

# The Impact of LGS and PM10 in Cardio Vascular and Respiratory System; A Study about the Air Pollution; Particles LGS &PM10' Impact in Cardiac and Respiratory Patients in the Cities of Fieri and Vlora

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**Abstract:** To evaluate the values of LGS and PM 10 in the air of Fier and Vlora cities in order to determine their high value impact on the cardio vascular and respiratory diseases. **Material and Method:** The study is concentrated in two cities with different climate Fier and Vlore. This is a clinic-epidemiologic study related to the connection of the dust particles measured with complex methods and the diseases of the cardio respiratory system. We got permission from the director of both the hospitals to use their facilities and the patient's charts to obtain information about the respiratory and cardiac diseases during the time period of 2004-2014. To measure the value of the LGS and PM 10 inside the trachea and other parts of the respiratory system based on the optical technique of laser by counting the fallen particles on the surfaces. Using some particular filters with organic parts and evolution base <65 grade C, we have measured LGS and PM 10 in the air of Vlora and Fieri. Using the normal values of LGS and PM 10 we have measured what are the values in females with IAM in both cities. **Results:** In all the data about the cardiac diseases we saw that all of them have a higher ratio of happening in the city than in the country. The ratios varied from 4/1 to 5/1 City/ village patients. According to the respiratory diseases we have noticed that almost all this diseases are more spread in the city than the town areas. The highest pollution is noticed in the city of Fier compared with the Vlora city; this for the reason of the hot environmental areas as the Marines Patos gas refinery, Ballsh refinery and Azotic chemicals factory. These areas have polluted the rivers of the city Gjanica and Seman, also the underground waters in combination with the transport vehicles which release a great deal of gases and dust. That's why the values of LGS and PM 10 are higher in Fier than Vlora. **Conclusions:** PM 10 has an influential impact in the cardio vascular system and the pathologies like IAM, Ischemia, Cardiopathy, etc so its levels should be kept under control. There are other factors like hypertension, diabetes and the cholesterol level which also should be kept under control. The levels of pollution lower the life expectancy.

**Keywords:** LGS, PM 10, respiratory and cardiac diseases, air pollution

## 1. Introduction

The climate changes accompanied with rapid socio economic changes have brought the increase of the pollution frequency [6]. The components of the air that surrounds us are 78.9% N<sub>2</sub>, 20.94 % O<sub>2</sub>, 0.93% Argon, and 0.03% Anhidrit carbonic. This compound is true for the places where the pollution is low like in the countryside without any factories or in the mountains. The air pollution is increasing from the country side to the cities, especially in the industrial areas. The dust is created in linear motion from the combustion of the car engines, mechanical works, evaporation, chemical processes, traffic, building sites and smoke inhalation [1, 2].



Figure 1: The landfills of Fieri

**Table 1:** The values of LGS pollution in city of Fier and Vlore

LGS	LGS	PM10	PM10	SO2	SO2	NO2	NO2	Pb	Pb
Fier	Vlora	Fier	Vlora	Fier	Vlora	Fier	Vlora	Fier	Vlora
258	152	109	70	22	14	21	21	0.226	0.224
232	144	107	63	19	10	23	16	0.2	0.19
227	157	105	69	19	10	23	17	0.34	0.43
203	161	93	72	18	12	23	18	0.25	0.25
219	187	106	86	24	16	25	23	0.29	0.24
230	193.3	102	87.6	20	29.7	30	31.3	0.22	0.161
228	210	112	86	19	7.8	32	33	0.25	0.19
225	212	110	87	12	9	31	31	0.24	0.17
227	155	108	86	18	12	30.5	23	0.24	0.21
232	148	107	84	19	10	32	31	0.26	0.18
224	152	109	87	17	11	31	21	0.22	0.19

Some of the pollution particles that have greater impact on the cardiac and respiratory diseases are LGS and PM 10. Normally their predetermined values from EU are 80 for LGS and 40 for the PM 10. But in different states these values differ for example in Italy for the LGS the normal good values are <50 µg/m<sup>3</sup>, critical are 50-100 µg/m<sup>3</sup> and the most dangerous values are >100µg/m<sup>3</sup>. In cases when these values are higher than usual these particles have a greater direct influence in the cardio respiratory system causing bronchitis, asthma, bronchopneumonia, etc. [11].

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LGS has a direct impact on the immune system activating mastocytes which release allergy mediators like histamines, causing bronchoconstriction and asthma spasticity. The disease becomes chronic and in the case of the ongoing accumulation of these substances is an initial cause of the asthmatic attack. [11]. PM 10 comes from transport with 49%, industry 27%, agriculture and forests p 11%, and energy production with 4%. [10, 2]. The damages caused by PM 10 depend on the particle's dimensions, their chemical nature, their capacity to be placed in different parts of the respiratory system. The particles with 7  $\mu\text{m}$  are placed in the nose and mouth, continuing in larynx. The particles 4-7 $\mu\text{m}$  are placed in the trachea and terminal bronchi, and 1.5  $\mu\text{m}$  in the pulmonary alveoli [8]. A value of PM 10 lowers the respiratory exchange, making the level of O<sub>2</sub> circulating in blood lower than normal, which causes respiratory insufficiency [8]. The continuous exposure in low percentages of PM 10 brings vascular inflammation and favors the atherosclerotic process. As a result of the dust passing in the blood, protein C, fibrinogen and the 8<sup>th</sup> factor are activated, altering the autonomous nervous system, which induces tachycardia, arrhythmia and hypertension. In the presence of the atherosclerotic plaques thrombosis happens easier and can cause cardiac ischemia [5, 6, 11]. PM 10 thickens the arteries' walls and increases the risk of cardiac attack. PM 10 also activates the coagulation factors, increases the blood viscosity causing a rise of the probability for thrombus formation and IAM. When the values of PM 10 and LGS are above the average, they cause cardiovascular disease as soon as the second day to the forth of being exposed [11].

## 2. Aim

To evaluate the values of LGS and PM 10 in the air of Fieri and Vlora cities in order to determine their high value impact on the cardiovascular and respiratory diseases.

## 3. Objectives

- a. To measure the values of LGS and PM 10 in the air of the cities of Fieri and Vlore.
- b. To evaluate the prevalence and incidence of the cardiac and respiratory diseases in the cities of Fieri and Vlora.
- c. To evaluate the impact of LGS and PM 10 in cardiac and respiratory patients.

## 4. Material and Method

The study is concentrated in two cities with different climates (Fieri and Vlore). This is a clinic-epidemiologic study connected to the connection of the dust particles measured with complex methods and the diseases of the cardio-respiratory system. We got permission from the director of both the hospitals to use their facilities and the patient's charts to obtain information about the respiratory and cardiac diseases during the time period of 2004-2014. Some of the data of LGS and PM 10 are obtained from the database of the PHI of Vlora city. To measure the value of the LGS and PM 10 inside the trachea and other parts of the respiratory system based on the optical technique of laser by counting the fallen particles on the surfaces. Using some particular filters with organic parts and evolution base <65

grade C, we have measured LGS and PM 10 in the air of Vlora and Fieri. Using the normal values of LGS and PM 10 we have measured what are the values in females with IAM in both cities. The formula to measure the mean value of LGS is  $\Delta X = X_{\text{mean}} - X_i$

## 5. Results

From the data received by both hospitals in the city of Vlora and Fieri we have noticed: MI happens 6 times more in people living in the city than in the country, ratio (6/1), and males suffer more from IAM than females, ratio 5/1.

- a. Angina pectoris city/country ratio is 4/1
- b. Cardiopathy city/country ratio is 4/1
- c. Cardiac insufficiency city/country ratio 3/1; male/female ratio is 2/1.

According to the respiratory diseases we noticed:

- a. Pneumonia: city/country ratio is 2/1
- b. Bronchopneumonia: city/country ratio is 5/1 more touched are 5-14 years old, male/female ratio 3/1
- c. Bronchitis: city/country ratio is 3/1
- d. Asthma: city/country ratio is 4/1 the most touched ages are 1-4 years old, 5-14 years old and over 65 years old. The highest pollution is noticed in the city of Fieri compared with the Vlora city; this for the reason of the hot environmental areas as the Marines Patos gas refinery, Ballsh refinery and Azotic chemicals factory. These areas have polluted the rivers of the city Gjanica and Seman, also the underground waters in combination with the transport vehicles which release a great deal of gases and dust. That's why the values of LGS and PM 10 are higher in Fieri than Vlora.

**Table 2:** The values of LGS in asthmatic patients from 2004 to 2014

Year	Patient number	LGS values
2004	119	152
2005	124	144
2006	145	157
2007	132	161
2008	140	187
2009	142	193.3
2010	167	210
2011	122	212
2012	135	155
2013	142	148
2014	145	152

**Table 3:** The values of PM 10 in asthmatic patients from 2004 to 2014

Year	Patients number	PM 10 values
2004	119	70
2005	124	63
2006	145	69
2007	132	72
2008	140	86
2009	142	87.6
2010	167	86
2011	122	87
2012	135	86
2013	140	84
2014	145	87

**Table 4:** Prevalence of IAM in female patients in Vlora and values of LGS

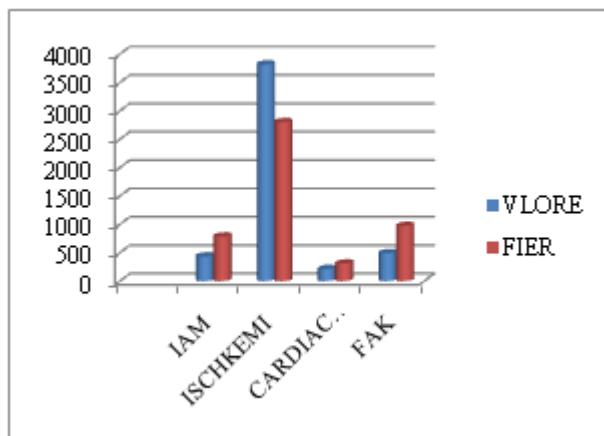
Year	Female with IAM	LGS
2004	6	152
2005	11	144
2006	9	157
2007	13	161
2008	16	187
2009	15	193.3
2010	13	210
2011	15	212
2012	11	155
2013	13	148
2014	15	152

**Table 5:** Prevalence of IAM in the female patients Vlore and values of PM 10

Year	Females with IAM	PM 10 values
2004	6	70
2005	11	63
2006	9	69
2007	13	72
2008	16	86
2009	15	87.6
2010	13	86
2011	15	87
2012	20	86
2013	18	84
2014	16	87

**Table 6:** Prevalence of cardio vascular diseases in both cities

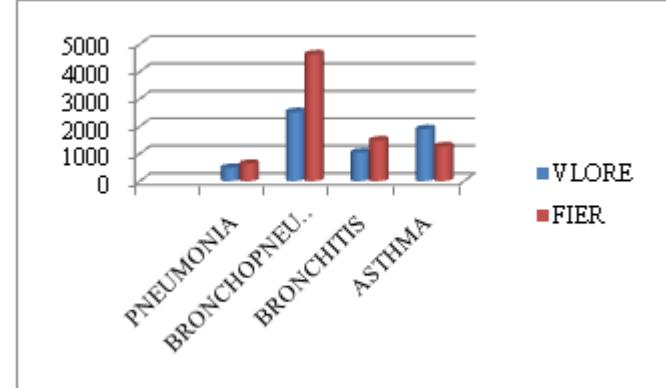
Pathologies	Vlora	Fier
Iam	437	788
Ischiemi	3822	2805
Cardiac insufficiency	216	313
Fak	495	976



**Graphic 5:** The prevalence of cardiac diseases in Vlore and Fieri

**Table 6:** The prevalence of pulmonary diseases in both cities

Pathologies	Vlora	Fier
Pneumonia	490	634
Bronchopneumonia	2524	4631
Bronchitis	1048	1487
Asthma	1902	1270



**Graphic 6:** The prevalence of the respiratory diseases in the city of Vlore and Fier

From the calculation of the table values we have noticed that:

- Mean value of LGS in the city of Fierfor 11 yearsis 227,33
- Mean value of PM 10 in the city of Fierfor 11 years is 105,5
- Mean value of LGS in the city of Vlore for 11 years is 177
- Mean value of PM 10 in the city of Vlorefor 11 years is 77,5
- Bronchopneumonia: In the city offierthe incidenceis 56.53 sick patients /1000 inhabitants, but in Vlore it is 22 sick patients /1000 inhabitants, so the number of the sick patients is 2.5 times higher in the city of Fieri than in Vlore. LGS is 1.2 times higher in Fier than in Vlore. PM 10 is 1.36 times higher in Fier than Vlore.
- Bronchitis: 18 patients in /1000 inhabitants for the city of Fieri and 9 patients for 1000 inhabitants for the city of Vlore. So the incidence inFieriis 2 times higher thanthe incidence in Vlore.
- Pneumonia: In Fieris 8 for 1000 inhabitants, in Vlora is 4 patientsfor 1000 inhabitants, so here we have an incidence of 2 times higher in Fier than in Vlore.
- IM:9.5 patients for 1000 inhabitants for Fieri and 4 patients for Vlora, so the incidence in Fieri is 2.3 times higher in Fieri than Vlore
- Cardiac insufficiency: InFieriis 3.7patiens in 1000 inhabitants and 1.8 in 1000 inhabitants for Vlora, so 2 times higher inFierthaninVlore.
- FAK: 12 patients in 1000 inhabitants for Fieriand 4.2 for Vlore, with an incidence 2, 7times higher in Fierthan in Vlore.

## 5. Conclusions

PM10 has an influential impact in the cardio vascular system and the pathologies like IAM, Ischemia, Cardiopathy, etc so its levels should be kept under control. There are other factors like hypertension, diabetes and the cholesterol level which also should be kept under control. The pollution levels are 1.2 and 1.4 times higher in Fierthan in Vlore and also the incidences of the diseases are 2 times higher in Fierthan in Vlore. These levels lower the life expectancy.

## 6. Recommendations

- To lower the level of pollution
- To avoid the roads with too much traffic,
- People should prefer staying on top floors, gardens, parks, to exercise and take part in sport events, so to frequent places where the pollution is lower.
- The health institution should routinely monitor the level of pollution in order to keep these levels within the normal values of the state.
- To take into consideration the complaints of the citizens for the different environmental pollution sources in the city or in the village not approved by the health institutions.

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