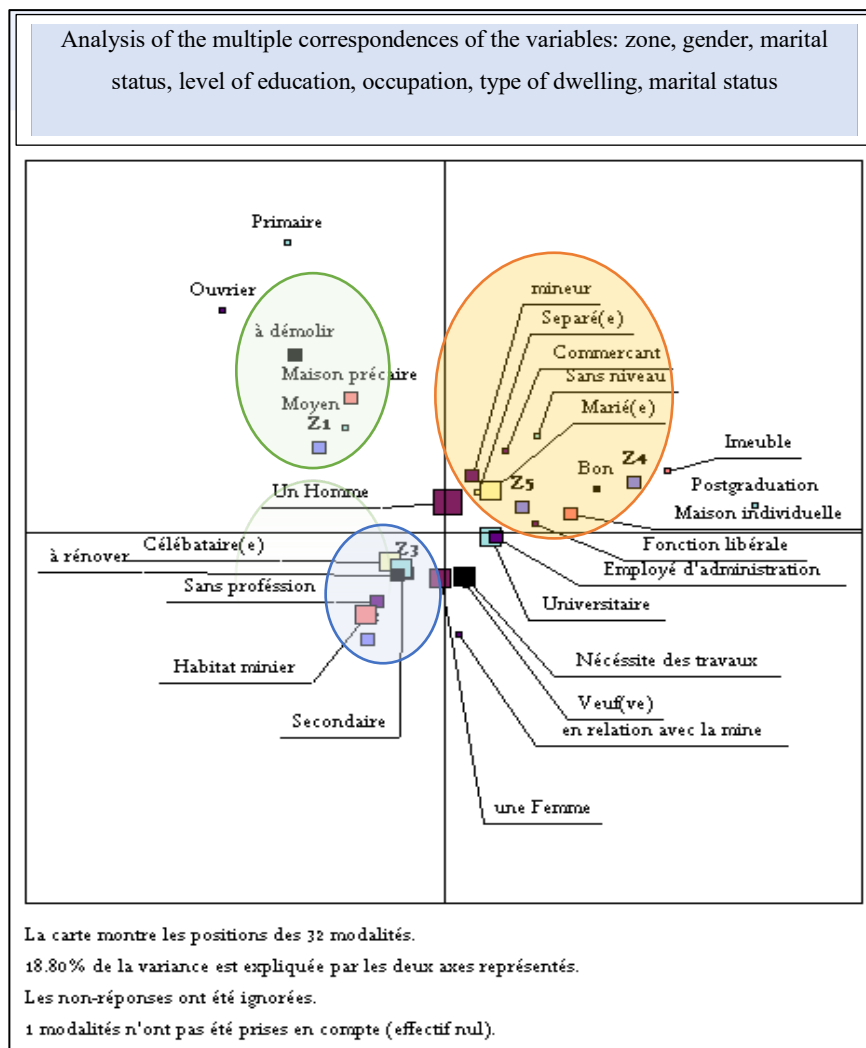


Figure 4. Source of pollution: Physical environment; housing condition.

Source of pollution in the different zones of the case study.

To understand properly the inhabitants' perception, we aimed to figure out the sources of pollution in the study area.

In the light of questionnaire results, traffic noise appears subjectively to be the major factor of noise pollution, followed by industrial nuisance and dust emanating from Ouenza's mine, precisely in zones 1 and 2 (Z1, Z2). Thus, this cartographic representation on the factorial plan symbolizes the visual pollution resulting from the unsafe conditions and the colors of buildings.

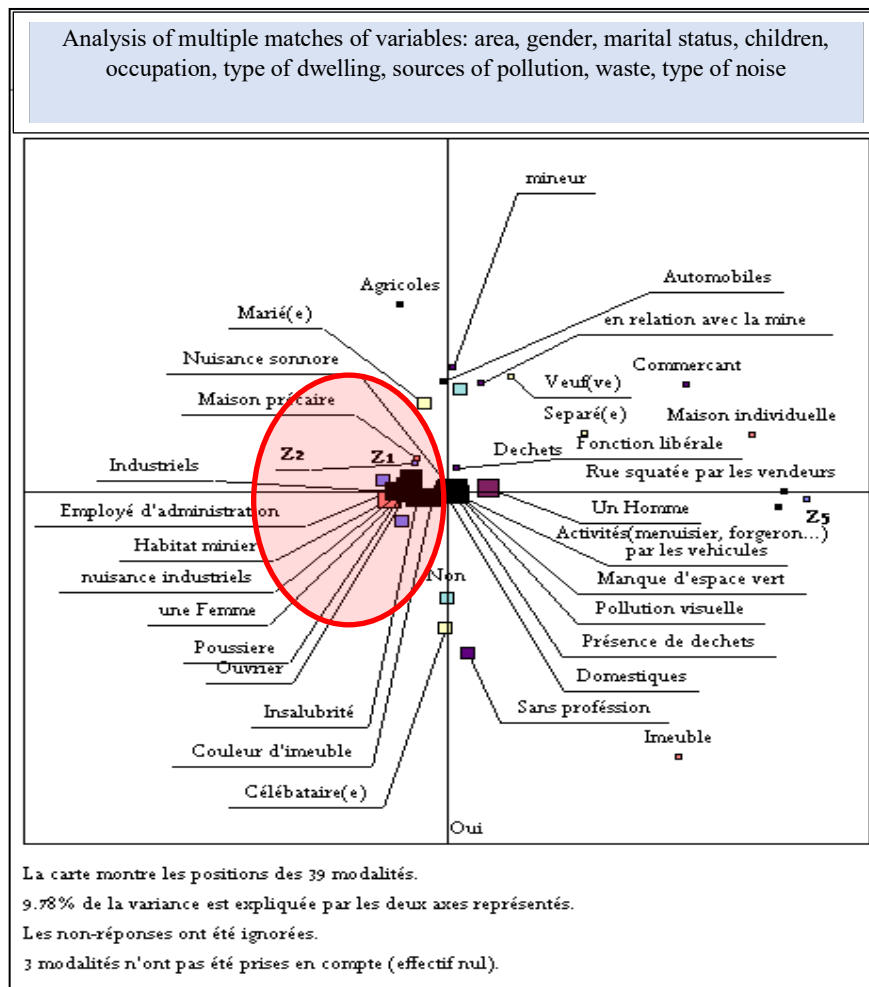


Figure 5. Source of pollution in the different zones of the case study.

The spatial disparity of these sound environments makes it possible to identify zones of degradation or preservation.

Health impacts associated with mining and the case study: Ouenza.

For a better understanding of the residents' perceptions, we asked them about the health impact of the mine on their region. [10]

With the focus on questioning the environmental impact of the mine on the neighborhood, it is high time to find out about people's experiences and habits .

The responses to this question were largely positive:

In zones 1, 2 and 3 (Z1, Z2, Z3), the reasons given were related to asthma diseases.

On the other side of this group, there are heart diseases.

To understand well the inhabitants' perception of the sources of pollution they suffer from, we looked for the sources of pollution .

Based on the results of the questionnaire where noise and road traffic are considered as the major factors of noise pollution followed by industrial nuisances precisely in zones Z1, Z2, and Z3.

These same areas are most affected by dust from mining facilities, unsanitary conditions, and visual pollution caused by the colors of buildings turning brown due to iron ore.

In contrast, zones Z5 and Z4 are away from these nuisances. The inhabitants' demands there are quite different (lack of green spaces, better management of household waste, sidewalks occupied by vendors, etc).

This situation is illustrated in Figure N°5 shows a certain disparity between the zones which are grouped clearly into two opposite groups. In zones Z1, Z2, and Z3, which represent the core of the town built during the colonial period around the mine, this proximity is worsened due to the direction of prevailing winds. It means that these areas are most affected by different forms of pollution. Inhabitants discussed the risks caused by the fall of stones especially in El Djebel Town located in Z1 which owes its name to El Djebel Chagoura (Chagoura Mountain) at the foot of which it was built.

On the other hand, zones Z4 and Z5 which represent neighborhoods built after the independence of Algeria, thus they are relatively more recent and located far from the mining concession, suffer significantly less from the environmental problems related to the mine. Their problems are completely different; nevertheless, they are affected by certain inconveniences such as the breakage of the windows during the mine operations and the visual pollution caused by the dust which is sometimes carried by the winds to miles .

Health impacts linked to mining activity and case study.

The analysis of the FCA results, illustrated in Figure No shows that the health problems affecting people in the case study display a clear disparity between the zones. Thus zones Z1, Z2, and Z3 are the most affected by respiratory (asthma) and skin diseases. On the other hand, zone Z4 and Z5 are affected to a lesser degree by other types of diseases such as heart disease, hypertension and eye diseases that are more linked to age and hereditary factors. [11]

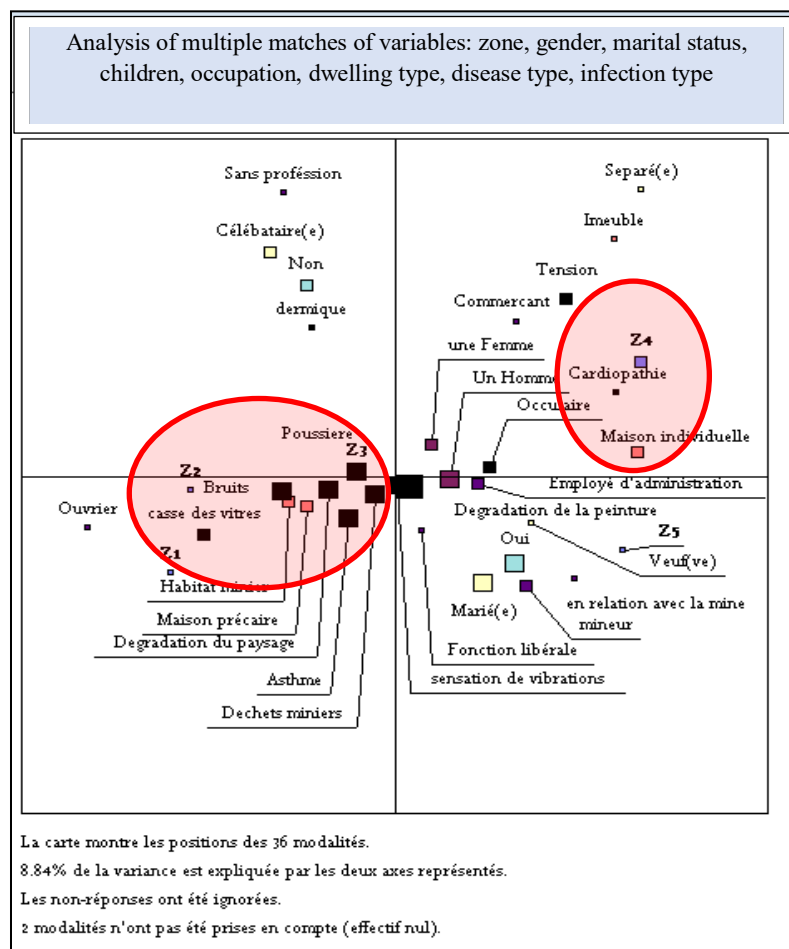


Figure 5. Health impacts linked to mining activity and case study.

Discussion.

Given these results, it should be noted that there is a clear environmental inequality between the two groups of zones in our case study.

The first group includes zones Z1, Z2, and Z3: these bring together the neighborhoods which were built in the area of mining facilities. They suffer from the spread of dust, the noise of machines, used oil, and desolation which makes up their daily life.

The exposure of residents to dust for extended hours, especially when loading wagons and transporting ore by conveyor belt led to serious health consequences. The majority of households in these neighborhoods have at least one person with asthma or respiratory allergies. Stress and industrial risks are widely spread with the risk of flooding which has become quite frequent in recent years due to the movement of slag heaps. [12]

The second group represents zones Z4 and Z5 which are less affected by air pollution as well as other forms of pollution linked to mining activity. The inhabitants in these neighborhoods are not exposed to the industrial risks to which those of other neighborhoods are exposed.

It is therefore clear that the study area represents a certain environmental disparity which has led to inequality in exposure to the harmful impacts of mining and, therefore, to health inequality. The inequality of environmental impact is the most important due to several factors such as the proximity and location of the districts regarding the direction of prevailing winds with the mining facilities and machines, in particular, the conveyor belt and the loading frame of the transport wagons of iron ore.

It should be noted that the establishment of the city at the foot of Chagoura Mountain followed much more the logic of profit and reduction of blows and transport time of workers. [13]

Conclusion.

Mining towns are often victims of environmental deterioration that varies in importance and nuisance from one town to another depending on the conditions and the type of exploitation (underground or open air, on a large scale or not, etc.). However, this variation in impact, also known as disparity or inequality, is not the only one. It is within the mining town itself that we can see inequalities in the impact of the mine among the different neighborhoods. Through this study, we attempted to characterize these inequalities within the mining town of Ouenza as a case study by surveying five zones that differ in their positions concerning the exploitation zones and their proximity to this same area. [14]

After processing the results by carrying out CFA (correspondence factor analysis) and using Sphinx software, we concluded that the impact of mining within the same city varies from one zone to another due to its form and intensity although the entire city is a victim of this impact. Also, the areas that are located in the environment next to the mining zone are the most affected by mining pollution in all its forms; however, the distant neighborhoods are less affected by this pollution. But it should still be noted that certain impacts are widely spread in all districts of the town, such as the deterioration of the colors of houses and landscapes, offering a spectacle of ruins. [15]

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