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The Relationship Between Emission by Transportation and Public Health

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Abstract: Nowadays climate change is a very popular topic for discussion, which is strongly connected to human's life. For example, the continuous temperature increase causes the increase death rate due to high temperature weather. The extreme weather like typhoon cause catastrophic disaster. The emission by transportations takes a large part of the global emission. It is one of the human activities which consume a large amount of energy and it is reasonable believed it is one of the factors that affect human's health condition. The pollutants emitted by transportations not only influence the possibility of getting diseases, but also affect the birth rate and mortality of human society, which even leads to a series of social problems. This article aims for discussing the relationship between emission by transportations and people's health. The investigation takes asthma as an example of disease and reasearching the relationship between the prevalence of astham, death rate and the emission by transportations in Europe. The result for the investigation discovered as the decline of pollutants emitted by transportations, the prevalence of asthma which caused by pollutants are significantly decreasing in EU in a period of time due to the introduction of government policy in EU. However, the death rate of asthma is not significantly influenced by the emission of transportations.

Keywords: emission, climate change, asthma, government policy

1. Introduction

The paper investigates the emission by transportations that influence global environment and human's health. With the increasing of global population, environmental problems become serious. Industrial production and human activity have produced a large amount of toxic substance and greenhouse gases. Transportation is one of the human activities that takes a large proportion of emission and it is the easiest part to reduce such great amount of emission. For example, government could introduce policies which limit the production of vehicles with internal combustion engine and encourage the production of electric vehicles. Furthermore, government should support other technologies which helps to reduce air pollution. Even there are lots of agencies and organizations have already research on the reduction of air pollution. However, most of the research only focus on carbon emission by human activities, which not include other pollutants and the proportionality of emission by all kinds of transportation. The investigation will focus on other pollutants and carbon dioxide which influence global environment and people's health condition. The summarization of data of pollutants emitted by transportations would be introduced in the paper to help the investigation. The illnesses cause by

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pollutants also will be investigated and figure out the relationship between the production of pollutants [1]. This paper only focuses on asthma due to it is a kind of disease which is sensitive to the change of environment. The data using in the analysis is collected by other agencies. By making comparison and find out the relationship between the emission by transportations and the prevalence of asthma. It is concluded the limitation for emission by transportation does help to reduce the prevalence of asthma. At the same time, the mortality of asthma also being investigated. However, the introduction of limitation for transportation does not have significant influence to the death rate of asthma, further investigations are required.

2. Background Description

Transportation account 15% of global carbon emission. It is the fourth largest part in the world produce greenhouse gases, that 95% of transportation using fossil fuel[1]. As the Health in the green economy stated transport-related air pollutants includes small particles matters (PM) like those which the diameter is smaller or equal than 10 micrometer and 2.5 micrometer. These particles are able to deep in the respiratory system and it contain composition includes heavy metals, sulfurs and carcinogens. Another two pollutants emitted by transportation are carbon dioxide and nitrogen oxides (CO_2, NOx). Which may cardiovascular disease and the reduction of lung function, respectively. The negative effect of pollutants has made a great contribution to the high death rate [2]. According to the study of ambient outdoor air pollution, in 2019, 37% premature deaths were related to air pollution. 18% of deaths were caused by chronic obstructive pulmonary disease and 23% of deaths were causing by acute lower respiratory infections [3]. The World health organization claimed 1/3 people dead from stroke, lung cancer and heart disease were caused by air pollution. With the increasing of global population, the amount of transportation will be demanded greater than history. Based on the survey, there are 1.474 billion cars on the planet which increase 12% since 2016, whereas the population increase 1.19% from 2016 to 2023.

2.1. Commerical Aviation

Based on the research of aviation to the climate impact, the air transportation is the part which grown dramatically in the globe. In 2017, the number of passengers it transported were over 4 billion. In terms of the emission, aviation transport has contributed 5% of climate change in human activities. The pollutants which are generate by this sector are carbon dioxide, nitrogen oxides, sulphate aerosols and compound which is not burnt completely [4]. Carbon dioxide is a kind of greenhouse gas which directly cause the global warming and the nitrogen oxides cause the greenhouse gas indirectly.

2.2. Road Transportaion

Cars, Buses and train are the most common road transportations nowadays. Between 2016 to 2023, the number of cars has increase around 12%. With such huge number increase of cars, the carbon dioxide emission also increased dramatically[2]. However, it dropped to 3 billion tons in 2020 due to the pandemic, but still equal to the amount of Carbon dioxide emission in 2015 and 2016. The data collected by international energy agency shows the number of electric vehicle sales globally. Between 2011 to 2022, even the number of EV sales and the market share of EV increase continuously[3]. It did not stop the increment of carbon footprint. Another research shows that, the emission of toxic substance is greatly reduced since the introduction of strict emission standard. The NOx emission by light duty and heavy-duty vehicle in US and EU has reduced 60 to 80% since 1990 [5].

[1] Source: https://www.un.org/
[2] Source: Carbon dioxide emissions from passenger cars worldwide from 2000 to 2020, www.statista.com
[3] Source: IEA, Global electric car sales by key markets 2010-2020

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3. Analysis

The analysis mainly uses the data of emission by transportations, percentage of prevalence of asthma and the death rate of asthma collected in between 1990 to 2019.

3.1. Negative Externality of Climate Change

Climate change refers to the change of temperature and form of weather in a long period of time. Transportation is a kind of human activity which generate a large amount of greenhouse gases, which the exceed generation of greenhouse gases cause the arise of temperature in the planet [6,7]. For example, commercial aviation produces most carbon emission compares to other form of transportations. Furthermore, the nitrogen oxide could react with hydroxyl radical and the ozone formed. The more nitrogen oxides emitted, the less methane concentration. If the equilibrium concentration were shift, the radiative forcing changed and cause the warming [8]. The climate change cause by transportations affects people's health, the research shows that the climate change will impact the biological system and the living environment of human. Meanwhile, it could increase the possibility of getting infect the respiratory diseases [9]. As the increase of percentage of respiratory diseases, those household with patient will be stressful for consuming money on the medical support. The large amount of patient also influences the government, it could make a huge impact to the medical system. Since the quantity demanded of doctors and medicine are quite large, forcing the shift of medical resources to concerning about respiratory health. In the UK, the total cost of asthma has been estimated roughly 5 billion US dollars. Countries with developed medical system, most of health services are free of charge. To ensure the people get cured from the respiratory diseases, government are required to spend the tax revenue to the health services. Instead of other component, like education, house benefits, which possibly slow pace down of development in the area, the immigration may happen.

3.2. Asthma

In the investigation asthma will be an example for researching the relationship between the emission of transportations and people's health. Asthma is a kind of respiratory diseases which is actively responds to the change of environment [10]. The main cause of the disease is the small particulate emitted by transportations, as it is extremely easy to enter the respiratory system. At the same time, the prevalence of asthma is easy to detect and statistics.

3.2.1. The Prevalence of Asthma

Table 1 below shows the change of percentage of prevalence of asthma between 1990 to 2019 in five European countries[4].

Table 1: The precentage of prevalence of Asthma in 1990 and 2019.

Country	1990	2019
United Kingdom	14.3%	9.2%
France	9.7%	6.6%
Germany	7%	4.2%
Italy	5.8%	4%
Sweden	11.4%	7.6%

Source: IHME, Global Burden of Disease, www.ourworldindata.org

[4] Source: ourworldindata.org

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These countries have strong industrial foundation on producing road transportations and aircraft. Also take a large percentage of population. Obviously, the tendency of the asthma prevalence is decreasing.

3.3. EU Emission Standard on Road Transportation

In order to reduce the carbon emission and greenhouse gases, the government start to introduce regulation to limit the emission by transportations. EU emission standard[5] is an example for the government react to the climate change.

The European emission standard first introduced in 1993. It is used for limiting the emission by road transportations including light and heavy-duty vehicles. As show in the Table 2, it became stricter in the past two decades. Theoretically, compared to Euro 1, the PM emitted by diesel gram per kilometer decrease by 96% in Euro 6. In terms of NOx emission, 60% and 84% reduction by petrol and diesel engine respectively. The number is calculated from Euro 3, previous data was the combination of Hydrocarbon (HC) and NOx. The EU emission standard greatly pushing the technology of controlling the emission of road transportations. For example, cars manufactures are more willing to invest on developing highly efficient engine. The introduction of new emission standard not only reduce the emission, but also encourage the development of new technologies. However, the EU emission standard did not regulate the emission of carbon dioxide.

Table 2: The European emission standard.

Stage	Year of introduction	Petrol HC+ NOx (g/km)	Petrol PM (g/km)	Diesel HC+NOx(g/km)	Diesel PM(g/km)
Euro 1	1993	0.97	No limit	0.97	0.14
Euro 2	1997	0.5	No limit	0.5	0.08
Euro 3	2001	0.15(NOx)	No limit	0.5(NOx)	0.05
Euro 4	2006	0.08	No limit	0.25	0.025
Euro 5	2011	0.06	0.005	0.18	0.005
Euro 6	2015	0.06	0.005	0.08	0.005

Source: TransportPolicy.net

4. The Cost of Asthma vs. the Cost of Govern the Environment

As mentioned previously, the climate change are causes by emission of greenhouse gases. The research has already indicated the climate change will increase the allergen and may result in high prevalence rate of asthma. Another research shown the asthma is extremely common among children, the prevalence rate is 9.4% in Europe. The direct cost and indirect cost for societies is enormous, which is 20 billion Euro and 14 billion Euro respectively [11]. Compared to the government spending on the health care for treating the asthma, the government expenditure on environmental protection is much cheaper. The statistic of the percentage of government expenditure in reduction of pollutant in EU is around 0.13% account for the total GDP. That would be 18 billion Euro, which is less than the cost of asthma[6]. The study indicated the asthma death rate has greatly reduced in the past decade worldwide [12]. However, it is not related to the reduction of emission by transportations. Instead, related to the medical reasons. Since the phenomenon is significant in the high-income group, whereas the patient in low-income group has a little change.

[5] Source: EU: Heavy-duty: Emissions, www.transportpolicy.net
[6] Source: Government expenditure on health, www.ec.europa.eu

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5. Suggestion

The result of the study is obvious, the prevalence of the asthma is positively related to the emission by transportations. As the decrease of number of pollutants in the atmosphere, the less percentage of prevalence rate. With that conclusion, the study would suggest countries or cities relatively developed can mobilize the administrative forces and try to introduce such regulation as European union. Not only to control the emission of carbon dioxide preventing global warming, but also reduce the prevalence rate of the respiratory diseases. Even reduce the pressure of public health service for those area with high prevalence rate and death rate of respiratory diseases. However, for developing and third-world countries. Transportations play an important role in the development. Lacking of technology and capital are the main difficulty to control the emission. In this case, government could put more resource on researching the diseases and building hospital to provide better public medical support. Promoting the zero emission is vital for developed countries, since climate change is an indirect factor which cause high prevalence rate. The reduction of carbon footprint is helpful. Based on the result of the study, government should support local automobile manufacture investing and producing zero-emission vehicles for decarbonization. At the same time, it is necessary to encourage people buying those vehicles by paying subsidy to the manufacture. Other than that, the public transportation in the city could be electrified. The estimation of bus electrification can reduce 80% of carbon emission by 2050 [13].

6. Conclusion

The percentage of prevalence of asthma is decreasing after the introduction of EU emission standard, which indicated the it is positively related to the emission by transportations. The implement of EU emission standard is effective for the reduction of prevalence rate of asthma. In terms of the mortality of asthma, previous research has shown it is little related to the emission by transportations. It is more likely related to the quality of medical support. In last section of the analysis, the study suggests have following suggestion. First, other areas around the world which has high prevalence rate respiratory disease could introduce such regulations as European union. Second, government should put more consideration on building the infrastructure and improving the quality of public health services in developing countries, in order to reduce the mortality and birth rate. Third, electrified the transportations, government could encourage people purchasing electric vehicle and replace the internal combustion engine buses into electric bus.

However, the research has limitation which it only considered the pollutants and Carbon emission produced by public transportations, whereas other industries are not being considered, for example, agricultural and electricity generation. Those industries also produce great amount of greenhouse gasses and CO, NOx. The significant reduction of prevalence of the diseases may also related to those industries. Furthermore, only asthma is taken as an example of respiratory disease in the study. Further study of other respiratory diseases is required.

References

[1] *World Health Organization, Health in the green economy. p21-23.*

[2] *World Health organization, Ambient(outdoor) air pollution. Retrieved from http://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health*

[3] *Grewe, V., Gangoli Rao, A., Grönstedt, T., Xisto, C., Linke, F., Melkert, J., Middel, J., Ohlenforst, B., Blakey, S., Christie, S. and Matthes, S., (2021). Evaluating the climate impact of aviation emission scenarios towards the Paris agreement including COVID-19 effects. Nature Communications, 12(1), p.3841.*

[4] *Worldwide number of battery electric vehicles in use from 2016 to 2022. Retrieved from https://www.statista.com/statistics/270603/worldwide-number-of-hybrid-and-electric-vehicles-since-2009/*

DOI: 10.54254/2754-1169/52/20230715

[5] *Winkler, S.L., Anderson, J.E., Garza, L., Ruona, W.C., Vogt, R. and Willington, T.J.(2018). Climate and Atmospheric Science. Vehicle Criteria pollutant (PM, NOx, CO, HCs) emissions: how low should we go?, 26.*

[6] *United Nations(2020). What is climate change? Retrieved from https://www.un.org/en/climatechange/what-is-climate-change*

[7] *Hannah Ritchie, Max Roser and Pablo Rosado (2020) - "CO_2 and Greenhouse Gas Emissions". Retrieved from https://ourworldindata.org/co2-and-greenhouse-gas-emissions*

[8] *Stefan, G., Andreas, H., (2020). The global scale, distribution and growth of aviation: Implications for climate change, Global Environmental Change, 65, p.1-12*

[9] *D'Amato, G., Cecchi, L., D'Amato, M., and Annesi-Maesano, I. (2014). European respiratory update environment lung disease. Climate change and respiratory diseases. 161-169.*

[10] *Olof, S., Maciej, K., Piotr, K., Piotr, Ł., Jean, B., David, B., Susanna, P., Javier, C., Mark, F., Gunilla, H., Sebastian, LJ., Renaud, L., Leanne, M., Samantha, W., Antonio, MG., Nikolaos, G, P., José, RP., Pippa, P and Tari, H., (2014). Asthma and allergy. National and regional asthma programmes in Europe, 24, p474-483.*

[11] *Carlos, N., Ana, M, P.,and Mário, MA. (2017). Asthma Research and Practice. Asthma costs and social impact.*

[12] *Gennaro D'Amato, Lorenzo Cecchi, Mariella D'Amato, Isabella Annesi-Maesano. Climate change and respiratory diseases(2014). European Respiratory Review, 23 (132) 161-169*

[13] *Kelly, B.(2017). Accelerating Bus Electrification: Enabling a sustainable transition to low carbon transportation systems, 143, p.7*