

## Can Low-Grade Chronic Inflammation From Air Pollution Cause Tumors and Neurological Pathologies up to The Risk of Suicide?

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### ABSTRACT

*Man modifies the environment, the environment modifies man. The various pollutants present in the environment in which we live can sometimes cause slow and progressive inflammatory processes in our organism; this process is called Low-grade chronic inflammation, a clinical syndrome not easy to diagnose early, because it is often clinically asymptomatic or with few symptoms and is frequently correlated with various viral or bacterial infections. This often precedes autoimmune diseases, diabetes, heart disease, obesity, neurological diseases, but above all tumors. Most affected are the inhabitants who live in environments polluted by industrial centers, often located on the outskirts of urban centers, which release toxic substances (cancer gas) into the air, where there is also intense vehicular traffic, or port areas, with both cruise ships and merchant ships dock there, as well as intensely busy airports. The most frequently detected carcinogenic and mutagenic substances are PAH, Nitro-PAH, diesel fumes, 1-3-Butadiene, Benzene, Formaldehyde, Chlorinated solvents, Vinyl chloride, Heavy metals, Asbestos, Acetaldehyde, Nitrogen dioxide etc. This chronic inflammatory process, not only of the respiratory tract, but also of "target" organs, can be exacerbated by the clumsy and excessive use of anti-inflammatory, antibiotic, antihypertensive, cardiotonics, anti-diabetic, sedative, anxiolytic and hypnotic drugs, which in addition to masking any preventive symptoms of the worsening of the disease, accentuate the mechanisms of bioaccumulation of toxic substances in some organs, altering their functionality. An example of the severity of the combinations of environmental pollution and low-grade chronic inflammation (L.G.C.I.) in polluted sites and in port and airport areas is given by the increase in various oncological and neurological diseases with an increase in their incidence and a lowering of age of onset. These pathologies are caused by uncontrolled inflammation of cells which undergo inflammatory and sometimes self-harming mechanisms. Our objective is to highlight a correlation between environmental pollution, particularly atmospheric pollution, and suicidal tendencies linked to anxiety-depressive forms often due to toxic substances present in these patients, especially if affected by tumors or neuro-damaging diseases, for place it as a paradigm for the identification of areas at high risk of onco-neuro toxic air pollution with possible suicide risk.*

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## Keywords

Mental disorders, Environmental pollution, Toxic substances.

## Introduction

Environmental pollution, particularly that of agricultural and atmospheric soil, causes various problems for our state of health and in recent years some correlations between environmental pollutants and various chronic-degenerative neurological and oncological diseases have been explored. It has been highlighted that some oncological and neurodegenerative pathologies can be caused by a qualitative and/or quantitative alteration of the atmosphere, with a direct or indirect action of some factors, such as:

- **Natural:** volcanic eruptions, fires, earthquakes, tsunamis, coastal erosions and changes in the earth's axis and climate. There is also natural air pollution caused by SO<sub>2</sub>, CO<sub>2</sub>, H<sub>2</sub>S, PM e HCL.
- **Anthropic:** air pollution, water pollution, land pollution, extraction processes, drilling and treatment of minerals, land drilling processes for hydrocarbon extraction, gas extraction, hydrogen extraction from natural deposits, extraction of rare earth minerals, creation of wells, dams, lakes, river diversion and of coastal and sea modifications, of industrial manufacturing and combustion processes, of urbanization and wild overbuilding, of waste management and disposal processes, of urban degradation, of wars, of migrations, of medical supports and therapies, of genetic modifications and future misuses of artificial intelligence. All these human processes cause air pollution, which is mainly caused by the following gases SO<sub>2</sub>, CO<sub>2</sub>, CO, PM, HCl, NO<sub>2</sub>, NO, NO<sub>3</sub>, NMHC, PAN [1,2].

Toxic substances present in the environment can reach humans mainly through inhalation, but also through contact or ingestion, causing bioaccumulation mechanisms over time in various organs or systems, which are unable to detoxify due to continuous exposure to constant and repeated polluting sources over time, causing tissue and genetic damage, with subsequent functional deficits and genetic mutations [3]. At the origin of the mechanism of toxic action of polluting substances there is always an inflammatory process, often underestimated due to mild and non-specific symptoms, which appears to be the basis of various chronic-degenerative diseases not only of tumors and of the nervous system, exacerbated sometimes from viral, bacterial or traumatic febrile episodes, characterized by the production of generic inflammatory biomarkers, which continue over time, often in a subclinical manner, becoming chronological.

The inflammatory process, which is at the basis of onco-neuro-damaging diseases, is not only caused by the threshold value of toxicity, intended as a reference data for the etiopathogenesis of the disease, but also by the duration of contact over time, even with minimal doses of pollutants that can cause possible mutation or organ damage. Often, our clinical-therapeutic approach is more easily aimed at the acute phase of the pathology, without placing

attention on the mild and repeated chronic-degenerative aspects, due to the polluted environment in which the patient lives and supported by the different bioaccumulation mechanisms level of the nervous or tumor tissue, which can more easily give rise to a harmful or degenerative pathology [4,5]. It is no coincidence that onco-neurological diseases are more present in inhabited centers with intense vehicular traffic, equipped with ports and airports with intense discharge of toxic gases, as well as industrial centers that release toxic substances (cancer gas) and ionizing radiation (x-rays which damage DNA with possible mutations), electromagnetic fields (non-ionizing radiation believed to be possible human carcinogens, class 2B) which can cause various clinical problems such as insomnia, headaches, tiredness, symptoms of emotional instability, abdominal pain, cardiac arrhythmias. The analysis of these data and a correct interpretation of their modifications must be considered as reference parameters of a serious form of air pollution in an inhabited center, equipped in addition to vehicular traffic, with a port [6], an airport [7], peripheral industrial centers, where observes an increase in the incidence of pathologies with environmental impact, among which chronic-degenerative onco-neurological pathologies are relevant. Our objective is to make people understand that some onco-neurological pathologies must be treated not only with a specific and symptomatic therapy, but also with the dosage of toxic substances, since the problems of suicidal risk can be related to a lack of self-management or self-control for damage neurotoxicants from toxic substances. In fact, the bioaccumulation of toxic polluting substances in various organs supported by viral and/or bacterial and/or traumatic insults can trigger a process called low-grade chronic inflammation (L.G.C.I.) [4,5], which can represent the point of starting of chronic-degenerative pathologies also of tumor and nervous tissue.

These pathological conditions, initially silent and difficult to diagnose early [8], frequently occur in inhabited areas adjacent to sites polluted by industries that emit cancer gas (with harmful emissions of nitrogen oxides, carbon dioxide, PM 2.5 and 10 particles, of neuro-damaging metals, etc.), in places adjacent to urban centers or in urban centers equipped with ports where both cruise and merchant ships dock or with the presence of airports, with national and international flights of both passengers and cargo. For these considerations, in the most polluted areas there may be an increase in patients with symptoms sustained by general malaise, persistent tiredness, state of stress, hypersensitivity to odors, muscle pain, headache, dizziness, nausea, tachycardia, lacrimation, asthma attacks, mood disorders, depression, anxiety, cognitive disorders, memory disorders, up to multiple sclerosis, Parkinson's disease, Alzheimer's disease etc., obviously in addition to an increase in the incidence of inflammatory diseases and tumors of the respiratory tract and lungs. We can consider this correlation starting from a very extreme data which starts from psychic pathologies or in any case all those pathologies affecting the nervous system which is represented by the number of suicides. In cancer patients the suicide rate is 2.5 times higher six months after diagnosis and increases over time [9]. In Italy approximately 4000 deaths by suicide are recorded every year, 78-

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79% are men and the highest incidence is in North-East Italy and precisely in the provinces of Padania (Cremona, Padua, Venice, Treviso, Milan, Monza, for do not exclude Brescia, Genoa, etc.) [10], without forgetting Frosinone and in the South especially in Campania, central-eastern Naples-Pellegrini Hospital-Ponticelli-Barra-S.Giovanni (with intense vehicular traffic, airport and port with cargo and passenger traffic and the former petrochemical depots Kuwait -cancer gas-), western Naples (ex-Italsider plants with deposits and abandonment of asbestos, cement, and various toxic substances), Naples-interland (Casoria-Volla-Acerra-San Vitaliano), Caserta (Teverola-Aversa), which went from 12.4% of suicides in 2012 to 21.8% in 2018, today in continuous increase and decrease in age, and in the province of Salerno where there will probably be a further increase in the activation of the new airport, in addition to the port with passenger and cargo ships and vehicular traffic, as well as Avellino and its province, which has a not well-motivated excess of suicides of any age, social and economic group [11].

A lower incidence occurs in Italian island regions. Furthermore, the rate increases with age even if in the last period there has been an increase in suicides even at a young age. As mentioned previously, this problem is difficult to identify because the very non-specific symptoms are often misinterpreted, and the signs related to reduced self-management are poorly assessed and mainly the presence of neurotoxic substances in these patients is not assessed. The objective of this work is to establish which toxic substances could cause this chronic inflammatory process, how to recognize it and how to correlate it with possible psychological disorders of different entities with suicidal risk.

## Discussion

Mental disorders are often triggered by multifactorial causes linked to social and economic issues, migratory flows, financial crises and pandemics. The factors that have the greatest impact on the risk of suicide are: unemployment, precariousness, reduction of income, social distancing, loneliness or self-isolation, alcohol and drug consumption, violence, especially domestic violence if supported by problems economic and/or social, the restriction of personal freedom, the fear of getting sick or having treatments in vain, or of making loved ones sick or infecting them, the fear of having contracted cancer, the stress and burnout of professionals, especially those who carry out strenuous jobs, the lack of health services dedicated to the prevention and treatment of mental distress, as well as the lack of doctors and healthcare personnel dedicated to emergencies and these tasks. In addition to this, however, the correlation between low-grade chronic inflammation and disorders of the central nervous system and oncological diseases is becoming increasingly insistent in the scientific community, considering that patients suffering from tumors are particularly subject to these manifestations. The problem is learning to recognize this subtle and harmful syndrome which can, in the early stages, cause mild and often underestimated disorders, but which often represent the prelude to much more serious problems. Our objective is to create a correlation between environmental pollution, particularly atmospheric pollution, and

the incidence of suicidal risk problems in patients with oncological and neurodestructive diseases, placing this parameter as a reference criterion for the identification of areas at high risk of air pollution (cancer gas), highlighting the correlation between a polluted working or living environment and the bioaccumulation of toxic substances at the level of the nervous system which are the cause of damage resulting in onco-neuro-damaging diseases. We can identify a series of key elements to analyze to evaluate the correlation between pollution and neurological pathologies to improve patient treatments and even be able to predict the areas where the incidence could be greater. These are related to exposure in polluted sites which can increase the risk of oncological and neurological damage. For example, exposure to ionizing radiation and some chemical substances, such as carbon dioxide, benzene, nitrogen oxides, some neurotoxic metals (lead, aluminum, nickel, titanium, iron, phosphorus, zinc, copper, etc.), glyphosate [12], PM particles and 10, are often correlated with the onset of neurological and oncological damage. In fact, an increased incidence of the pathology has been found in areas heavily polluted by ultrafine dust (PM2.5). These pollutants can cause inflammatory changes, with a subsequent onco-neuroharmful state, which begins with L.G.C.I., a silent killer that slowly wears out the tissues and organs of our body, changing our state of health. Specifically, in the table below we highlight the substances (gases, heavy metals or other compounds) that are most present in the environment and that cause neurological problems:

There is evidence demonstrating that levels above the safety threshold in the atmosphere of PM2.5, NO and NO<sub>2</sub> have led to an increase in the incidence of depression and anxiety in the population with a greater increase in men than in women [13]. These pollutants cause oxidative and inflammatory stress in different parts of the nervous system such as the olfactory receptors, the trigeminal nerve and the circulatory system, inducing the production of pro-inflammatory cytokines and free radicals [14], damaging the blood-brain barrier and causing damage at a central level which is the point of onset of psycho-neurological problems, especially such as depression and anxiety which can then lead to much more serious problems. This inflammatory phenomenon can also manifest itself with other symptoms such as recurrent infections, frequently viral or bacterial, supported by often non-specific symptoms supported by recurrent feverish episodes, pallor, asthenia, weight loss, tiredness, night sweats, loss of appetite, headache, nausea, bruising, easy bleeding, joint pain and enlargement of the lymph nodes and sometimes of the spleen and liver. The correlation between environmental pollution, especially atmospheric pollution, and Low-grade Chronic Inflammation related to tumor or neurodegenerative diseases allows us to use this data as a reference criterion in identifying particularly polluted environments. Our considerations evaluate epidemiological data to highlight how excessive air pollution in certain areas can be closely linked to tumor or neurodegenerative diseases with suicidal manifestations. Therefore, particular attention must be paid to infections and recurrent feverish episodes in patients with suspected oncological or neurological damage, especially if they live in polluted environments [15].

Pollutant	Principal Sources	Toxic Effects
NO <sub>2</sub> Nitrogen Dioxide	Diesel engines and industrial emissions	Possible carcinogen, irritant to the respiratory tract and conjunctiva, causes chronic inflammatory damage to the central nervous system.
SO <sub>2</sub> Sulfur Dioxide	Combustion of coal, oil, and diesel	Acute and irritating cough, rhinitis, pharyngitis, headache, convulsions with cardiorespiratory failure, and chest pain.
O <sub>3</sub> Ozone	Atmosphere	Acute and irritating cough, rhinitis, pharyngitis, conjunctivitis, even at low concentrations leading to headaches, convulsions with cardiorespiratory failure, and chest pain.
CO Carbon Monoxide	Exhaust from gasoline engines	Conjunctivitis, rhinotracheitis, general psychomotor deficits, and high concentrations.
PM10-PM2.5	Industrial and vehicular exhaust gases (ships and cargo and passenger planes)	Headaches, psychomotor deficits, respiratory disorders with enhanced effects when combined with Nitrogen and Sulfur Oxides.
Ionizing Radiation and Electromagnetic Fields	Electronic devices such as mobile phones, computers, and household appliances. Radon, UV rays, X-rays, and gamma rays.	Oxidative damage with premature aging, blockage of cellular metabolism, increased permeability of the blood-brain barrier, reduction of melatonin, antioxidant, regulator of circadian rhythm and sleep patterns leading to insomnia and neoplasms, alterations in glucose metabolism, production of stress molecules with subsequent inflammation of organs and systems.
Aluminum	Medicine and Food Containers	Degenerative encephalopathies, including memory loss (possible correlation with Alzheimer's disease), neurofibrillary degeneration.
Arsenic	Pesticides, insecticides, in metal alloys, cosmetics, dentistry, chemotherapy	Vasodilation, accumulates in leukocytes, causes abdominal pain, diarrhea, vomiting, exfoliative dermatitis, hyperkeratosis, cirrhosis, arterial hypertension, cutaneous, and pulmonary tumors.
Cadmium	Meat, fish, shellfish, cereals, vegetables, fruits	Damage to the central nervous system, psychological disorders, anxiety, fatigue, depression, as well as osteomalacia, hypertension, and heart disease.
Mercury	Industrial effluents, incinerators, in thermometers, barometers, fluorescent lamps, dental amalgam, vaccine preservative, present in many fish	Damage to brain functions, including prenatal in pregnant women with neonatal malformations, ataxia, and neurological deficits.
Lead	Aqueduct pipes, gasoline, food containers, various industrial products, especially for welding	Cognitive delays with feeding difficulties, speech difficulties, refusal of group games, learning deficits, hyperactivity, persistent drooling, impulsivity, delayed appearance of smiling, epileptic crises, muscular deficits, infantile encephalopathies (autism), senile neurodegeneration.
Barium	candles for internal combustion engines, fireworks and fluorescent lamps	Alters nervous reflexes and has an inflammatory action on nervous tissue
PCB	Hydraulic systems and heat exchangers, paints, plastic materials	Memory loss, anxiety, fatigue, depression, impotence.
Glyphosate	Pesticides	Linked to the development of neurological diseases such as Parkinson's disease, altering neuronal growth and myelin sheath growth, neurotransmission with oxidative stress for neuro-inflammation, and mitochondrial dysfunction with necrosis of nerve cells.

Our considerations evaluate epidemiological data to highlight how excessive air pollution in certain areas can be closely linked to tumor or neurodegenerative diseases with suicidal manifestations. Therefore, particular attention must be paid to infections and recurrent feverish episodes in patients with suspected oncological or neurological damage, especially if they live in polluted environments. For this reason, this clinical condition must immediately be investigated not only with specific clinical-diagnostic tests, but above all it may be useful to dose not only in the blood, but also in the various biological matrices, some toxic substances such as benzene, nitrogen oxides, glyphosate and some heavy metals (lead, aluminum, nickel, titanium, iron, phosphorus, zinc, copper, etc.), dioxins and PCBs which, as mentioned, affect the functionality of the nervous system, but also the success of ongoing therapeutic programs [16]. The inflammatory process and

the action of air pollutants also act on the immune system which has the ability to recognize and control modified cells, thus reducing the risk of developing oncological or neurological damage. On the other hand, a lack of early exposure to common infections could compromise the proper development of the immune system [10]. The role of the immune system in the development of oncological and neurological lesions is not well understood. Some studies suggest that genetic changes to the immune system in tumors may contribute to the failure of cellular immune surveillance, which allows mutated cells to proliferate.

### Conclusion

In conclusion, industrialization and technological progress have brought social well-being and economic growth but have also been the cause of an increase in the disposal of toxic waste by

petrochemical and chemical industries, those that produce paints, fertilizers and pesticides, but mainly those that produce and process plastic material. All these substances are the main cause of environmental pollution due to the spillage of toxic waste into the air, on the soil, in the subsoil, in sewage discharges, in aquifers, in rivers, in lakes in the seas etc. The increases in atmospheric particulate matter are mainly related to vehicular traffic, cancer gases from factories and coal-fired power plants, domestic heating, airline flights and the presence of both cargo and passenger ships, in cities with ports and airports, as well as agri-food and livestock industries. It could be useful, for example, to evaluate the role of some foods (both of vegetal and animal origin), as well as some clothes worn, especially by younger people, such as nylon, acrylic, polyester with phthalates, etc., all petroleum derivatives, which may contain, in addition to the many toxic substances, also dyes which, if absorbed, can cause allergic reactions, skin or organ inflammation and can interfere with the endocrine system of our body (fertility, obesity, diabetes, asthma, heart disease, etc.), to evaluate a possible bioaccumulation in some organs of these toxic substances or their metabolites, evaluating the harmful effects or diseases related to them. In fact, low-grade chronic inflammation from air pollution can be the cause of onco-neuro-harmful pathologies with suicidal risk. It has its origins in the air pollution-illness combination which we can highlight in the evaluation of polluting sources in the air we breathe, due to the presence in addition to pollutants from vehicular traffic, also from ports and airports, from cancer gas industries, adjacent to population centers. In fact, it is necessary to evaluate the presence of toxic substances in the atmospheric matrix, but also an appropriate qualitative and quantitative evaluation of toxic substances in the various human matrices, to discover any clinically silent neurological or oncological diseases linked to the L.G.C.I. This would allow the development of primary and secondary prevention measures in areas at risk of air pollution. Biomonitoring is a useful and well-validated tool for evaluating the individual accumulation of pollutants and the related risk of possible neurodegenerative and oncological diseases. Obviously, the analysis methodologies, the control of the procedures and calibrations of the substances are also fundamental for a fair and appropriate environmental recovery program. The populations and matrices must be selected based on specific objectives and scientific criteria and within the context of adequately structured study protocols, preferably born from participatory processes involving communities, researchers, but mainly institutions. Obviously, the results obtainable with monitoring are currently correlated to the resources available (funding, availability of laboratories and competent researchers). The commitment of scientific and political organizations, but also of the health system, the academic world and research should be aimed at protecting the health of inhabitants and promoting the prevention of diseases and the remediation of polluted environments. In particularly polluted places, personalized, predictive, preventive, participatory medicine must be introduced, with the collection of clinical, diagnostic, genetic, molecular data and with a multipurpose clinical approach, which involves all health guardians, from epidemiologists to general practitioners,

to different clinical and diagnostic specialists, to allow prevention programs for the various pathologies occurring in that place in order to implement preventive medicine with participation and global consensus. Unfortunately, the genotoxic damage from exposure in polluted environments both at the level of DNA and to the replication mechanisms, which can be assessed or predicted is a fundamental element for verifying the extent and irreversibility of the possible risks caused by various toxic substances which is not always easy to evaluate.

In conclusion, the increase in suicides in inhabited centers equipped with ports, airports, intense city traffic and industrial centers may be the pathognomonic sign of a serious form of air pollution, for which both adults and young people suffering from ongoing oncological or neurological pathology, a possible suicidal risk linked to anxiety-depressive forms, due to uncertainty and loss of hope for a better future, must also be analyzed. Therefore, environmental pollution, particularly atmospheric pollution, can cause onco-neuro-damage with possible suicidal risk, creating an extremely uncertain and harmful future for our children, giving them false certainties and hopes about environmental pollution, causing harmful illusions (Principle of the false and the deluded - of the uncertain and of damage from environmental pollution) - P. Ruffolo.

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