A Study on the Health Risks of Motorcycle Riders In Manila West

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Abstract: Motorcycle drivers are constantly exposed to the environment that is characterized by heat, air pollution and high level of humidity. This study determines the possible type of diseases motorcycle drivers in the West part of Manila can acquire. Respondents were chosen randomly and were surveyed. Results were treated statistically in order to determine the level of correlation. The results show that respiratory diseases are correlated to how long motorcycle drivers spent in driving and how long they travelled. Heat related illnesses and irritations have shown a strong correlation as well. All of the illnesses that were listed in the survey form have positive correlation. Motorcycle riders are not only prone to respiratory diseases, in fact, higher correlation values were exhibited by illnesses related to noise pollution and irritations.

Key Words*: Health Risk, Respiratory Illness, Air Pollution, Motorcycle Drivers*

1. INTRODUCTION

Transportation is basically defined as a complex system of movement of people and goods from one place to another through land, air and water. Land-based transportation is the generally used mode of transportation for efficiency, safety and economical basis *(Land Transport in the Philippines: Retrogressing towards Motorcycles, NSCB* October 2009). The most economical preferred mode of transportation is the fastest, this being the most economical. In any major roads, an emerging number of motorcycles can be remarkably observed, most especially on busy streets due to its great maneuverability and ability to penetrate though traffic streams *(LTO Statistics)*. Due to the nature of motorcycles, the risk presented to motorcyclists' health and safety is greater. Since they are directly exposed to the outer surroundings, they are likely to acquire diseases that would probably make their health conditions vulnerable (*Addressing Health Risks Associated with Motorcycles,* Motarodline, 2010)

The journal released by the World Health Organization (WHO) in July 31, 1998, entitled "Averting the Three Outriders of the Transport Apocalypse: Road Accidents, Air and Noise Pollution" assessed the impact of mass transportation on environment and human health. Aside from road accidents, it was also disclosed that air and noise pollution are two of the prevailing problems the transportation sector faces. Most respiratory diseases can be attributed to long term exposure to road traffic air pollution. Environmental noise produced by vehicles affects health and well-being physically, mentally and socially. There is ample evidence showing that high noise levels interfere with speech and communication, cause sleep disturbance, decreased learning ability and scholastic performance, increase stress-related hormones, blood pressure changes, impaired hearing ability, ischemic heart disease as well as the use of psychotropic drugs and medicines. In addition, long term exposure to heat and rain has detrimental effects on human health. According to the Canadian Centre for Occupational Health and Safety, constant exposure to excessive heat can cause physical problems which impair one's efficiency and may cause adverse health effects like heat stress, heat cramps skin illnesses including cancer, heat exhaustion, bleeding of the nose and the like. On the other hand, exposure to heavy rains may induce common ailments such as colds, coughs, fever, pneumonia and other related ailments.

Motorcycle riders are regularly exposed to the outer surroundings, thus putting their health into a very great peril of acquiring various diseases. However, the queries on what particular illnesses they most commonly acquired and would likely acquire, including the external and internal factors that might contribute to such ailments remain unknown.

Although there were already studies conducted, that associate to this matter, facilitating a definite study would provide further details to fully disclose such aforementioned queries. The conduct of this study intends for information dissemination on the most common diseases motorcycle riders are likely to acquire.

Climate change, as generated by gradual deterioration of nature, brings adverse effects not only on to the environment, but as well as on human beings. Health is indispensable to every person, hence necessary treatments and prevention should be given priority.

The extent of this study would only envelope the most common diseases to which motorcycle riders in the western part of the municipality of Manila are vulnerable to, including some practical preventive measures, and the most detrimental air pollutants carried in the atmosphere in the metropolitan.

2. REVIEW OF RELATED LITERATURE

Based from the statistics conducted by the Land Transportation Office under the jurisdiction of the Department of Transportation and Communications, the number of registered motorcycles dramatically increased from 2,982,511 to 3,482,149 from the year 2008 to 2010 or having an overall 8.05% average increase. With these numerical figures, it cannot be refuted that more and more Filipinos prefer motorcycles for convenience, efficiency and fun. In addition, several motorcycle riders have said that motorcycles are fuel efficient, have better gas mileage, cheap, less cost to insure, easier to park in small spots, quicker through traffic, have a very good manoeuvrability, more thrilling and fun to ride at, and have a low environmental impact. (DOTC Statistics)

Indeed, motorcycles, unlike any other types of vehicles, can be considered as the fastest land-based transportation mode that could bring you to your destination without any delay especially even at heavy traffic jams. But it is also one of the leading causes of inflating number of vehicular accidents that induced injuries and loss of lives.
Someone uttered, "I get the feeling of being isolated or cocooned within the cage of the car. On a motorcycle, being more exposed, I feel more like a part of the road and the surroundings." The more exposed to the outer surroundings the riders are, the more they are prone to various risks, not only in terms of safety, but especially with regards to health. Constant exposure to the outside environment, particularly to different pollutions weakens one's health.

According to the statistics conducted by the World Health Organization, approximately 57 Million people died in the year 2008; 3.46 Million of them died from respiratory diseases which are one of the world's leading causes of death, next to cerebrovascular and cardiovascular diseases. Respiratory diseases are either due to a person's genetic background, his lifestyle or living conditions, or his exposure to environmental factors. Usually, they are due to constant exposure to dust, tobacco or vehicular smoke, industrial fume and excessive air pollutants like ozone, particulate matters, carbon monoxide, nitrogen oxides, sulfur dioxide and lead.

Data from the Department of Health also showed that respiratory diseases (excluding pneumonia and tuberculosis) are the one of the leading causes of deaths in the country, having a mortality rate of 24.6. Statistics shows that respiratory diseases are one of the major problems every Filipino is facing especially that it climbed to number seven of the top leading causes of death in 2005 from number eight in 2004. The study also showed the visibility of other respiratory diseases that can be attributed to the increase of pollutants in the air. (DOH Statistics)

Disorders and symptoms related to the respiratory system include asthma and allergy, heavy breathing, watering nose or eyes, common cold or sore throat and taking antihistamine drugs. These are due to exposure to cigarette smoke, breathing polluted air, inhaling other respiratory irritants, breathing in allergy-causing substances (allergens) such as molds and dust, exposure to cold and dry weather, and stress.

Researchers found out that long-term exposure to pollutants can increase the risk of respiratory illnesses which include asthma. Constant and prolonged exposure to pollutants that are found in cars exhaust fumes and industrial air pollution may lead to pneumonia especially for adults aged 65 and older. Exposure to air pollution can increase the individual's susceptibility to pneumonia by interfering with the immune defenses of the lung that protect from pathogens. A new study at the University of Alabama also showed that pollutants like tobacco smoke, which is an extremely toxic gas, can trigger tuberculosis infections (*ScienceDaily*, Retrieved August 14, 2011).

Pollutants like ozone, particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxide and lead are most commonly found in the air. According to the United States Environmental Protection Agency, exposure to these pollutants can be associated with numerous effects on human health, which include increased respiratory symptoms, hospitalization for heart or lung diseases, and even premature death.

Breathing ozone can trigger a variety of health problems including chest pain, coughing, throat irritation, and congestion. It can worsen bronchitis, emphysema, and asthma. Ground-level ozone also can reduce lung function and inflame the linings of the lungs. Repeated exposure may permanently scar lung tissue. People with lung disease, children, older adults, and people who are active can be affected when ozone levels are unhealthy. Numerous scientific studies have linked ground-level ozone exposure to a variety of problems, including airway irritation, coughing, and pain when taking a deep breath, wheezing and breathing difficulties during exercise or outdoor activities, inflammation, which is much like a sunburn on the skin, aggravation of asthma and increased susceptibility to respiratory illnesses like pneumonia and bronchitis and permanent lung damage with repeated exposures.

Exposure to particles can affect both lungs and heart. Small particles of concern include "inhalable coarse particles" (such as those found near roadways and dusty industries), which are larger than 2.5 micrometers and smaller than 10 micrometers in diameter; and "fine particles" (such as those found in smoke and haze), which are 2.5 micrometers in diameter and smaller.

CO can cause harmful health effects by reducing oxygen delivery to the body's organs (like the heart and brain) and tissues. At extremely high levels, CO can cause death. Exposure to CO can reduce the oxygen-carrying capacity of the blood. People with several types of heart disease already have a reduced capacity for pumping oxygenated blood to the heart, which can cause them to experience myocardial ischemia (reduced oxygen to the heart), often accompanied by chest pain (angina), when exercising or under increased stress. For these people, short-term CO exposure further affects their body's already compromised ability to respond to the increased oxygen demands of exercise or exertion.

Current scientific evidence links short-term NO_2 exposures, ranging from 30 minutes to 24 hours, with adverse respiratory effects including airway inflammation in healthy people and increased respiratory symptoms in people with asthma. Also, studies show a connection between breathing elevated short-term NO_2 concentrations, and increased visits to emergency departments and hospital admissions for respiratory issues, especially asthma.

NO_2 concentrations in vehicles and near roadways are appreciably higher than those measured at monitors in the current network. In fact, in-vehicle concentrations can be 2-3 times higher than measured at nearby area-wide monitors. Near-roadway (within about 50 meters) concentrations of NO_2 have been measured to be approximately 30 to 100% higher than concentrations away from roadways.

Current scientific evidence links short-term exposures to SO_2, ranging from 5 minutes to 24 hours, with an array of adverse respiratory affects including bronchoconstriction and increased asthma symptoms. These effects are particularly important for asthmatics at elevated ventilation rates (e.g., while exercising or playing.)

In addition to exposure to lead in air, other major exposure pathways include ingestion of lead in drinking water and lead-contaminated food as well as incidental ingestion of lead-contaminated soil and dust. Lead-based paint remains a major exposure pathway in older

homes. Once taken into the body, lead distributes throughout the body in the blood and is accumulated in the bones. Depending on the level of exposure, lead can adversely affect the nervous system, kidney function, immune system, reproductive and developmental systems and the cardiovascular system. Lead exposure also affects the oxygen carrying capacity of the blood. The lead effects most commonly encountered in current populations are neurological effects in children and cardiovascular effects (e.g., high blood pressure and heart disease) in adults. Infants and young children are especially sensitive to even low levels of lead, which may contribute to behavioral problems, learning deficits and lowered IQ.

Respiratory Diseases are directly attributed to the poor air quality of the environment, most particularly along roadways where the degree of pollution is remarkably high. Diseases are induced by harmful and toxic substances present in the air that weaken ones immune system, thus making them vulnerable to other related infections. The longer a person is exposed to pollutants, the greater his risk to acquire ailments. The degree of air pollution is determined by the number of Total Suspended Air Particulates (TSP) present in the air.

The studies conducted by the Department of Environment and Natural Resources (DENR) revealed that the most polluted quality of air can be found in Metro Manila. The Total Suspended Air Particulates (TSP) Air Quality Survey found out that the air quality in metropolis in 2008 was at an average of 138 micrograms of pollutants per normal cubic meter, which greatly deviates from the standard 90 micrograms per normal cubic meter as set by the DENR. These pollutants include sulfur dioxide (SO2), nitrogen dioxide (NO2), carbon monoxide (CO), ozone and other particulate matters.

Actually, the air quality of the metropolis was improving from 2004 to 2007. In 2004, the average was at 160 micrograms, 154 micrograms in 2005, 142 micrograms in 2006 and 132 micrograms in 2007. But it rose again in 2008. The increase in TSP could be attributed to the worsening traffic condition in Metro Manila. Motored vehicles were the main source of pollution in the metropolis, accounting for as much as 80 percent of the pollution while the rest comes from industrial sources. These results from the continuously emerging number of vehicles along the major roads in Metro Manila, particularly along Epifanio Delos Santos Avenue (EDSA), Taft Avenue, South Luzon Express Way / South Super Highway, North Luzon Express Way, Commonwealth Avenue, Osmena Highway, Quirino Avenue, Roxas Boulevard, Manila-Cavite Expressway, Marcos highway, Emilio Aguinaldo Highway and other major roads.

The longest of them is EDSA, having a span of 30 kilometers. Aside from being the country's longest road, it also contains the dirtiest quality of air in Metro Manila, with 283 micrograms per normal cubic meter as recorded by the DENR. According to the Metro Manila Development Authority, every day, an average of 400,000 vehicles pass through EDSA. Most of them are buses, jeeps and private vehicles. Environmental experts have said that vehicles that use diesel fuels are the biggest source of air pollution due to their emission of toxic substance contents that are hazardous to the environment and the health of the people. These toxic chemicals emitted by diesel-powered vehicles are carbon monoxide, methane, nitrous oxide, sulfur and benzene. It has been proposed that decongestion of EDSA as well as other major roads can lower the degree of air pollution in Metro Manila so as to protect the environment and prevent the spread of respiratory diseases.

3. MATERIALS AND Method

The study was conducted along different locations in the West Part of Manila. According to Land Transportation office, the total number of registered motorcycles in the western part of Manila is 27,433. The sample size formula used in the study is Cochran's formula

$$n = \frac{t^2 \, x \, s^2}{d^2} \tag{1}$$

The data is considered to be continuous. The value of margin of error is 0.03 and the alpha level a priori is set at 0.05, thus, having an estimated value standard deviation equal to 1.96.

Survey questions were provided to a total of one hundred and nineteen motorcycle drivers and some were interviewed further as well. The respondents were randomly selected. The survey was given only to licensed professional drivers whose ages range from eighteen and above. Student drivers and minors were not included in the study.

The respondents were assisted very well in answering the given queries so as to obtain the necessary data for subsequent analyses. Most of them did not write down their answers themselves, rather, questions were asked one-by-one then, when they provide their answers, we are the ones who wrote them down. Conversations were conducted in Filipino for straightforward communication. Supplemental materials such as pictures of motorcycle rider's protective gear including the definition of some slightly unfamiliar terms were provided for easy comprehension, thus eliminating more questions relative to the survey.

Statistical analysis of health risks of motorcycle drivers was done with Pearson's Correlation approach for the determination of existing linear relationship, either positive, negative, or none at all, between various diseases and related parameters that would probably induce them. Moreover, we could not use the t-test and the z-test since this study did not engage into the process of observation and did not perform experiments.

4. RESULTS

As shown in Figure 1, the total number of respondents consists of eighty nine male and thirty female. Majority of the respondents are male, which comprises 74.79% of the total number of respondents, while females are only 25.21% of the total number of respondents.

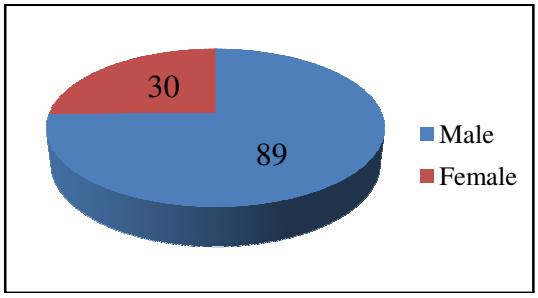

Figure 1 Respondents based on Gender

Most respondents, with a total frequency of thirty one, are between seventeen to twenty one years of age (Figure 02). On the other hand, there is only one respondent whose age is fifty two. Among all the total number of respondents, the youngest is eighteen years old while the oldest is fifty two. Among the respondents, Ten years old is the youngest age to start driving motorcycle while the oldest was forty seven. Most of them started driving motorcycle when they were eighteen years old. 1978 was the earliest year of starting driving motorcycle while the most recent one was 2011. Most respondents have been driving motorcycle for not longer than six years. On the other hand, least number of respondents was driving motorcycle for thirty one to thirty four years.

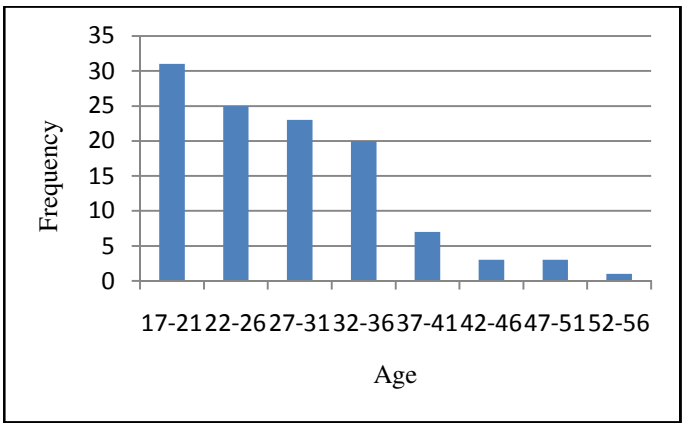

Figure 2 Age Distribution of Respondents

Majority of them used to travel everyday and it usually took them thirty minutes to one hour of travel (see Figure 3 and 4). The shortest time traveled daily by a respondent was twenty minutes while the longest time was twelve hours.

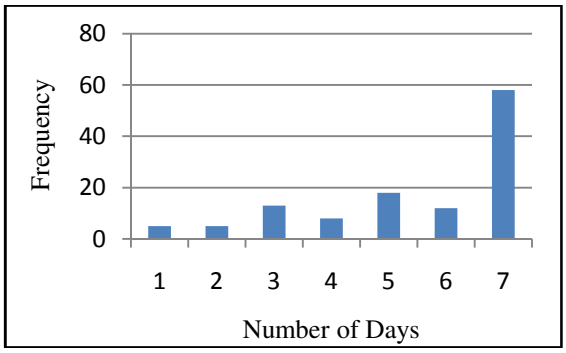

Figure 3 Number of Days the Respondents Travelled in Week

Most respondents travel between four to twenty tree kilometers a day. The shortest distance travelled daily among the respondents was four kilometers while the farthest was two hundred eighty kilometers The Street with most number of respondents who used to pass through was United Nations Avenue while least one was along Aurora and Bonifacio Drive.

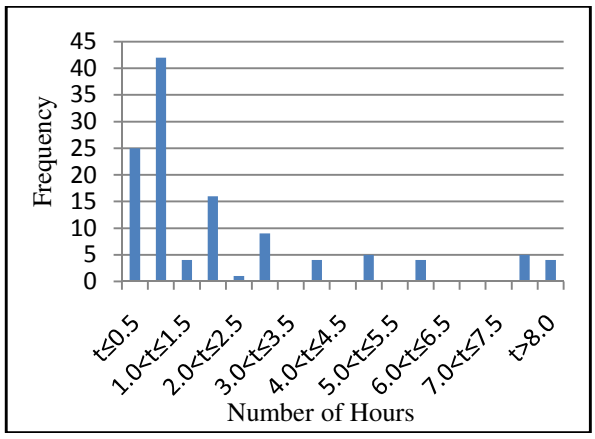

Figure 4 Number of Days the Respondents Travelled in Week

Eight respondents indicated they already had ailments before they started driving a motorcycle and most of them were middle-aged men whose ages ranged between thirty two and thirty six. Their diseases were tuberculosis, high blood pressure, diabetes and bronchitis, and four of them have asthma. Six of them believed that driving a motorcycle has aggravated their illnesses; particularly those who have respiratory ailments.

Included in one hundred and eight respondents who constantly wear protective gear were all the six respondents who have indicated they have existing ailments. The most common protective gear that most respondents used to wear was helmets.

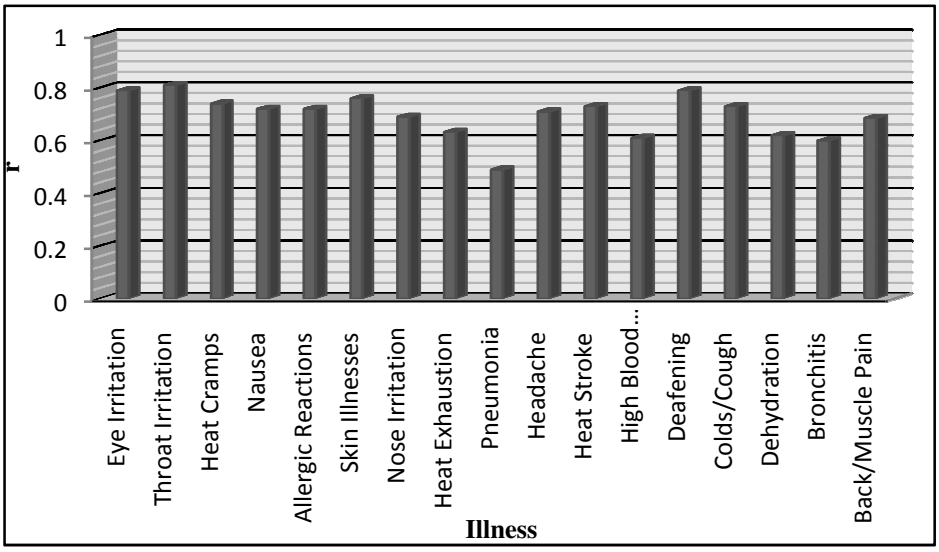

Figure 5 Computed Pearson Correlation Coefficient (r) for Number of Days the Respondents travelled in a Week

Pearson Correlation or Pearson Product-Moment Correlation was used to treat the obtained data statistically. Figure 5 shows the correlation between numbers of days they drive in a week to what possible sickness/sicknesses they can acquire. Nose Irritation has the highest correlation value of 0.81 while heat Stroke has the lowest correlation value of 0.49. This means that the number of days is highly correlated to Throat Irritation. Meanwhile, based on the computed value of correlation, the number of days has a moderate to correlation to

Heat Stroke. Other illness that are strongly correlated to number of days include Eye Irritation, Nausea, Allergic reaction, Skin Illness, Headaches, Deafening and Cold and Coughs, while Illnesses that are moderately correlated to number of days a motorcycle driver travels in a week includes Nose Irritation, heat Exhaustion, Pneumonia, High Blood Pressure, Dehydration, Bronchitis and Back/Muscle Pain.

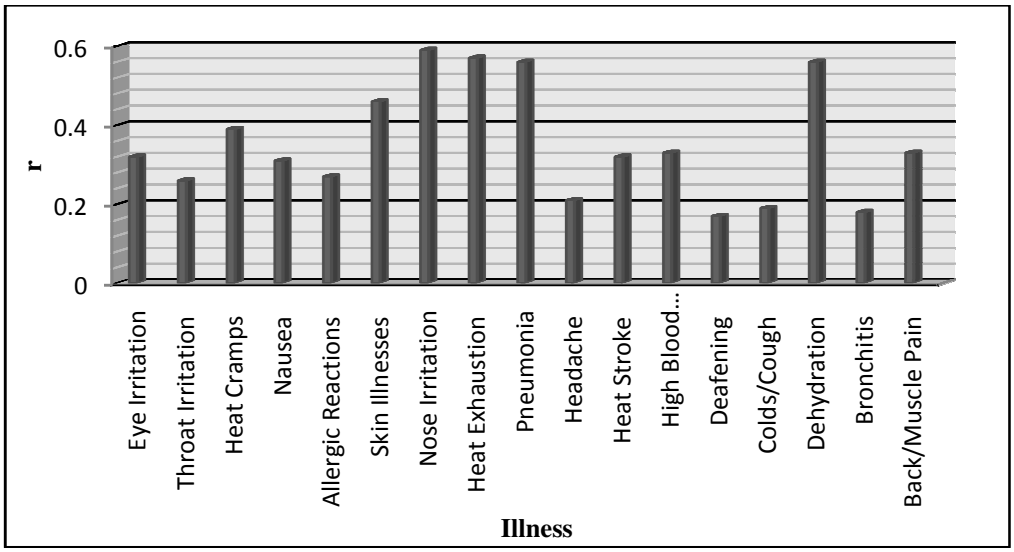

Figure 6 Computed Pearson Correlation Coefficient (r) for Number of Hours

The Travel Time or how long the respondents' travel took in a day was also correlated to the type of illness they can possible acquire. In this case, the independent variable is the number of hours while the independent variable is the type of illness. As shown in figure 6, Nose Irritation has the greatest value of Pearson correlation coefficient with 0.59 while Deafening has the lowest value with 0.17. This can be interpreted that Number of Hours has a moderate correlation to Nose Irritation and it has a slight correlation or almost negligible correlation to Deafening. Compared to figure 5, the values of r in this figure are smaller which means that Number of days is more correlated than that of how long the respondents travel in a day. Meanwhile, other illnesses that can be moderately correlated to numbers of hours include Skin Illness, Heat Exhaustion, Pneumonia and Dehydration. On the other hand, Bronchitis also shows slight or almost negligible correlation. The remaining illnesses are considered to have a small correlation o number of days.

Figure 6 shows the computed value of Pearson correlation coefficient for Number of Kilometer the respondents travelled in a day and to the type of illness they can possibly acquire. In this case, the number of kilometers was considered to be the independent variables(x) while the types of illnesses are the dependent variable (y). Based from the figure above, Throat Irritation has the highest value of r (0.93) while six illnesses, that include Allergic Reactions, Throat Irritation, Heat Exhaustion, Pneumonia, and High blood Pressure, got the lowest value. These values mean that Nose irritation can be strongly correlated to Number of kilometers he respondents travelled in a day. The figure also shows that illnesses like Eye Irritation, Heat stroke, Colds/Coughs and Bronchitis have strong correlation, Skin Illnesses with moderate correlation and Heat Cramps, Nausea and Deafening have small correlation. The six illnesses that were mentioned have correlation values that are approximately equal to zero. This value implicates that those six illnesses have slight or almost negligible correlation.

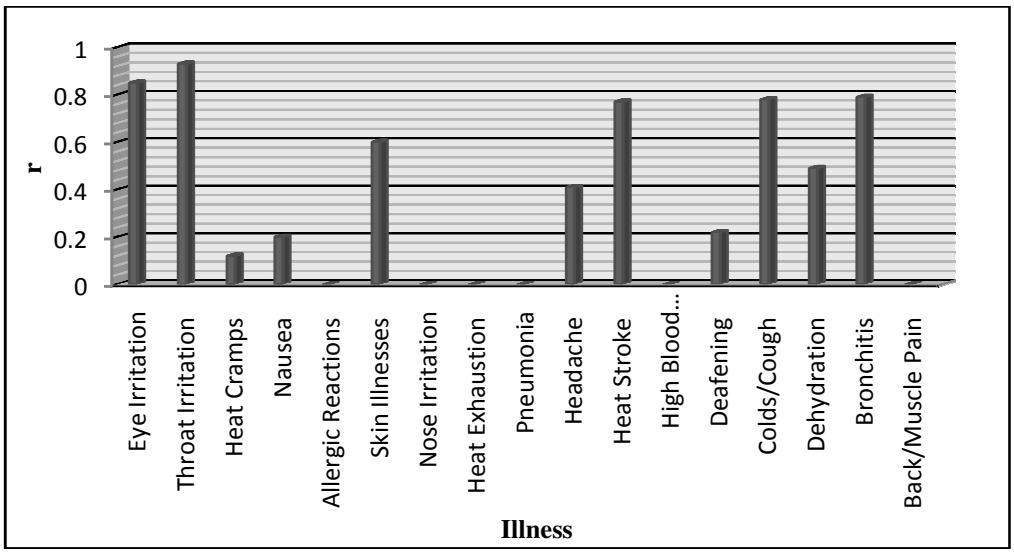

Figure 6 Computed Pearson Correlation Coefficient (r) for Number of Kilometers the Respondents travelled within a Day

5. CONCLUSION AND RECOMMENDATIONS

Motorcycle Drivers are considered to be prone to Respiratory Diseases because they are constantly exposed to air pollution. The findings show that there is a moderate correlation between the two. However it should be noted that the results indicate that the value of correlation for respiratory diseases is not consistent when it is being correlated to the Number of Days, Number of Hours and Number of Kilometers the Respondents travelled in a day. One of the most important findings in this study is the strong correlation between Throat Irritation and Number of Days and Number of Kilometers. In this study, motorcycle riders in West Manila do not only experience respiratory diseases when they started driving motorcycle. Throat, Nose and Eye Irritation as well as heat related problems are highly associated as the common diseases motorcycle drivers can acquire. In fact, the findings show that these illnesses have stronger correlation to that of respiratory related diseases. Meanwhile the three parameters that we correlated to type of illnesses do not necessarily suggest a single type or related diseases that drivers can possible acquire because the correlation value of a type of disease is not consistent on the three parameters.

The study has define the relationship between the number of days the respondents drive in a week, the number of hours they allotted in driving motorcycle within a day, and the number of kilometers they travelled in day to what type of diseases they could possibly acquire. However, it could be possible that findings would vary in different areas of Manila City or other key cities in our country with different environment, weather, average temperature and climate. These factors can produce different results. In addition, it can be noted that the methodology used in this study as well as the time that was allotted in conducting this study limits our interpretation.

Future study can use other type of statistical tool such as z-test. Bigger sample size and more follow-up interviews should be done in order to obtained results that can forecast possible diseases motorcycle can acquire.

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