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Open Schools Journal for Open Science

# Air Pollution: What are perspectives of Greek students?

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## Abstract

In this paper we analyze the causes and effects of the phenomenon of Air pollution. based on research evidence in the global scale. Our aim is to inform people about this burning issue and to propose solutions to the problem. Thus, we have asked for impact to students' community through questionnaires. The results for the resolution include our inclusiveness in the problem and our efforts to make collaborative environment with stakeholders.

## Keywords

air pollution; research; local community; global scale

## Introduction

In this paper we analyse the following research questions:

- Why was the topic of Air pollution chosen to be analyzed?
- Which are the causes of this phenomenon?
- Which are the effects of Air Pollution and how does it affect the environment and the human health?
- What is the global overview of research in Air Pollution?
- What do Greek students believe about the current situation of Air Pollution?
- What impact did this project had on our local community?

## Theoretical Framework - Analyzation of the problem

Air pollution can be defined as a change in air quality that can be characterized by measurements of chemical, biological or natural pollutants in the air. The air pollution problem is concerned with the undesirable effects which are produced by excessive atmospheric pollutants. The effects are three basic types: i) nuisance, ii) economic and iii) health [1]. Therefore, air pollution is essentially the release of pollutants that are harmful to human health and to the entire planet or abnormal increase in the proportion of certain components of the atmosphere. It is increasingly recognized that air pollution is transported on mid-latitude westerly winds from Eurasia to the Pacific Ocean basin and across to North America. This trans-Pacific pollution reaches North America and may have substantial impacts on ecosystems and climate in the entire Pacific region. Air pollution categorized into: i) Pollution of the outdoor area includes the exposure of pollutants outside the built environment. Particles produced by the burning of fossil fuels, harmful gases, soil ozone and tobacco are examples of outdoor pollution ii) Indoor pollution includes the exposure of particles, carbon oxides and other pollutants transported by indoor air or dust. Carbon monoxide gases, radon, chemicals, building materials (asbestos, formalede), allergens, tobacco, mold and pollen are examples of indoor pollution. In some cases, outdoor pollution can be turned into indoor pollution through windows and ventilation [2].

Although official efforts to control air pollution have traditionally focused on outdoor air, it is now apparent that elevated contaminant concentrations are common inside some private and public buildings. Concerns about potential public health problems due to indoor air pollution are based on evidence that urban residents typically spend more than 90 percent of their time indoors, concentrations of some contaminants are higher indoors than outdoors, and for some pollutants personal exposures are not characterized adequately by outdoor measurements. Among the more important indoor contaminants associated with health or irritation effects are passive tobacco smoke, radon decay products, carbon monoxide, nitrogen dioxide, formaldehyde, asbestos fibers, microorganisms, and aeroallergens. Efforts to assess health risks associated with indoor air pollution are limited by insufficient information about the number of people exposed, the pattern and severity of exposures, and the health consequences of exposures. An overall strategy should be developed to investigate indoor exposures, health effects, control options, and public policy alternatives [3].

Due to climate change and other factors, air pollution patterns are changing in several urbanised areas of the world, with a significant effect on respiratory health both independently and synergistically with weather conditions; climate scenarios show Europe as one of the most vulnerable regions. European studies on heatwave episodes have consistently shown a synergistic effect of air pollution and high temperatures, while the potential weather-air pollution interaction during wildfires and dust storms is unknown. Allergen patterns are also changing in response to climate change, and air pollution can modify the allergenic potential of pollens, especially in the presence of specific weather conditions. The underlying mechanisms of all these interactions are not well known; the health consequences vary from decreases in lung function to allergic diseases, new onset of diseases, exacerbation of chronic respiratory diseases, and premature death. These multidimensional climate-pollution-allergen effects need to be taken into account in estimating both climate and air pollution-related respiratory effects, in order to set up adequate policy and public health actions to face both the current and future climate and pollution challenges [4].

## Global overview of research in air pollution

In Xuan Wei County, Yunnan Province, lung cancer mortality is among China's highest and, especially in females, is more closely associated with indoor burning of "smoky" coal, as opposed to wood or "smokeless" coal, than with tobacco smoking. Indoor air samples were collected during the burning of all three fuels. In contrast to wood and smokeless coal emissions, smoky coal emission has high concentrations of submicron particles containing mutagenic organics, especially in aromatic and polar fractions. These studies suggested an etiologic link between domestic smoky coal burning and lung cancer in Xuan We [5]. Ambient (outdoor) air pollution is now recognized as an important problem, both nationally and worldwide. Our scientific understanding of the spectrum of health effects of air pollution has increased, and numerous studies are finding important health effects from air pollution at levels once considered safe. Children and infants are among the most susceptible to many of the air pollutants. In addition to associations between air pollution and respiratory symptoms, asthma exacerbations, and asthma hospitalizations, recent studies have found links between air pollution and preterm birth, infant mortality, deficits in lung growth, and possibly, development of asthma. This policy statement summarizes the recent literature linking ambient air pollution to adverse health outcomes in children and includes a perspective on the current regulatory process. The statement provides advice to pediatricians on how to integrate issues regarding air quality and health into patient education and children's environmental health advocacy and concludes with recommendations to the government on promotion of effective air-pollution policies to ensure protection of children's health [6]. Traffic-related air pollution exposure (particulate matter (PM), soot and nitrogen dioxide (NO2)) has been associated with premature skin aging in several independent cohorts. In real life, human skin is additionally exposed to UV radiation, which is known for its effects on premature skin aging. More recent epidemiological findings suggest that (1) associations of PM can be altered by UV radiation with stronger PM associations at lower levels of UV, and (2) there is an association of tropospheric ozone with wrinkle formation, independent of NO2, PM, and UV. The association between traffic-related air pollution and skin aging has been well-established. More recent epidemiological studies focused on the associations with ozone as well as interactions with of ambient air pollution with UV radiation, a research area that is becoming more important with the increase of global warming [7].

The impact of global air pollution on climate and the environment is a new focus in atmospheric science. Intercontinental transport and hemispheric air pollution by ozone jeopardize agricultural and natural ecosystems worldwide and have a strong effect on climate. Aerosols, which are spread globally but have a strong regional imbalance, change global climate through their direct and indirect effects on radiative forcing. In the 1990s, nitrogen oxide emissions from Asia surpassed those from North America and Europe and should continue to exceed them for decades. International initiatives to mitigate global air pollution require participation from both developed and developing countries [8].

The Relationship Between the Actual Level of Air Pollution and Residents' Concern about Air Pollution:

Researchers in Shanghai of China explored the relationship between the actual level of air pollution and residents' concern about air pollution. The actual air pollution level was measured by the air quality index (AQI) reported by environmental monitoring stations, while residents' concern about air pollution was reflected by the Baidu index using the Internet search engine keywords "Shanghai air quality". On the basis of the daily data of 2068 days for the city of Shanghai in China over the period between 2

December 2013 and 31 July 2019, a vector autoregression (VAR) model was built for empirical analysis. Estimation results provided three interesting findings. (1) Local residents perceived the deprivation of air quality and expressed their concern on air pollution quickly, within the day on which the air quality index rose. (2) A decline in air quality in another major city, such as Beijing, also raised the concern of Shanghai residents about local air quality. (3) A rise in Shanghai residents' concern had a beneficial impact on air quality improvement. This study implied that people really cared much about local air quality, and it was beneficial to inform more residents about the situation of local air quality and the risks associated with air pollution [11].

### Survey on deaths caused by air pollution

Despite some advances, poor air quality in Europe persists, even in high-income countries. According to the latest report from the European Environmental Agency (EEA), more than 500000 people died in Europe in 2015 due to air pollution [1]. This corresponds to about one sixth of all deaths related to air pollution in the world. The EEA data take into account deaths caused by PM2.5 (particulate material with less than 2.5 μm in diameter), NO2 and ozone. Particulate material has been recognized as the main risk factor associated to air pollution. About 83% of all deaths related to air pollution in Europe in 2015 were attributed to PM2,5, 14% to NO2 and the remaining deaths were attributed to ozone. An analysis of the countries with more deaths attributed to air pollution reveals that Italy, Germany, Poland, France and UK, in this order, are at the top of the list. Spain, Romania, Bulgaria, Greece and Hungary complete the 10 countries with more deaths caused by air pollution. If we look at the countries with higher death rates, the list changes considerably, including Eastern and Southern European countries as the leading ones, with Kosovo, Bulgaria, Serbia, Macedonia and Hungary at the top of the list and also includes Italy, Greece, Romania, Poland and Croatia. These data show that despite stricter rules for car emissions, there are unjustifiable high numbers of deaths related to air pollution in many European countries. The annual mean PM 2.5 levels for most of the countries with higher death rates are close to or twice as high as the WHO recommended levels of 10 μg/cm$^3$, except UK, show PM2.5 levels above this limit [10]

## Research methodology and methodological design

During our research, it was necessary not only to get information about Air Pollution from scientific references, but to understand young people's perspective on this phenomenon. Thus, we created a questionnaire for this specific reason and afterwards analyzed the answers. This experiential way enabled us to deepen the causes of the phenomenon and fully acknowledge what it needs to be done in order to alleviate Air Pollution. More specifically:

- The sample of the questionnaire was taken from the 10$^{th}$ year of Evangelical School of Smyrna. 50 16-year-old students were asked to participate in this activity and express their opinion on the topic of Air Pollution. With a great percentage of responses 45 students eventually answered to the questionnaire and helped us to analyze deeper this phenomenon.

- During our analysis, we chose to send the questionnaire to our peers because we wanted to see the corresponding opinions of 16-year olds who have not gathered as much information as we have.

- We chose the method of questionnaire in order to analyze Air Pollution after much consideration. Firstly, online questionnaires are a fun and easy way to gather samples for the project. With a great percentage of people responding, we confirmed our previous hypothesis.

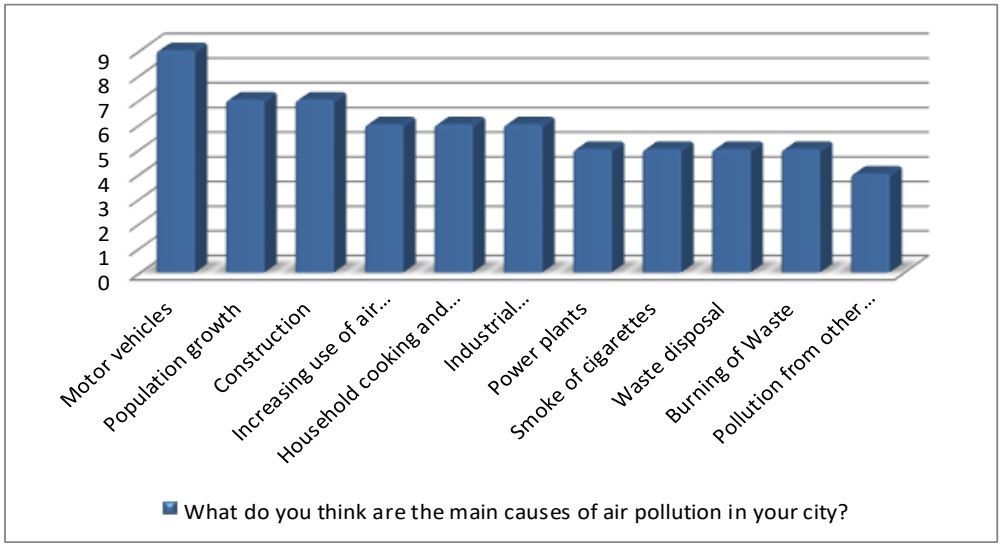
- As we fully acknowledge, there were some restrictions concerning the sample of the questionnaire. Had we given the chance, we would send the questionnaire to more people and include all ages in order to be more aware of the opinions of other people in the topic of Air Pollution. However, the great percentage of our peers who responded and expressed their opinion, we were able to understand how much they are concerned about this issue and how willing they are to try and change the current situation.

- As previously said, the aim of the questionnaire was to enable us to deepen the causes of the phenomenon and fully acknowledge what it needs to be done in order to alleviate Air Pollution. Thus, we asked them questions such as which are the causes that provoke Air Pollution, how much they believe they are affected by it, how many people die annually from it, how they would characterize the air quality of their city comparatively to the previous year and finally how optimistic they are about the air quality of the following years. These questions were chosen carefully as we tried to capture everyone's personal opinion about this topic. In addition, the questions were asked in a specific way. Firstly, we decided to ask them more general questions related to Air Pollution(causes), and as the situation progressed, we asked them more personal questions referring to their optimism about the future. Meanwhile we understood whether they were concerned about the air quality of their city or not. Moreover, the sample was asked to answer monosyllabic and we used the method of not two but multiple choices. After the conduction of this activity we used the internet site “Survey Monkey” and gathered the responses. Finally, with the use of “Microsoft Words” we represented graphically their answers in order to be easier to understand by the public.

## Results

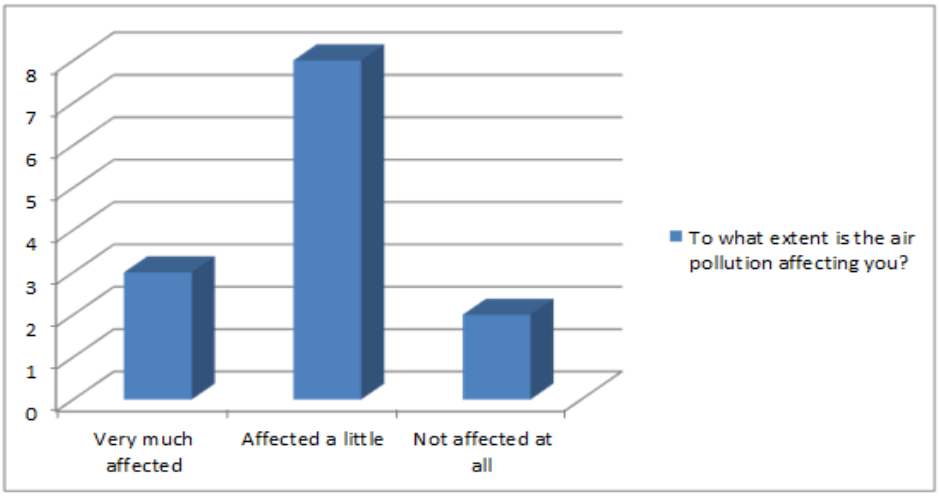
Analyzing the responses, we understand that students are relatively aware of the issue of air pollution. However, they ignore the number of people killed (per year) from air pollution and believe that the situation will not improve in the next few years. Analytically:

1)




By the question 'what do you think are the main cause of air pollution in your country'we understand that young people are informed about the main causes of Air Pollution, without being said that they are willing to change something about it.

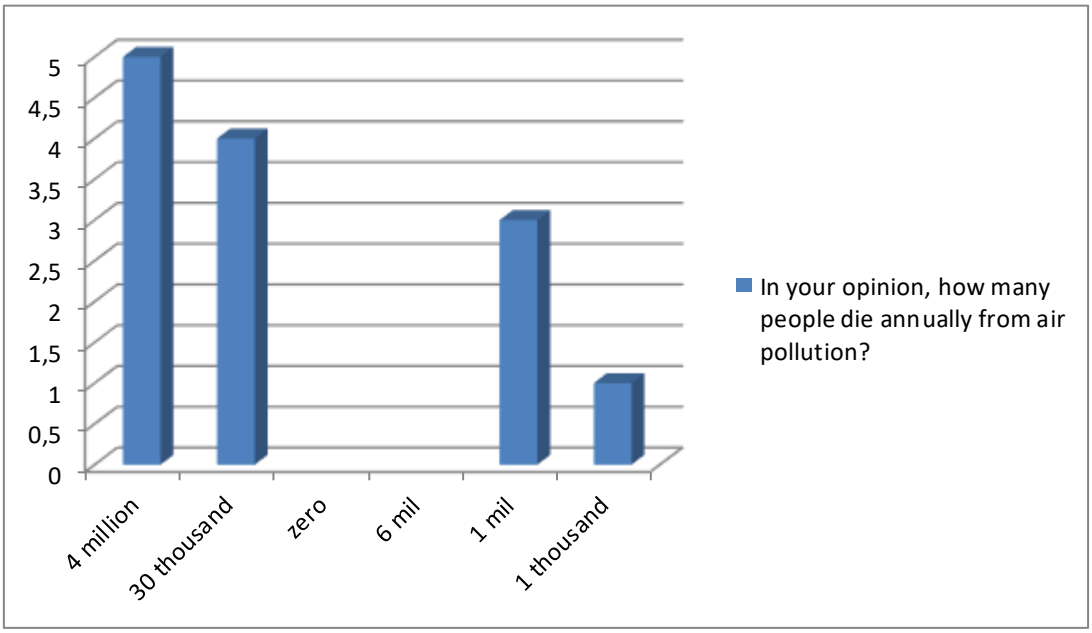
2)




By the question 'to what extent is the air pollution affecting you', we understand that young people are not fully aware of the consequences of Air Pollution, so they believe that they are affected a little by it.

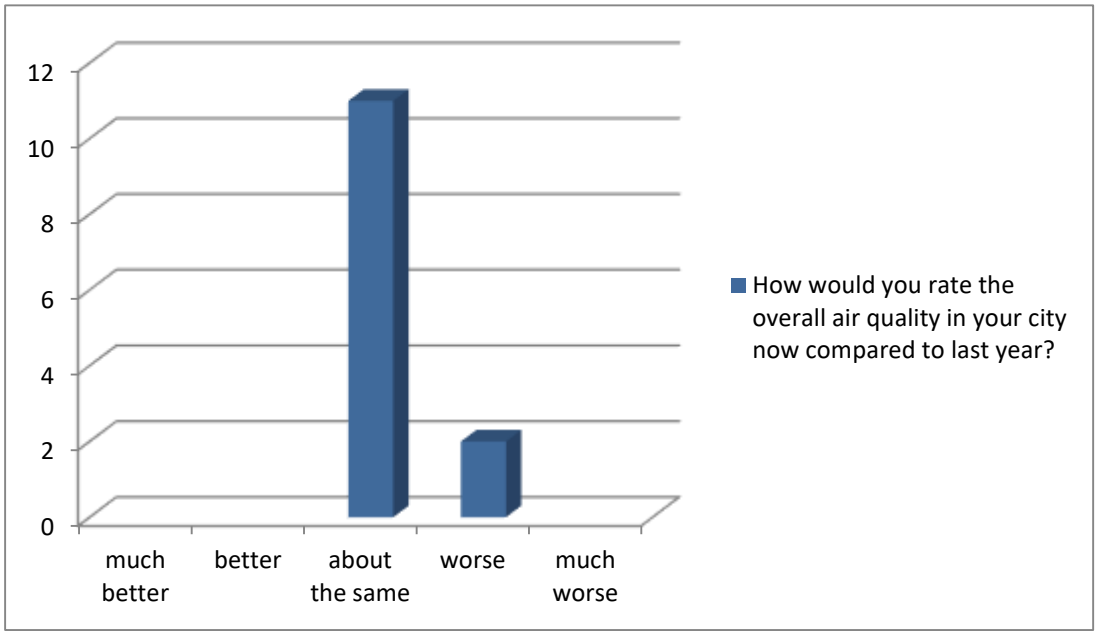
This is a common yet very serious mistake because the health of every single person is greatly affected by the quality of the air in their city.

3)



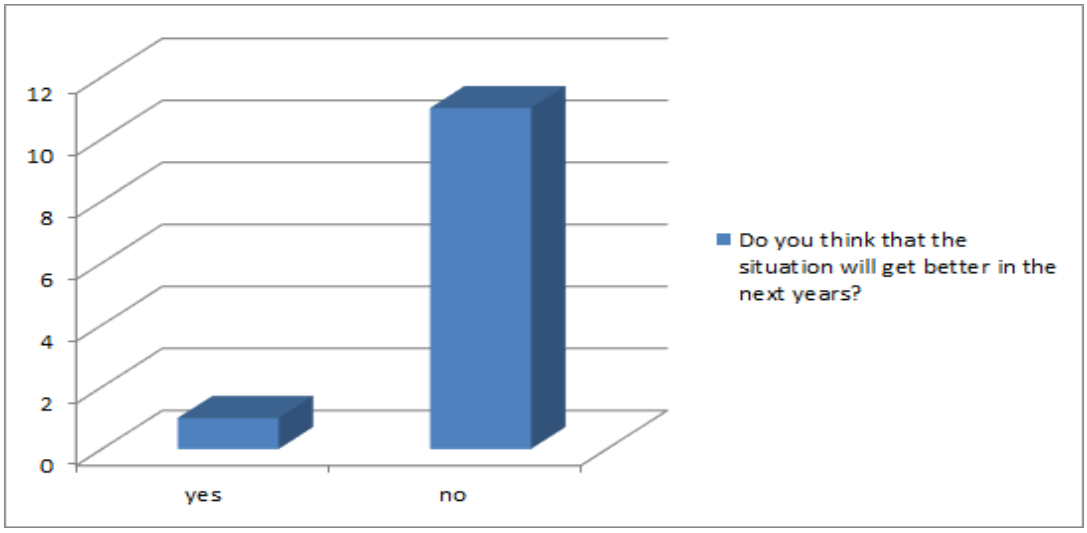

By the question 'how many people die annually from air pollution', we compared with the correct answer '6 million people die annually from Air Pollution'. Throughout the sample not even one student answered correctly, which was very disappointing. However, the most common answer was 4 million deaths, which was the closest answer to the correct one.

4)




As we know, through human actions, air quality worsens every year. Thus, the greater percentage answered false this question as they believed that it is about the same. However, no one answered irrationally by choosing “better” or “much better” so this is a sign that young people are informed generally about the issue of Air Pollution.

5)




Last but not least, the greater percentage of the sample was not optimistic referring to the future of air quality. In other words, young people are convinced that adults are not willing to do anything drastic to change the current situation and neither are them. However, we must acknowledge that the sample had never been informed properly about the issue of Air Pollution, and do not know how to help alleviate it, so their answer can be justified.

## Conclusion

### Discussion – Our influence on the local community

One of the main reasons we have chosen the issue of Air Pollution was the impact it has on our society. Air pollution concerns not only one social group, but all of us as it affects health of all citizens. That is why we have been in contact with the National Weather Service of Greece and we discussed with them effects of air pollution on weather events pf Athens. In addition, we have contacted the world health organization so that we fully understand the effects of air pollution on the health of the Human. From the above, therefore, we understand that the atmospheric pollution is a burning issue and affects excessive our society.

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