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A survey on the effects of vehicle emissions on human health in Chidambaram town

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Abstract:- Vehicular emissions generally include oxides of nitrogen, sulphur, carbon hydrocarbon, mercury and leads. The effects of vehicular emissions on human health, vegetations, and environments were investigated in four locations of Chidambaram (East Car Street, West car street, North Car Street and south car street junctions). The investigation was carried out with the use of questionnaires and High volume sampler. The experiments were conducted on air samples collected from each location to determine the level of CO, NO_X,SO_2 and SPM. The results obtained from questionnaire show that on the average, 71%, 39.5%, 64.5%, 26%, 47% were respectively affected by sleeplessness, running nose, eye irritation, asthmatic attack, and headache respectively. Chidambaram town is suffering from poor air quality, mostly because of vehicular emissions or fumes. Air pollution caused by existing vehicle emission is known to have already contributed to an increase in asthma, acute respiratory diseases and even sometimes resulted in death. This study aims at assessing the effects public health relating to vehicular emissions in Chidambaram. Primary data was collected using questionnaires and oral interviews on the trend of vehicle ownership between November-December (2012) to January-February (2013). Vehicle emissions are a significant contributor to ambient pollution, especially in urban areas. Monitoring of ambient hourly concentrations of CO, NO_x, Spm and SO_2 took place at four major junctions in Chidambaram during morning, low-traffic hours and during afternoon, high-traffic hours. Concentrations of NO_x were alarmingly high in all locations tested. Carbon monoxide concentrations were also high. Concentrations of both CO and NO_x were significantly higher during the afternoon than during the morning. Air quality crisis in cities is mainly due to vehicular emissions. The effect of vehicular emission on urban air quality and human health has been described. Recommendations were made to reduce vehicular emission in the study area.

Keywords:- Vehicular emissions, illness, Public Health, Traffic Related Air Pollution Diseases, Emission inventory, driving patterns.

ABBREVIATIONS & ACRONYMSBBREVIATIONS

CO	: Carbon Monoxide
CO_2	: Carbon Dioxide
HC	: Hydrocarbons
$\mu g/m^3$	: microgram per cubic meter
NAAQS	: National Ambient Air Quality Standards
NO_x	: Oxides of Nitrogen
NO_2	: Nitrogen Dioxide
O_3	: Ozone
PM	: Particle Matter
PM10	: Particle Matter less than 10 microns
PM2.5	: Particle Matter less than 2.5 microns
ppm	: Parts per million
SPM	: Suspended Particulate Matter
SO_x	: Oxides of Sulphur
SO_2	: Sulphur Dioxide

I. INTRODUCTION

Air pollution has remained a major health concern in India. In the past decades, several studies highlighted the important contribution of ambient air pollution to excess morbidity and mortality (Schwartz, 2001, Le et al., 2010). In particular, exposure to particulate air pollution has been found to be associated with increase in hospital admissions for cardiovascular and respiratory disease and mortality in many countries (Samet et al. 2000; Dockery, 2009) including India (Kumar et al., 2010; Balakrishnan et al., 2011; Rajarathnam et al., 2011). Epidemiologic studies also depicted a close link between air pollution and asthma and allergic

diseases (Kelly and Fussell, 2011). Health impact of air pollution depends on the pollutant type, its concentration in the air, length of exposure, other pollutants in the air, and individual susceptibility. Poor people, undernourished people, very young and very old, and people with pre-existing respiratory disease and other ill health are more at risk .Vichit-Vadakan et al., 2010). The ambient air of most of the Indian cities contains respirable suspended particulate matter in levels that are above the national ambient air quality standards. The most important contributor to air pollution in the cities is exhausts from petrol- and diesel-fuelled vehicles. Millions of people are exposed to this poor quality of air for years. The consequence could be adverse health effects that could be sub-clinical or overt. Despite these, little is known about the health impact of urban air pollution at the cellular and sub-cellular levels among people residing in the Indian mega cities. Against this background, this cross sectional study was undertaken to examine the health impact of air pollution in Kolkata (former Calcutta), a city with high level of air pollution from vehicular traffic.

(a) Necessity of the air pollution study

Two decades ago, most of the air pollution was due to industrial emissions and burning of fuel. But the situation has changed considerable since then. The ever increasing proliferation of automobiles would indicate that, if uncontrolled, gaseous exhaust products could increase without limit. In India, during the last four decades of progress, greater emphases has been laid on industrialization rather than motorization, yet there are strong indications that automotive vehicles are turning to be an important contributor to air pollution. Auto exhaust pollution has assumed a menacing proportion in the developing countries and its control should not be delayed any more especially in India, where its contribution is about 45% - 70% of the total air pollution in urban areas. In major Indian cities, the ambient CO levels along the roads of commercial zones have reached alarming levels indicating that though the number of vehicles in major cities is comparatively smaller, the intensity of pollutants can be compared to that of any other metropolis in the world. This can be attributed to the age of vehicles with poor maintenance, poor road conditions and lack of traffic planning. Moreover the automobiles leave the emission at the ground level resulting in greater impact on the air quality. Table I shows the Different pollutants and their emissions. TableII shows the Effects of vehicle mode on emissions.

Table I Different pollutants and their emissions

Type	Category	Examples	Pollutants
Combustion	Fuel burning transportation Refuse burning	Domestic burning, Thermal power plants, cars trucks and Railways. Open burning dumps	Sulphur oxide Nitrogen oxide Carbon monoxide Lead, smoke, organic vapours Odours etc. Fly ash and particulates
Manufacturing process	Chemical plants	Petroleum refineries. Fertilizers Cement Paper mills Ceramic and Clay products.	

TableII Effects of vehicle mode on emissions

Sl.no	Vehicle condition	Engine	Flow	Concentration		
				Hydrocarbon	Carbon monoxide	Oxides of nitrogen
1	Idle	Operating	Very low	High	High	Very low
2	Cruise					
	Low speed	Operating	Low	Low	Low	Low
	High speed	Operating	High	Very low	Very low	Moderate
3	Acceleration					
	Moderate	Operating	High	Low	Low	High
	Heavy	Operating	Very High	Moderate	High	Moderate
4	Deceleration	Operating	Very low	Very High	High	Very low
5	Soak					
	Hot	Stopped	None	-	-	-

II. PREVIOUS WORK

Vehicle emissions significantly pollute air and require control **(Karlsson, 2004).** With increasing concern for air toxics and climate modification caused by exhaust emissions, the need for tighter control increases in importance. There is therefore a great need for studies involving emission factors and impact. In recent years, there has been considerable research on vehicle emissions and fumes **(Bailey 1995; Lilley 2000; Marshall et al 2003; Ababio 2003; Cadle et al 1997, 2000-2004)**.

Carbon monoxide causes blood clotting when it reacts with haemoglobin, which cuts the supply of oxygen in the respiration system after long exposure. This is a common occurrence in urban centres with a high level of commercial activity **(Ackerman et al 2002; Gibbs et al 1995; Glen et al 1996; Johnson et al 2000).** The worst levels of pollution are seen in such urban cities as are densely populated with a low standard of living **(Addy and Pietrass 1992; Washington et al 1998).** Unfortunately, vehicle emissions present an important environmental hazard that needs to be investigated, since it may shorten the lifespan of exposed people. Research has also indicated that the depletion of ozone layer is largely due to pollution from industries and the use of automobiles. A study has also been carried out on forecasting vehicle models of operations as an impact to modelling emissions **(Washington et al 1998)**.

An extensive body of growing research is provided on experimental issues relating to vehicle emission. In a related study, an investigation was made on vehicle exhaust gas casting in a diesel emissions control system **(Addy and Pietrass 1992).** The use of intra-red and ultraviolet spectrometers to measures vehicle emission on urban air quality has also been investigated experimentally **(Gibbs et al 1995).**

Another study relates metrological variables and trends in motor vehicle emissions to monthly urban carbon monoxide **(Glen et al 1996)**. Another experimentally bared research was conducted to determine the intake fraction of primary pollutants from motor vehicle emission in the South Coast Air Basin **(Marshall et al 2003).** In two cases, the scientific behaviours and effects at unregulated emissions were studied.

Another major group of research centres on reviews of the literature on some themes on emission research. A series of is review as provided on real-world vehicle emissions in a consistent study of over 7 years **(Cadle et al 1997, 2000-2004).** An interesting review on ammonia inventory update for the South Coast Air Brain is provided **(Chitjian et al 1997).** Another interesting study on emissions relates to ammonia, motors oxide and hydrogen cyanide emissions from five passenger vehicles **(Karlsson 2004)**. Experimental of vehicles emission also include unregulated emission from three-way catalyst cars **(Bardow and Stump 1997).**

III. HEALTH EFFECTS FROM AUTOMOBILE EMISSIONS

The Emissions From Millions Of Vehicles Add Up. These Emissions Are By-Products From The Engine Combustion Process And From The Evaporation Of Fuel. Despite The Ever-Growing Number Of Vehicles On The Road, Studies Show That Ten To Thirty Percent Of Vehicles Cause The Majority Of Vehicle-Related Air Pollution. This Fact Sheet Lists Some Of The Air Pollutants Associated With Vehicle Emissions. Because Exposure To These Pollutants Can Cause Serious Health Problems, The U.S. Environmental Protection Agency Has Established Air Quality Standards To Protect Our Health.

(a) Carbon Monoxide

Carbon monoxide is a colorless, odorless, poisonous gas emitted from the vehicle's exhaust as a result of incomplete combustion. It interferes with the blood's ability to carry oxygen to the brain, heart, and other tissues. Unborn or newborn children and people with heart disease are in greatest danger from this pollutant, but even healthy people can experience headaches, fatigue and reduced reflexes due to CO exposure. Motor vehicles produce more than two-thirds of the man-made carbon monoxide in the atmosphere. Carbon monoxide reduces the volume of oxygen that enters the bloodstream and can slow reflexes, cause drowsiness, impair judgment and vision and even cause death.

(b) Hydrocarbons

Are unburned fuel vapors. When hydrocarbons and other pollutants are exposed to sunlight, a chemical reaction occurs that produces ground-level ozone (smog), which is harmful to our health and the environment. Vehicles are responsible for about 50 percent of the emissions that form ozone. Hydrocarbons are formed by incomplete fuel combustion. When combined with nitrogen oxides in the presence of sunlight, hydrocarbons produce ground-level ozone, which can irritate the eyes, damage lungs, and aggravate respiratory problems. Symptoms include coughing, shortness of breath, and decreased lung function. Many hydrocarbons are also considered hazardous air pollutants.

(c) Ozone

Ground-level ozone is the major component in what we know as smog. It is not emitted directly into the air but is produced in the atmosphere when gases called hydrocarbons combine with nitrogen oxide

compounds in the presence of sunlight. In the body, ozone reacts with lung tissue. It can inflame and cause harmful changes in breathing passages, decrease the lungs' working ability and cause coughing and chest pains. Even healthy people are found to be sensitive to ozone exposure. Ozone smog at ground level is different from the ozone layer in the upper atmosphere, which filters out harmful solar radiation. Ozone is a severe irritant. It is responsible for the choking, coughing, and stinging eyes associated with smog. Ozone damages lung tissue, aggravates respiratory disease, and makes people more susceptible to respiratory infections. Children are especially vulnerable to ozone's harmful effects, as are adults with existing disease. Even otherwise healthy individuals may experience impaired health from breathing ozone-polluted air. Elevated ozone levels also inhibit plant growth and can cause widespread damage to crops and forests. Ozone is not emitted directly. It is formed in the atmosphere through a complex set of chemical reactions involving hydrocarbons, oxides of nitrogen, and sunlight. The rate at which the reactions proceed is related to both temperature and intensity of the sunlight. Because of this, problematic ozone levels occur most frequently on hot summer afternoons.

(d) Sulfur Dioxide

Sulfur dioxide is emitted when fuel containing sulfur is burned in diesel engines. Sulfur dioxide exposure constricts air passages, creating problems for people with asthma and for young children, whose small lungs need to work harder than adults' lungs.

(e) Nitrogen Dioxide

Nitrogen dioxide and related nitrogen oxides (NOx) are produced when fuel is burned. These compounds contribute to ozone formation and are a health problem themselves. The effect of NOx exposure on the respiratory system is similar to that of ozone and sulphur dioxide. Nitrogen oxides are by-products of fuel combustion and contribute to the formation of ground-level ozone. Health effects include coughing, shortness of breath, and decreased lung function.

(f) Lead

Lead content has been reduced in gasoline. As a result, there is a significant drop in public exposure to outdoor lead pollution. Lead poisoning can reduce mental ability, damage blood, nerves, and organs, and raise blood pressure. Even small ingestions or inhalations of lead can be harmful because lead accumulates in the body.

(g) Particulate Matter

Particulate matter includes microscopic particles and tiny droplets of liquid. Because of their small size, these particles are not stopped in the nose and upper lungs by the body's natural defences but go deep into the lungs, where they may become trapped and cause irritation. Exposure to particulate matter can cause wheezing and similar symptoms in people with asthma or sensitive airways.

The health effects of diesel exhaust are both acute, from short-term exposure, and chronic, from long-term or repeated exposure. Specific health risks and their severity depend upon the amount of chemical exposed to as well as the duration of the exposure. An acute exposure to diesel exhaust could cause an irritation of the eyes, nose, throat, and lungs as well as light-headedness. Chronic exposure to diesel exhaust can have several more severe effects on human health. Human health studies demonstrate a correlation between exposure to diesel exhaust and increased lung cancer rates in occupational settings. Experimental animal inhalation studies of chronic exposure to diesel exhaust have shown that a range of doses cause varying levels of inflammation and cellular changes in the lungs. Human and laboratory studies have also provided considerable evidence that diesel exhaust is a likely carcinogen. The table III below shows the types of health effects experienced by the most common pollutants at elevated levels.

Table III The types of health effects experienced by the most common pollutants at elevated levels

Pollutant	Health effects at very high levels
Nitrogen Dioxide, Sulphur Dioxide, Ozone	These gases irritate the airways of the lungs, increasing the symptoms of those suffering from lung diseases
Particles	Fine particles can be carried deep into the lungs where they can cause inflammation and a worsening of heart and lung diseases
Carbon Monoxide	This gas prevents the uptake of oxygen by the blood. This can lead to a significant reduction in the supply of oxygen to the heart, particularly in people suffering from heart disease

The health impacts of air pollutants are numerous and varied and can become manifest in any compartment of the human body. Compartments affected include the respiratory system, immune system, skin and mucous tissues, sensory system, central and peripheral nervous system, and the cardiovascular system.

Health effects of air pollution on the respiratory system include acute and chronic changes in pulmonary function, increased incidence and prevalence of respiratory symptoms, sensitisation of airways to allergens, and exacerbation of respiratory infections such as rhinitis, sinusivitis, pneumonia, alveolitis, and legionnaires' disease. Principal agents for these health effects are the combustion products sulphur dioxide (SO_2), nitrogen dioxide (NOx), particulate matter (PM), and carbon monoxide (CO Health effects of air pollution on the skin and on mucous tissues (eyes, nose, throat) are mostly irritating effects. Primary sensory irritations include dry-sore-throat, tingling sensation of nose, and watering and painful eyes. Secondary irritation is characterised by oedema and inflammation of the skin and mucous membranes up to irreversible changes in these organs. Principal agents include volatile organic compounds, formaldehyde and other aldehydes (e.g. acetaldehyde, acrolein) and ETS.Sensory effects of air pollution include nuisance and annoyance reactions caused by perception of air pollutants through sensory organs. VOCs, formaldehyde and ETS can act as principal agents. Effects of air pollution on the central nervous system manifest themselves in damage of the nerve cells, either toxic or hypoxic/anoxic. Principal agents are VOCs (acetone, benzene, toluene, and formaldehyde), CO and pesticides.

(h) Short-term effects

Air pollution has a range of effects on health. However, air pollution in the UK on a day-to-day basis is not expected to rise to levels at which people need to make major changes to their habits to avoid exposure; Nobody need fear going outdoors, but they may experience some noticeable symptoms depending on which of the following population groups they are in:

- **Adults and Children with lung or heart conditions** - It is known that, when levels of air pollutants rise, adults suffering from heart conditions, and adults and children with lung conditions, are at increased risk of becoming ill and needing treatment. Only a minority of those who suffer from these conditions are likely to be affected and it is not possible to predict in advance who will be affected. Some people are aware that air pollution affects their health: adults and children with asthma may notice that they need to increase their use of inhaled reliever medication on days when levels of air pollution are higher than average.
- **Older people** - Older people are more likely to suffer from heart and lung conditions than young people and so it makes good sense for them to be aware of current air pollution conditions.
- **The general population** - At Very High levels of air pollution, some people may experience a sore or dry throat, sore eyes or, in some cases, a tickly cough even in healthy individuals.
- **Children** - Children need not be kept from school or prevented from taking part in games. Children with asthma may notice that they need to increase their use of reliever medication on days when levels of air pollution are higher than average.
- Adults and children with heart or lung problems are at greater risk of symptoms. Follow your doctor's usual advice about exercising and managing your condition. It is possible that very sensitive individuals may experience health effects even on Low air pollution days. Anyone experiencing symptoms should follow the guidance provided.

IV. MATERIALS AND METHODS

(a) The Study Area

Chidambaram is an ancient famous temple town of the Lord Nataraja (Siva) in Hindu, Religion. It is most important holy and pilgrimage centre attracting tourists, coming from all over India and Abroad. The town is named after the temple called "Chit Saba". On the other hand, Chidambaram (i.e. Music Hall or Hall of wisdom) The temple Nataraja was built during the 6-8th centuries after which it was historically influenced and place of sanctity of divine Lord Siva by devoting service of Chola, Pandya, and Vijayanagara Kings during their regime. The Saivate Saint Thiru Manickavasagar, who visited this place and made miracles, fascinating public in the part of divinity, enlightened the Shine of divine Sanctity. This town is called "Thillai as sung in Saiva Puranas. Since the place was Thillai forest and in later stage it is called as Margali (December) is celebrated every year, fascinating devotes from all over India and abroad. The temples at Kalahasti, Kanchipuram, and Chidambaram all stand on a straight line at 79' 45" east longitude The Chidambaram temple houses the Akasha Lingam of Shiva and is considered one of the greatest Shiva Temples of Tamil Nadu.

The objectives of this study are: (i) to investigate the state of vehicular emission in Chidambaram (ii) to investigate the state of vehicular emission on people and the environments; and (iii) To prescribe ways of reducing these emissions. These objectives are justified when one considers the argument by **Kpako (2003),** who stated that vehicular emissions accounts for about 60% of the total pollutants emitted when compared to

other sources and are a dangers to society. Data was collected in Chidambaram town, a commercial and residential town in cuddalore district.

(b) Air Sampling and Chemical Analysis

An eight hour ambient air sampling has been carried out using a high volume sampler at four different select pollution prone locations on a continuously selected day each during January 01-01-2013 to 28-01-2013. Sampling was done at each location for continuous 7 days (one week).The research focused on congested areas of Chidambaram town where heavy vehicular emissions are common. The sample areas are densely populated. They were observed both in the day and night. A common characteristic of these areas is the presence of heavy flow of transportation. In these study areas, concentration of pollutants such as carbon monoxide, sulphur oxide, nitrogen oxides (obtained mostly from exhaust gases) in the atmosphere is high. However, vehicular emissions account for more than 60% of the total pollutants emitted when compared to other sources.

(i) The effect of emission on health:

In determining the health effects in the samples location, questionnaires were prepared and administered on 50 selected individuals each who live or work in the study areas. The data obtained from the questionnaires were analysed based on the information obtained from them. The questionnaire also sampled people's opinions on what they think should be done to reduce these harmful exhausts.

(ii) Effect of emission on plants:

The investigation carried out in the work entails observing vegetations in the sampled area to determine samples showing the effects of emissions.

(c) Procedure

SPM (suspended particulate matter) concentrations were found by measuring the sample air volume (m^3) through an orifice meter and the mass (μg) of particulate matter collected in a Watt man grade 1 fiberglass filter paper. Concentrations of SO_2 and NO_2 (μg/m^3 or PPM) were colorimetrically determined using a spectrophotometer. 5 to 20 ml of reagent (sodium tetra chloro mercurate for West and Geake method to find SO_2 and sodium hydroxide for NO_2) filled in a train of impingers of the high volume sampler trap specific contaminant in air. Air flows to the impingers were determined using rota meters. Instantaneous carbon monoxide concentrations were directly recorded using a battery operated portable CO monitor (CO 84 ENDEE make.)

V. RESULTS AND DISCUSSION

From the results, it can be concluded that Suspended Particulate Matter (SPM) is the main pollutant within the Chidambaram town. All eight sampling stations, the concentration of SPM exceeded the ambient air quality standard by CPCB .The reason is being the growing number of automobiles and poorly and congested road with heavy traffic. This problem can be overcome by adapting advance eco-friendly transport systems, usesage biofuels and widening of roads. In Chidambaram town, many individuals residing nearby traffic intersections are suffering from respiratory diseases. Proper environmental awareness and personal protective devices may be useful in avoiding health problems. This study has shown that chronic exposure to air pollution of Chidambaram town that arises mostly from vehicular exhausts of more than one million motor vehicles plying in the town adversely affect the health of its residents. It impairs lung function, increases the risk of life-threatening COPD, elicits pulmonary and systemic inflammation, causes covert pulmonary hemorrhage, alters immunity that may make the citizens susceptible to infection, increases the risk of hypertension and consequent cardio-vascular diseases, damages DNA and the chromosomes, interferes with DNA damage repair mechanism and enhances dysplasia of airway cells thereby increasing the risk of cancer in the lung and the airways. Carcinogenic changes were mediated by up-regulation of Akt signal transduction pathway, and PM level in breathing air was positively associated with most these changes via generation of oxidative stress.

(i) East and South car street junction

This site has one way traffic system, heavy non-smooth vehicle flow, narrow sharp turn, shopping complex, and parking lots. Percentage traffic shares of two wheelers/ three wheelers/ light vehicles/ heavy vehicles were 54, 15, 13 and 18 respectively. The respondents in East and South car street junction were frequently affected by catarrh. This may be due to the heavy emissions from big buses that ply East and South car street junction to other parts of Chidambaram. These vehicles are mainly powered by diesel fuel and in most cases, are not frequently serviced. They operate almost 20 hours a day, hence the possibility of worn rings thereby causing heavy soot from their exhaust pipes. Asthmatic attacks were rare in all areas, but traders in this place showed the highest complaints. Heavy eye irritation, which is closely linked to sleeplessness, ranks second in East and South car street junction. Therefore after assimilating different kinds of emissions for a large number

of hours, they suffer from heavy eye which is the cause of sleeplessness. Table IV shows the Effects of automobile emissions on the respondents at East car and South car street junction.

(ii) South and west car street junction

This site has one way traffic system, heavy non-smooth vehicle flow, narrow sharp turn, shopping complex, and parking lots. Percentage traffic shares of two wheelers/ three wheelers/ light vehicles/ heavy vehicles were 50, 13, 18 and 19 respectively. The percentage of respondents affected by heavy eye was the highest in South and west car street junction. This may be due to the fact that small buses are more common in this area. The effects of these emissions may not be more noticeable during the day on the people but a night, the people find it difficult to sleep due to heavy eye. This may be due to the fact that offices, banks and business areas are along the bus stops in this area. Twenty percent of the respondents in Mushin are affected by headache. Table V shows the Effects of automobile emissions on the respondents at south car and west car street junction.

(iii) West and North car street junction

This site has one way traffic system, heavy non-smooth vehicle flow, narrow sharp turn, shopping complex, and parking lots. Percentage traffic shares of two wheelers/ three wheelers/ light vehicles/ heavy vehicles were 55, 16, 13 and 16 respectively. In West and North car street junction, there is a mixture of big buses and small buses, this allows for the comingling by diesel and petrol. Since these emissions are a mixture of gases from different sources, it results quickly into adverse effects on the respondents hence the greatest percentage of the respondents in this area suffer from catarrh. Table VI shows the Effects of automobile emissions on the respondents at West car and North car street junction.

(iv) North and East car street junction

This site has one way traffic system, less frequent queuing, less stop-go practice, and commercial bazaar activity. Percentage traffic shares of two wheelers/ three wheelers/ light vehicles / heavy vehicles were 62, 11, 9 and 18 respectively. There are many types of vehicles plying this area mainly big buses which produce heavy emission. Twenty-five percent of respondents suffer from headache and the aftermath is sleeplessness. This is due largely to the amount of gases (exhaust) that they have emitted during the day while undergoing their business activities. There is a high percentage of respondents being affected by sleeplessness in this area This area is partly residential and commercial. The subtle emissions from neighbouring bus stops, car parks are being felt during the nights resulting in sleeplessness Table VII shows the Effects of automobile emissions on the respondents at North car and East car street junction.

(a) Questionnaire

Questionnaires (see appendix) were administered in four areas of Chidambaram town: East car and south car street junction, south car and west car street junction, west car and north car street junction and north car and east car street junction. Questionnaires were administered on a total of 200 respondents to determine the effects of emissions on their health, particularly in congested areas of Chidambaram town, where heavy vehicular emissions are common. Preliminary observations were done for one month in many areas before selecting the sampled areas. These are the areas where there are heavy flows of transportations. A total of 50 respondents were carefully selected each from the four locations. Questionnaires were administered on them over a period of 4 months. The selected respondents include office workers, market women, street hawkers, drivers, conductors, Annamalai university employees, school children, Traffic policeman, traders and residents. Those that had difficulty in responding to the questionnaires were assisted by the crewmembers. The questionnaires were analysed based on the factors/symptoms that constitute health problems. Table VIII shows the Effects of automobile emissions on the respondents in the study areas and the table IX shows the Results from on analysis on air samples in the four locations of Chidambaram town.

Table IV Effects of automobile emissions on the respondents at East car and South car street junction

Respondent	Sleeplessness	Eye irritation	Asthmatic attack	Headache	Running nose
Market women	2	3	2	3	2
Street hackers	2	1	1	2	3
Drivers	3	4	1	2	1
Conductors	3	3	1	3	2
AU Employees	3	4	2	1	2
School children	5	2	1	1	2
Office workers	4	2	1	3	2
Traders	6	5	1	2	1
Residents	2	3	0	5	2
School teachers	2	2	0	1	0

Table V Effects of automobile emissions on the respondents at south car and west car street junction

Respondent	Sleeplessness	Eye irritation	Asthmatic attack	Headache	Running nose
Market women	**6**	**3**	**2**	**3**	**2**
Street hackers	**2**	**1**	**0**	**5**	**3**
Drivers	**2**	**4**	**2**	**2**	**1**
Conductors	**2**	**4**	**1**	**3**	**2**
AU Employees	**8**	**6**	**2**	**1**	**2**
School children	**5**	**7**	**1**	**1**	**2**
Office workers	**4**	**4**	**1**	**3**	**2**
Traders	**2**	**1**	**1**	**1**	**1**
Residents	**3**	**3**	**1**	**3**	**2**
School teachers	**1**	**2**	**0**	**3**	**1**

Table VI Effects of automobile emissions on the respondents at West car and North car street junction

Respondent	Sleeplessness	Eye irritation	Asthmatic attack	Headache	Running nose
Market women	**4**	**3**	**3**	**3**	**2**
Street hackers	**2**	**1**	**0**	**1**	**3**
Drivers	**3**	**4**	**2**	**2**	**1**
Conductors	**3**	**4**	**1**	**4**	**2**
AU Employees	**5**	**6**	**2**	**0**	**2**
School children	**6**	**4**	**0**	**4**	**4**
Office workers	**3**	**4**	**4**	**3**	**2**
Traders	**2**	**5**	**1**	**1**	**1**
Residents	**7**	**1**	**1**	**3**	**2**
School teachers	**3**	**2**	**0**	**2**	**2**

Table VII Effects of automobile emissions on the respondents at North car and East car street junction

Respondent	Sleeplessness	Eye irritation	Asthmatic attack	Headache	Running nose
Market women	2	3	2	2	2
Street hackers	3	1	1	2	3
Drivers	2	4	1	5	1
Conductors	2	3	5	3	5
AU Employees	10	5	2	2	2
School children	2	2	2	1	2
Office workers	5	6	1	3	3
Traders	3	5	1	2	1
Residents	6	0	2	1	2
School teachers	2	2	0	2	2

Table VIII Effects of automobile emissions on the respondents in the study areas

Ailment	Number of respondents affected				
	East car &south car street junction	South car &west car street junction	West car &north car street junction	North car &east car street junction	Totals
Sleeplessness	32	35	38	37	142(71%)
Running nose	17	18	21	23	79(39.5%)
Eye irritation	29	35	34	31	129(64.5%)
Asthmatic attack	10	11	14	17	52(26%)
Headache	23	25	23	23	94(47%)

Table IX Results from on analysis on air samples in the four locations of Chidambaram town.

Pollutant	East car &south car street junction	South car &west car street junction	West car &north car street junction	North car &east car street junction
Oxides of Nitrogen	75.86-100.52	65-95.23	70.21-108.3	69.54-105.65
Sulphur dioxide	62.50-92.78	53.52-90.68	60.24-95.65	68.35-97.65
Carbon mo noxide	0-2.4	0-2.4	0-2.4	0-2.4
Suspended Particulate Matter	232.52-320.92	209.52 -301.92	202.13 -298.24	225.44-285.64

VI. CONCLUSION

The study is worth considering in view of the cost savings that would result if adequate traffic controls were implemented. Future studies need to consider the development of models, analysis, and empirical scrutiny of vehicle emission models. The result of such a research will be useful to the vehicle manufacturers in the design of new exhaust pipes. But deep studies indicate that these problems not only affect the local environment, but the ill-effects spread to the other parts of the world as well. If this situation continues, then life on earth on becomes intolerable. Hence “Save our Earth” has become the slogan now. The problems and their ill-effects have to be thoroughly analyzed at the global level. But, to prevent ill-effects, suitable action has to be taken at the level. Environment is a partner to development and not an impediment. In order to maintain essential ecological process, to ensure genetic diversity, sustain species and eco-systems, prevent environment degradation, the following changes should be made in the vehicle to reduce the emission. The study reveals that traffic related pollution in Chidambaram town is significant with possibly severe health consequences,

especially for people living in areas or in locations close to busy roads. If allowed to continue, it is likely that air quality will only deteriorate as the town continues to grow. The resultant health care and lost productivity costs are very high, especially now that there is influx of vehicle and high traffic build-up within the town. The adoption of rigorous regulations and implementation of transport-policies will lead to an uptake of clean air and play a very significant role in reducing air pollution and its consequential harm to the community and the national economy.

Appendix: questionnaire

Questionnaire I.D. No
Date
Place of Study
Name of Interviewer
Signature

Please tick ( ) corresponding to the appropriate answer under the code indicated. Also, fill in the necessary information in the spaces provided

S/No.	Questions	Categories
1	Sex	Male Female
2	Age	Specify…….. 15 – 19 20 – 24 25 – 29 30 – 34 35 and above
3	Respondents	Driver (private/personal) Conductor Commuter Traders School children Street hackers AU Employees Market women Office workers
4	Type of Automobile	Two wheelers-2w Three wheelers-3w Cars of all types- LMV Buses – HMV Big Buses (all types)- HMV Trucks (all types)- HMV
5	Type of Fuel	Petrol Diesel Lpg
6	Duration of Exposure to Exhaust/day	1– 3 hours 8 hours 12 hours 12 hours and above
7	Effect on Individual	Sleeplessness Running nose Irritation of eye Asthmatic attack Headache

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