Occupational Health Impacts on Traffic Police: A Case Study of Islamabad and Rawalpindi

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Abbreviations

ATS-DLD	American Thoracic Society- Division of lung Disease
BMRC	British Medical Research Council
BMI	Body Mass Index
CO	Carbon Oxide
CDA	Capital Development Authority
COPD	Chronic Obstructive Pulmonary Disease
DALY	Disability Adjusted Life Years
FEV_1	Forced Expiratory Volume in One Second
FVC	Forced Vital Capacity
ICT	Islamabad Capital Territory
ILO	International Labor Organization
MC	Medical Cost
NIHL	Noise-Induced Hearing Loss
NMC	Non-Medical Cost
NO	Nitrogen Oxide
OHH	Occupational Health Hazard
OLS	Ordinary Least Square
OSHA	Occupational Safety and Health Administration
Pb	Lead
PM	Particulate Matter
PPE	Personal Protective Equipment
SO	Sulphur Oxide
SPM	Suspended Particulate Matter
VOC	Volatile Organic Compound
W.H.O	World Health Organization
PFT	Pulmonary Function Test
NEQS	National Environmental Quality Standard

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Abstract

Traffic policemen contribute a lot to the community by regulating traffic and ensuring public safety. They compromise on their health since they are constantly exposed to all types of pollution. They are at high risk of developing a number of diseases due to noise, dust, fumes, gasses etc. due to their profession. The aim of this study is to find out the health cost borne by traffic personnel and the factors that determine the likelihood of occupational illness. This cross-sectional study is conducted among the traffic police of Islamabad and Rawalpindi. A convenient sampling method is adopted and a structured questionnaire is used to assess the prevalence of respiratory, auditory, ophthalmic illnesses, use of personal protective gear, and health-seeking practice. Ordinary Least Square (OLS) is used for health cost estimation. The prevalence of cough, red & burning eyes, vision reduction, difficulty in hearing, tinnitus, and ear discharge are found among them. Respondent's age, work-related factors like working hours, years, and days, use of personal protective equipment are significantly associated with the prevalence of the disease. Police personnel working along the roadside have a high prevalence of occupational illness. Appropriate use of face masks and protective gear can help them against unavoidable pollution. Monthly health checkups and a check & balance on pollution emitting vehicles should be taken to protect precious lives.

Keywords: Traffic police, Pollution, Occupational illnesses, Health Cost

CHAPTER I

Introduction

1.1 Background

Work receives economic importance because it produces and provides goods and services to the community. It can lend vitality to existence and establish a cyclical pattern of days, months, years in one's life. Work is a powerful force to shape an individual's life, physical and psychological life. Work plays a crucial role in bringing self-esteem, identity, and a sense of knowledge (Theorell, 2015). This makes the occupational environment important in the life of exposed, workers can be exposed to many different things e.g. heat, radiations, sedentary work, vibrations, noise, chemicals, etc.(Satapathy,Behera&Tripathy,2009). By looking into these entire unavoidable work environments International Labor Organization (ILO) provided few guidelines stated Occupational Safety and Health (OSH) for worker's safety. Hazard and risk are associated with the work environment, so proper maintenance and health safety should be monitored, the employer tries to remove or to minimize hazard at the source. The sum of life years lost due to premature mortality, years of lives with a disability, or suffering from some morbidity are all account for Disability Adjusted Life Years (DALYs) (Patil, Chetlapally & Bagavandas, 2014).

By considering all the hazards and risks associated with any occupation, the occupational hazard is a major economic burden on the global economy in the form of mortalities, morbidities, DALYs, productivity loss, suffering. There is a certain extent to which occupational risks are unavoidable. There has been a long struggle by workers to establish liability against the employer who tries to deny or reduce their liabilities. Mortalities related to work is not easy to estimate since mortality can be dependent on many factors, which makes it difficult to particularize causal of death due to occupation. Acute hazard and risk burdens can be identified using death records, hospitals records, compensations claims, workplace records, sentinel's reports etc. while chronic illnesses build over time and is a long-term disease and workers are often unaware of such morbidities or workers try to hide their illnesses owing to the fact that they can be drop off

from their job due to impaired health. Respiratory diseases come under the top ten occupational diseases globally(Leigh, Macaskill, Kuosma & Mandyrk, 1999).

1.2 Vehicles as a Source of Pollution in Pakistan:

Air and noise pollution is aggravated due to increasing traffic and is bound to increase further due to the absence of transport policies and sustained investments. The demand for private vehicle ownership originated because of factors increasing affordability and the banking system facilitate in vehicle financing. Two-wheeler motor industries are growing very abruptly, rickshaws have grown by 34% while motorcycles and scooters double over the decade. Air quality is disturbed by varying quantity of different pollutant including Suspended Particulate Matter (PM with a diameter of 10 microns or smaller: PM_{10} or PM_{25}. or smaller), Nitrogen Oxides (NO), Sulphur Oxides (SO), Carbon Monoxide (CO), ozone, Volatile Organic Compound (VOC) and Lead (Pb) (Sohail, Asif & Malik, 2011).

SPM comes from two sources: natural and anthropogenic. Three key sources of anthropogenic PM are vehicular, industrial, and burning of waste. The concentration of air pollutants increases up to 6 to 7 times than the WHO prescribed limits. Nitrogen oxide is phototoxic in nature, Sulphur Oxide and Nitrogen Oxide are environmental pollutants and alsothe precursor to the secondary particulate formation and photochemical smog which can become a problem in the future (Sánchez & Afzal, 2012).

Traffic in urban cities is a major problem for polluted air, traffic accidents, injuries, congestion, and noise pollution. There is no major road construction or overhead bridge plans initiated by the government but every day newly registered cars are being introduced on the roads which are not already efficient to handle the current traffic burden which causes congestion. Road traffic data collected by WHO(2015) is as follows

Total registered vehicles for 2011	9080437
Cars and 4-wheeled light vehicles	3095900
Motorized 2 and 3-wheelers	5560218
Heavy trucks	223152
Buses	201167

Roads carry a wide range of users from heavy traffic likes bus trucks to vehicles and bicycles and pedestrians without any separation. Drivers on roads are mostly illiterate or less

literate with poor road and civic because they don't know the importance of life or any minor to major injury or illness can be fatal to someone, which in turn place a heavy burden not only to the household but a burden on the economy as well.

1.3Air Pollutant Effect and Mechanism of Respiratory Morbidity:

Emissions of chemicals from vehicles, industries and burning of waste results in economic burden in the form of impaired health of the citizen, degraded air quality, low standards of living and cost of abatement if the community wants to improve standards of lifestyles. Traffic police knowledge and awareness is extremely important to the possible impacts and its mechanism (Sohail et al. 2011).

It's a fact that pollutants are a serious threat to human health but different pollutants have a varying degree to affect health and is dependent upon many factors e.g. age, diet, smoking habit, area of living etc. Air quality is degraded to such an extent that it's so enmeshed that's why it's difficult to draw clear lines that which pollutant is affecting and to what extent. Some chemicals might not seem disturbing but only after mixing with other pollutants or they can become a precursor for the formation of a secondary pollutant. SPM is provoking a number of respiratory illnesses and heart ailments, every year 415 million cases of chronic bronchitis and an implicated 500,000 premature deaths worldwide, while Pakistan's share for premature deaths 22,000 of adults and 700 of young children. Mortality, DALYs lost estimated to be 60 percent followed by respiratory symptoms. Adults are highly vulnerable to respiratory illnesses and a greater danger of developing lung cancer (Christopher & Alan, 2004).

The study of the complex relationship between people's physical and psychological aspects of the work environment is Ergonomics. Numerous respiratory illnesses arise from air pollution it includes bronchitis, asthma, wheezing, breathlessness, dry cough, cough with phlegm, Chronic Obstructive Pulmonary Disease(COPD), tuberculosis (Mary, 2013). Traffic police have more chances to develop respiratory symptoms because of close contact to poisoned air. COPD can become a fore factor to develop cardiovascular symptoms, even after controlling other factors e.g. cholesterol level, smoking, hypertension, obesity etc. people suffering from COPD have higher chances of cardiac arrest (Sin & Man, 2005). COPD is common, costly and preventable but increases the

trend of smoking can make COPD a dominant disease and will increase the economic burden (Hurd, 2009).

1.4Noise Pollution Effect on Hearing:

Unwanted sound is referred to as noise and traffic is the main contributor towards this. Regardless of the region or country the consequences of occupational exposure to noise remain the same i.e. hearing impairment. Epidemiological studies support the relationship between occupational noise and hearing loss. Different occupation offers varying exposure to noise pollution e.g. construction, transportation, mining, manufacturing etc. (Theorell, 2015). Traffic police are majorly affected by Noise-Induced Hearing Loss (NIHL), it's a sensory neural loss and it occurs because of prolonging exposure to noise. Exposure to unwanted noise has a number of effects e.g. insomnia, annoyance, mental disorder (Ingle, Pachpande, Wagh, Patel& Attarde, 2005).

1.5Effect on Eyes Due to Vehicle Exhaust:

Vehicles exhaust significantly degrading the eyes. Traffic police are facing the problem of teary eyes, cataract, short/long-sightedness, redness and itchy eyes. This shows a greater vulnerability of traffic police to all health risks associated with automobiles pollution (Sinha, 1993). Eyes are highly vulnerable to air-borne particles and reports suggest that it can cause corneal drying and irritation to the continuously exposed individuals (Gupta, Agarwal, Sushma & Saxena 2007).

1.6 Occupational Factors Influencing Illnesses:

The following are the factors that can help in understanding the prevalence of occupation-related morbidities

1.6.1 Duration: Pollution is not only posing health threats but also sharing its part in global warming. The longer the duration of exposure to deteriorated environment, heat, noise and humidity the more severe will be the health effects. Traffic police is an occupation in which, they are exposed to pollution for the longest and at the peak hours of the day (Theorell, 2015).

1.6.2 Intensity: Pollution level varies from place to place and is higher at ground level. The increase of population, industries, consumption of diesel and two stokes vehicles make the urban environment impossible to breathe. The pollution level is higher in the city area

as compared to the residential area. The concentration of pollutants is high at a road intersection, industries etc. Poorly tuned engine, worn-out tires and leaded oil is worsening the pollution picture.

1.6.3 Personal protective equipment (PPEs): Personal Protective Equipment is undeniably helpful for workers who are exposed to varying levels of pollution because of their occupation. PPE includes masks, respirators, gloves, comfortable shoes, earplugs/buds, sunscreen, compression stockings, cap etc. Occupational Safety and Health Administration (OSHA) has provided guidelines for the workers involved in a different occupation. Besides being exposed to pollution, unfortunately, traffic police do not use PPEs and vulnerable to acute and chronic respiratory ailments.

1.6.4 Other factors: Respiratory morbidities are dependent upon a lot of factors besides pollution level, duration etc. all other factors include age, smoking, passive smoking, type of fuel used in the kitchen, past record of respiratory infection or any genetic morbidity.

1.7 Problem Statement:

Among the occupational diseases studied, respiratory illnesses and illnesses associated with ears and eyes gain importance nowadays because of alarming increases in atmospheric pollution and congestion in urban areas. More than 1.2 million people die on roads each year, Pakistan shares a death toll of 25781 fatalities. The mortality rate per 100 thousand population in Pakistan is estimated to be 14.2 (WHO, 2015). Traffic police are one of the occupations in which their duty hours exposed them to multiple pollutants i.e. chemicals, vehicular emission etc. which make them at a high risk of developing adverse health impact (Patil et al. 2014).

1.8 Research Question:

The following are the research questions of the study:

i. What is the extent of occupational illnesses that prevail among traffic police?
ii. Do work-related factors determine the illness?
iii. What cost traffic police bear due to their occupational illnesses?

1.9 Objective of the study:

The objectives of the study are as follows:

i. To find the prevalence of morbidities among traffic police.
ii. To explore the relationship of illness with work-related factors.
iii. To estimate the health cost of traffic police due to respiratory, eyes and ears illnesses.

1.10 Research Gap

There are numerous publicationson vehicle exhaust and its impacts on human health. The studies were clinical using the Spiro metricand different measuresto assess the health of the exposed individual. These studies point out the number of morbidities that might happen but unable to quantify human health and lack the necessary emphasison the importance of health of every human being and especially traffic police who are appointed for public safety. This study tries to bridge the gap between the occupational health effects and corresponding monetary damages borne by the victim and the money spend on averting measure on the diseases they face due to their occupation. According to the best of my knowledge, there has been no previous such kind of research to monetize the damages because of their profession. This study tries to fill this gap efficiently.

1.11 Organization of the Proposal:

The first chapter consists of background, sources and components of air pollution. Further, this chapter provides a problem statement, research question and objectives.The second chapter i.e. literature review is about the occupational illnesses in the global and Pakistan perspective. The third chapter gives the econometric model, sample size, study area and brief definition about variables.Chapter IV discusses the estimated results and descriptive statistics of the collected data. In the last chapter summary of the study, conclusion recommendation, strengths and constraints have been made.

CHAPTER II

Thematic Review of Literature

This chapter describes different research findings and covers a wide variety of literature in the occurrence of respiratory illnesses. Literature is drawn from global as well as Pakistan's perspective from numerous occupations including cement, marble, brick kilns, mining etc. In this review of literature, various clinical, occupational and air quality is taken into consideration so as to understand the occurrence of the problem.

2.1 Occupational Morbidities- Global Scenario:

Workers get seriously affected by the work environment. Traffic police is such a job that offers a lot of work-related risks and hazards, few related risksare discussed at the global and at Pakistan level below.

2.1.1 Respiratory Diseases

Occupationally related diseases result in suffering and hardship not only to the worker and his family, but it also cost the community. DALY's is estimated to be 38 million and occupational risk factors are responsible for 18.6 DALYs per 1000 persons globally Leigh et al., (1999).It reflects how crucial one person's life and disability due to the occupation put pressure not only on the individual and his family but also on society. Another thing about disability attached to the profession leads a negative impression on the employees and on the person who might want to pursue such a job.

An investigation was established on the possible chances of chronic respiratory effects and related symptoms on traffic police of Bangkok, using stepwise multiple regression analysis. It was a comparative analysis between the police of Bangkok to Ayutthaya, major prevalence of chronic cough and phlegm was found among Bangkok police due to heavy traffic jams and busy roads (Karita, Yano, Jinsat, Boudoung & Tamura, 2001).

In order to estimate that vehicular emission does pose a chronic impact on human health a study was conducted in North Wales, an area was selected with high traffic congestion (study) and in this similar area data from the uncongested street (control) was collected. A by-pass was constructed so as to see the change in particulate matter concentration;the control area was taken to compare the PM concentration over a period of 2 years. Health

effects of the study group are likely to be more apparent for nasal and ocular symptoms (Burr, Karani, Davies, Holmes & Williams, 2004).

As it is established that occupation is a major effectors in an individual's life, risk assessment carried out by WHO and ILO highlighted the humongous burden of morbidity and mortality due to occupation, this situation becomes more complicated in developing countries. A comparative questionnaire-based cross-sectional study in Jalagon an Indian city, by using spatial modeling using GIS, distance to roads and source intensity was measured to assess at which concentration respondents are exposed. The study suggests that automobile is 'necessary evils' resulting in the occurrence of respiratory diseases among policemen (Ingle et al., 2005).

Satapathy et al(2009) conducted this study to assess the health status of traffic police personnel of Brahmpur city and to find related risk factors so that appropriate preventive measures can be recommended. The study was cross-sectional conducted in Brahmpur. The health status of police constables was assessed by conducting appropriate anthropometrical, clinical and laboratory examinations of each individual. The majority of respondents were lying in the age group of 30-50 years. Tobacco chewing was common among them followed by alcohol consumption. Diseases in traffic personnel were observed like anemia was 43.7%, musculoskeletal disorder in 27% hypertension in 25%, respiratory disorders 16%. The author suggested the periodic health status check of traffic police personnel for any morbidity.

India climatic condition and illiteracy level is comparable to here in Pakistan, study conducted in Jaipur an Indian city is also facing a similar traffic problem, comparative study of Rajasthan police working at traffic signals (study group) and police working in the outskirts of the city (control group). Traffic pollution is attributed to decrement in pulmonary function (Singh, Sharma, Yadav & Meena, 2009).

Gupta, Mittel, Kumar & Singh (2011) estimated vehicular emissions affecting badly the quality of air since cities are expanding. The exhaust of motor vehicles consists of thousands of pollutants including NO, SO and particulate matter. Traffic police personnel are continuously exposed to it because of the nature of their job. The author aimed to determine the detrimental effect of vehicular exhaust on the pulmonary function of traffic policemen. Author especially collected data from non-smoking policemen working in

Patiala city as a study group while policemen working indoors or offices job as a control group. Pulmonary function tests of all respondents were performed using Spiro-meter and the data on the health status of the study group was obtained using Respirator Medical Evaluation Questionnaire. Results show that more than 66% of the control group were in service >8years. Subjects were suffering majorly from frequent cough and minor affected from shortness of breath. The values that were obtained show a significant risk of respiratory morbidity in traffic police and a recommendation of compulsory use of PPEwas established.

Studies opted different designs e.g. cross-sectional study as well as comparison within a cross-sectional study to assess occupational illnesses both acute and chronic. Acute illnesses include upper respiratory tract infection, cough, wheezing, bronchitis, breathlessness, phlegm, sore throat etc. Diagnosis of such diseases is made through x-ray, these diseases are irreversible once a positive x-ray is obtained (Theorell, 2015).

A thorough study by Panta & Neupane, (2016) delicately explains the health hazards/risks that policemen are exposed to because of the nature of their job. Although OHH is preventable most of the policemen are not aware of them or they are ill-informed about the intensity of the hazard. Author conducted this questionnaire-based descriptive study in Kathmandu valley aiming to collect information regarding personal protective equipment and what type of diseases prevail because of the nature of their job. Cluster sampling technique was used and sample size was 282, results reveal that 40% of subjects were fairly aware of the adverse effect of noise pollution, 90% of them wear caps during duty hour, 5% wear earplugs. It shows that there is a significant association exists between policemen's level of knowledge on the prevention of occupational health hazards. The findings of this study suggest that three fourth of respondents have a fair knowledge ofthe effects and prevention of OHH due to dust/gas, noise and prolonged standing effects on backache.

In another study, the author aims to assess the occupational health risk of traffic police in Kathmandu Valley. Besides noise pollution motor vehicles emit a large quantity of a numbers of gasses, these gasses are largely responsible for global warming and posing an adverse impact on health. Traffic police work in close proximity to motor vehicles. They have to stand at a road intersection and it’s a 24/7 days’ job. A structured questionnaire was built to assess health status including depression, dependency on nicotine, and

prevalence of the musculoskeletal disorder, acute respiratory tract infection, skin allergy, eye problem, ear problem and utilization of personal protective equipment. Results show that the maximum number of respondents was suffering from almost all of the above diseases mentioned. Respondents were young of age 25-29. Based on the questionnaire 70+ percent complained about problems related to eyes, ears, respiratory infection and skin allergy. Nearly 9 out of 10 had musculoskeletal pain in at least one part of the body (neck, shoulder, elbow, wrist/hand, upper back, lower back, and hip/thigh. knee and ankle). A major portion of respondents was not using personal protective equipment (Dhakal, Shah, Sainju & Manandhar, 2017).

2.1.2 Ophthalmic Diseases:

Every occupation offers a certain amount of eye-related diseases but the occupation which involve exposure to smoke containing the chemical are important and the ophthalmic health of such individual is of concern. A study conducted on workers employed in the tobacco industry indicates the harmful exposure of tobacco dust, the questionnaire was distributed among respondents. Results indicate the presence of eye irritation, redness, eyelid dermatitis etc. Eye irritation is caused by the mechanical effect of air-borne particles (Kjærgaard & Pedersen, 1989). Another clinical study on ocular surface by Gupta et al (2007) gathers information from respondents who are living near an extremely polluted area or are working in a polluted environment. Clinical examination of respondents slit lamp, visual acuity test, tear-film breakup time and Schrimer test revealed that subjects were suffering from blurring, redness, watering and strain.

Altshuller (1977) highlighted the adverse impact of photochemical smog on eyes in California. Heavy traffic in LA, forest fires have increased the incidence of eye irritation, visibility reduction etc.

2.1.3Auditory disease:

God has blessed sapiens with five senses and hearing is one of them, an occupation that bestowed an individual with partial or permanent hearing has its own economic and psychological impacts. Traffic police is such a job that involves such incidents. Ingle et al (2005) studied hearing loss among traffic police of Jalagon city. They use a questionnaire on which they can self- report about hearing difficulty. An auditory test was performed on subjects using conventional earphones. Results show that 84% of police have self-reported

about the hearing difficulty. Police working near roads are exposed to loud noises for almost 8-12h per day have the highest chances of hearing loss, deafness etc.

Omidvari & Nouri (2009)highlighted noise pollution as a problem in urban areas of city Tehran. The sound level meter was used to measure the amount to which traffic police was exposed, all the reading was taken in peak hours. 46% of policemen considered traffic noise as a major problem they were facing in their duty.

2.2 Occupational Respiratory Diseases-Pakistan Scenario:

In addition to respiratory illnesses, a huge number of road injuries and accidents are also attributed to road traffic. Ministry of Transport and the Ministry of Health and Planning Commission revealed that there has never been an improved transport policy in Pakistan. It's been proven that lead toxicity, sedentary lifestyles and air pollution based illnesses are the outcome of road traffic (Hyder, Ghaffar, Sugerman & Masood, 2006).

Health related issues arise from the degraded quality of air which is attributed to traffic. Road traffic has poisoned the air by adding dust, dirt, soot, smoke, fog, smog etc. data collected from Rawalpindi through questionnaire suggested a high incidence of respiratory symptoms, eye and skin allergy, respondents have low education level and their unawareness regarding preventive measure have worsened the situation (Ali, Rashid, Yousaf & Kamal, 2017). In another study conducted in Lahore, the Spiro-metric method was used to study the effect of dust pollution on different parameters of lung function (FVC, FEV_1 and $FEF_{25-75\%}$). Exposure to a rather low level of a pollutant for a long period of time can increase the occurrence of airway obstructive diseases and asthma. Impairment in lung function is found to be positively related to roadside dust and air pollution (Jafary, Faridi & Qureshi, 2007).

A cross-sectional study to inquired about COPD, asthma and other respiratory diseases through a questionnaire, results show a high correlation these symptoms to reduced lung function (Abbasi, Ahsan & Nafees, 2012).

A comparative study between exposed and control was made out in Multan. Air quality has been degraded and people residing near road banks and traffic police were among the ones having impaired lungs. Decreased lung function results in changes in PFT (pulmonary function test) parameter (Zafar, Asmatullah & Ahmed 2015).

A cross-sectional study to estimate respiratory diseases, results of data collected for about one year reported that asthma, COPD, pneumonia, lung cancer, tuberculosis to be the most common among patients. Respiratory disease is a joined term used for a lot of symptoms infection of respiratory symptoms affecting lungs, bronchial tubes, pleural cavity, upper respiratory tract, trachea and nerves associated with breathing either individually or in combination(Sultana et al., 2017).

2.3 Summary of Literature:

Traffic police as public servant job comes with its own cost in the terms of health. Although traffic personnel do enjoy some governmental benefits like insurance, better pay packages etc. but their occupation becomes an important factor in determining their health.

Industrialization, urbanization and unplanned city expansion is contributing towards air pollution. Different human practices like coal extraction, mining, marble industry, cement, construction etc. contributes a lot towards air pollution. It is a well apparent fact that traffic congestion is one of them and can become a fore factor to develop morbidities. A number of major and minor accidents also lead to impairment in individual's life. Ambient air quality monitoring was carries out in different studies based on which establish a fact that traffic police are exposed to inferior air quality. Air pollution is a predominant factor to develop breathing and respiratory problems, existing respiratory and cardiovascular system become aggravated, body defense system becomes weak, carcinogens and premature deaths. Air quality is deteriorating in metropolitan city like Rawalpindi and environmentalist claim that breathing in such are is equivalent to smoking 10-15 cigarettes per day. Toxicology of air pollution is highly complex as there are number of pollutant and the amount by which they have the potential to detriment human health varies, there are certain pollutant who becomes more aggressive when oxidized in air or in the presence of some other pollutant. National Environmental Quality Standard (NEQS) are provided in order to keep a check and balance on all the environmental pollutant but due to low civic sense, illiteracy and ignorance we are unable to get the life standard according to the provided instructions. Traffic congestion is also contributing towards noise, since *Homo sapiens* have mastered the art of damaging the gifts of God i.e. health. Persistent noise can result in hearing loss, hypertension, insomnia etc. Traffic police is not only exposed to environmental pollutant but this sedentary job exposed them to multiple health threats as musculoskeletal disorder, skin allergy/cancer, fatigue, stress, communicable disease which

is a very serious issue in Covid times. Public servants bear monetary damages in terms of taking averting measure, expenditure on health treatment, working hours' loss and income stress.

CHAPTER III

Methods and Technique

This chapter gives a framework of research strategies that will be adopted in the study. This chapter covers the data collection procedure, study area, sampling technique and empirical framework of the model which will be used in further estimation and calculations.

3.1Data and Methodology:

It is a cross-sectional study survey. Data for this is collected by using a structured questionnaire. Primary data is collected from a traffic police personnel by exploring respiratory illnesses (asthma, cough, chest tightness/pain, cough with sputum, breathlessness), ophthalmic illnesses and auditory illnesses and also inquiringabout the cost of illnesses (direct & indirect cost).

3.2Study Area:

Islamabad is maintained by Capital Development Authority (CDA) with a population of 1,014,825 per the 2017 census. Islamabad Traffic Police (ICT) department was established in 1997. Islamabad is 4th most green and clean city in the world. Adjacent to ICT lies Rawalpindi, it comes at 4th in population among Pakistani cities. Rawalpindi traffic is managed by a structured organization 'City Traffic Police Rawalpindi' and its mission is to provide safe trips to the public and prevent anti-social road behavior (Wikipedia, 2010).The area of study is the busy roads of Rawalpindi and Islamabad, traffic police working at the bank of such roads will be the targeted subjects of this study.

The focus of the study is the busy roads of the twin cities upon which traffic police personals perform their duty. From Islamabad, questionnaire samples were collected from Serena Signal, the junction of Kashmir highway and 7th avenue, the junction of Pir-Sohawa and Margalla Road, the junction of Jinnah Avenue and 9th avenue. While from Rawalpindi, data was collected from Murree road, Pir-Wadahi, Adyala Road, Airport Road and Faizabad.

3.3Choice of Method:

This study is a questionnaire-based convenient sampling. A number of different measurement strategies which include clinical, questionnaire-based, using different instruments to predict the prevalence of occupational illness. Detection of symptoms of respiratory morbidities using structured questionnaire American Thoracic Society-Division of lung Disease (ATS-DLD), British Medical Research Council(BMRC) was used by Dhakal et al., (2017), Satapathy et al., (2009), Sinha (1993) and García, Rao & Pulido(2019) for estimation.

3.4 Sample Size:

<table>
<tr><td>Cities selected for data collection</td><td colspan="4">Islamabad+ Rawalpindi</td></tr>
<tr><td rowspan="2">Total strengths of police personnel from selected cities</td><td colspan="2">Islamabad</td><td>Rawalpindi</td><td>Total</td></tr>
<tr><td colspan="2">400</td><td>410</td><td>810</td></tr>
<tr><td rowspan="3">Number of the person eligible to participate</td><td colspan="2">Islamabad</td><td colspan="2">Rawalpindi</td></tr>
<tr><td>Indoor</td><td>Outdoor</td><td>Indoor</td><td>Outdoor</td></tr>
<tr><td>230</td><td>170</td><td>200</td><td>210</td></tr>
<tr><td rowspan="2">Number of personnel participated in the study</td><td colspan="2">Islamabad</td><td>Rawalpindi</td><td>Total</td></tr>
<tr><td colspan="2">50</td><td>50</td><td>100</td></tr>
</table>

The following formula is used for sample size calculation

$$n = \left(\frac{Z_{\frac{a}{2}}\,\sigma}{e^2}\right)$$

Where:

n = sample size

σ = expected standard deviation of the outcome variable

Z = Standard normal deviation at the required confidence level of 95%

e = designed margin of error

At a 10% margin of error and a 90% confidence level, the sample size is taken. Traffic police that is more prone to occupational illnesses are the ones that are more exposed i.e. traffic police that perform duty outdoor. A total of 380 perform duty outdoor, I have taken a sample of 100

respondents working at high traffic roads using a convenient sampling procedure (Dhakal et al, 2017).

3.5 Empirical framework:

Convenient sampling is applied in this study, in order to identify the respondents facing occupational illnesses. A questionnaire is divided into three sections, the first section of the questionnaire requires personal information from subjects, second section deals with socio-economic information and few basic question regarding genetic morbidities and finally last section inquire about the health cost directly or indirectly they incur on the treatment of illness. Primary questionnaire-based data were collected for the study. Respondents were inquired about the doctor fee, travel cost medicinal expenses, lab tests or any other expenses which they incur due to the disease.

3.6 Variables of the Study:

The study includes several variables including dummy, continuous variable in order to check the factors which are work-related that might control the prevalence of illness and the attached cost they incur due to such disease. Table 1 provides all these variables and their nature.

Table 3.1 Study variables

Dependent Variable	**Variable Code**	**Units**	**Nature**	**Expected Sign**	**Reference**
Morbidity (Respiratory, ophthalmic and auditory)	**RM**	Dummy	Presence of any morbidity =1 No=0	+/-	(Mary, 2013)
Independent Variables	**Variable Code**	**Units**	**Description**	**Expected sign**	**Reference**
Age	**Age**	Continuous	Age of respondents (in years)	+	(Ali et al., 2017)
Marital Status	**MS**	Dummy	married= 0, Unmarried=1	+/-	
Income	**I**	Continuous	Total income in Rupees	+/-	
Education	**Edu**	Continuous	Qualification of respondent		
Household size	**HHS**	Continuous		(Dhakal et al., 2017)	
Number of working years in city	**WY**	Continuous			
Working Hours near the roadside	**WH**	Continuous			
Working days	**WD**	>=6 days = 0 7 days = 1			
Use of personal protective equipment	**PPE**	No=0 Yes=1			
Non-occupational exposure (Smoking Tobacco user)	**NOE**	No=0 Yes=1		(Pope III et al., 2002)	

Co-morbidities (Obesity, Diabetes, high cholesterol etc.)	**CM**	No=0 Yes=1	(Sultana et al., 2017)
Body mass index	**BMI**	Continuous	

3.7 Variables description:

A brief description of the study variables in tables 2 is given. It tells about the variable specification, whether they are dummy or continuous, and its importance in the study.

Table 3.2 Variable Description

Sr no.	Variables	Description
1.	**Occupational morbidities**	It is my independent variable and it is a dummy variable which means the presence of any illnesses is 1 otherwise 0. This is regressed on many independent variables. In order to capture the relationship of occupational illnesses with different variables, the model includes independent variable income, work characteristics, daily exposure, use of personal protective equipment etc.
2.	**Current income**	This study includes the current income in rupees of the respondent.
3.	**Education**	Education is a variable on which the occurrence of respiratory symptoms depends. More educated people will try to use PPE and monthly health checkups to avoid respiratory morbidities.
4.	**Age**	This is taken as a number of years; as young people are more vulnerable to respiratory illness. Police personnel who are of higher age are promoted to office level work or indoor job where there are fewer chances of exposure as they are unable to control traffic in rush hours
5.	**Respiratory Diseases**	There are different respiratory symptoms that can be present in respondents it includes the asthmatic problem, frequent coughing, chest tightness/ pain etc.
6.	**Ophthalmic Diseases**	Presence of eye-related diseases in respondents e.g. burning eyes, red eye, tearful eye, cataract etc.

7.	**Auditory Diseases**	Presence of ear-related problems in respondents e.g. hearing difficulty, ear discharge, hearing loss, tinnitus etc.
8.	**Use of personal protective equipment**	Respondents who are using personal protective equipment will be less vulnerable to diseases hence face less cost.
9.	**Non-occupational exposure**	Respiratory symptoms might be due to their own personal habit of smoking and tobacco chewing etc.
10.	**Co-morbidities**	Respondents might have any previous record of illnesses or he might be facing any other disease which can aggravate the occupational illnesses.
11.	**Body mass index**	BMI might be a variable that can worsen any of the morbidities that traffic police are facing. The following formula will be used (BMI Calculator,2019). $$BMI = \frac{\text{Weight}}{Height^2}$$

3.8Cost variable description:

Table 3 provides the various categories of costs that will be estimated in the study. It also describes the cost incurred by the traffic police because of traffic-related pollution.

Table 3: Cost variable description

Type of Cost	**Category of Cost**	**Description**
Direct cost	Medical	Cost of consultation Cost of medication Laboratory/diagnosis Treatment
Indirect cost	Non- medical	Travel, food and drink cost of patient and accompanying person and cost incur to take averting measure.
	Productivity loss	Productivity losses of the patient in terms of absentees, working hour loss, travel time etc.

3.9 Econometric Model:

To achieve the objective of the study following two econometric models will be adapted according to the dependent variable.

3.9.1 Model I:

To check the prevalence of morbidities due to traffic exhaust and pollution, I used a logit model which is also used by Mary(2013), Abbasi et al (2012) and Dhakal et al(2017)because it is an efficient model to describe the relationship between a non-negative binary dependent variable and continuous independent variable. This model will check the dependent variable respiratory, ophthalmic and auditory diseases (1 for presence otherwise 0).

$$(logit)D = \beta_0 + \beta_1 Age + \beta_2 Edu + \beta_3 HHS + \beta_4 WH + \beta_5 WY + \beta_6 WD + \beta_7 CM + \beta_8 PPE + \beta_9 Q\_PPE + \varepsilon$$

3.9.2 Model II:

Studies based on the cost of illnesses estimate the amount that could be saved, gained or invested onto some other project if a disease to be cured or eradicated. The cost can be measured by summing direct and indirect costs, which involve medical treatment, medication, travel, time, food etc. cost.

Direct cost = Medical cost+ Non-medical cost = DC $= \sum_{i=1}^{k} Pi * Qi$

The medical cost can be calculated by multiplying price with the treatment or medication during illness

$$MC = P_1 * Q_1 + P_2 * Q_2 + P_3 * Q_3$$

The non-medical cost will be the services (food, drinks etc.) used by the patient or by accompanying person.

$$NMC = P_4 * Q_5 + P_6 * Q_6$$

The Sum of both MC and NMC will be a direct cost. There is a third type of cost called intangible cost and consists of pain, suffering which can't be measured in monetary value. Indicator of intangible cost is fear, pain, emotional suffering of the individual and his family.

Ordinary Least Square (OLS) can be used to explain the relationship of one continuous dependent variable and two or more independent variables (continuous) as used by Aliet al., (2017). A separate equation is used to determine the different factors which cause a different type of cost.

$$HC = \beta_0 + \beta_1 Age + \beta_2 MS + \beta_3 Edu + \beta_4 I + \beta_5 WY + \beta_6 Dum + \beta_7 CM + \beta_8 BMI + \beta_9 OD + \beta_{10} PPE + \beta_{11} D + \varepsilon$$

Chapter IV

Results & Discussion

This chapter sketches respondents based on collected data. Descriptive statistics about socio-demographic variables of both groups have been discussed in this chapter like age, education, income into experience, diseases in both groups and health statistics. The further regression analysis has also been done about the health cost of both samples. The factors that determine the likelihood of disease is also discussed in this chapter.

4.1 Descriptive Statistics of Socio-Economic characteristics:

The age of traffic police is between 28 years to 54 years. As shown in figure 4.1 majority of personnel are around 25 to 50 years, as per the collected sample of 100 respondents 63% are aged between 35 to 44 years, 27% are aged between 45 to 60 years and 10 % are aged between 25 to 34 years. (Figure 4.1)

Qualification of traffic personnel is found between 10 to 16 years of qualification. 50 % of the sample is graduated which shows a high number of traffic police is qualified, among 50% of them Islamabad traffic police are more qualified and have a high number of graduated personnel as compare to Rawalpindi, 36 % were found to have education up to inter-level while 14% were qualified to 10^{th} grade as shown in figure 4.2.

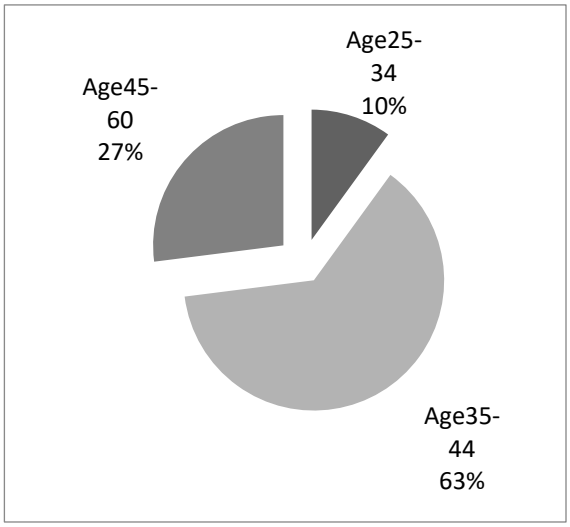

Figure 4.1 Age of respondents

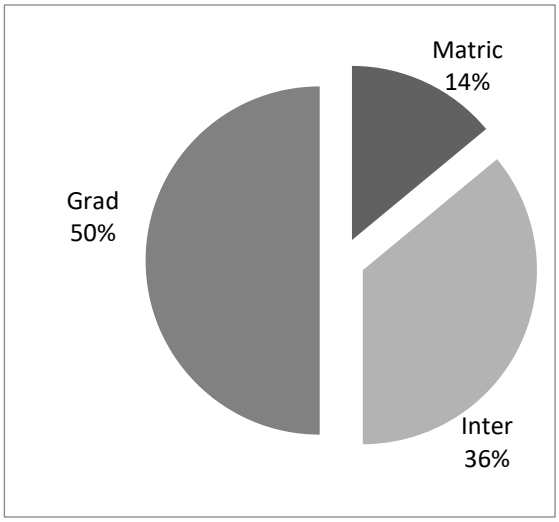

Figure 4.2 Qualification of respondents

Islamabad and Rawalpindi traffic police were found to be 56% overweight, 17% obese, 27% of respondents were having a normal weight, while no one is found to be underweight as shown in figure 4.4. It shows that the occurrence of occupational diseases and genetic disease can be linked to their Body Mass Index (BMI).

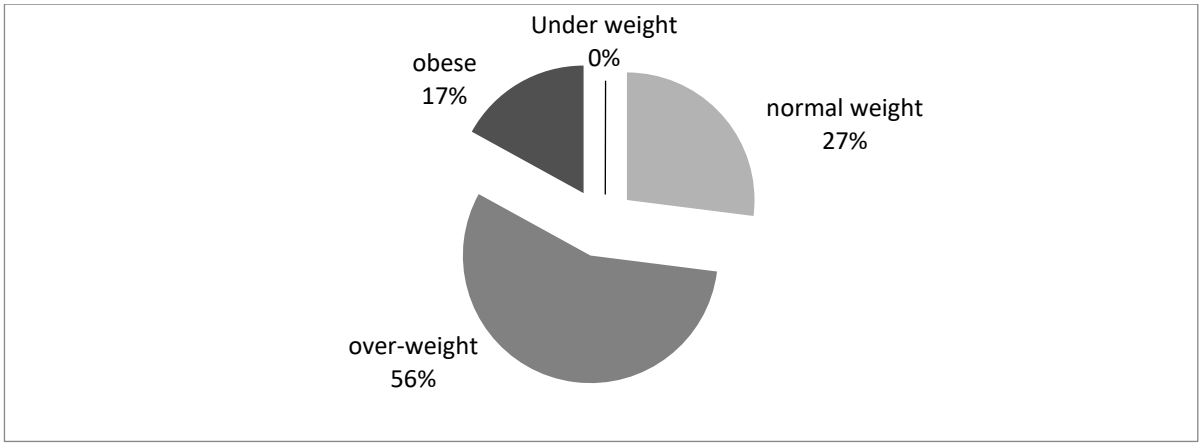

Figure 4.4Body Mass Index of respondents

The income of traffic police depends on education and experience as shown in figure 4.5. The scatter plot shows that they receive income between 40,000 to 60,000 rupees with the experience between 5 to 15 years. Traffic personal having more experience, less qualification and less experience with more qualification receives almost around the same income. The scatter plot shows that their income increases with experience as one of the personnel are found to have experience of 32 years receives 80,000 rupees per month.

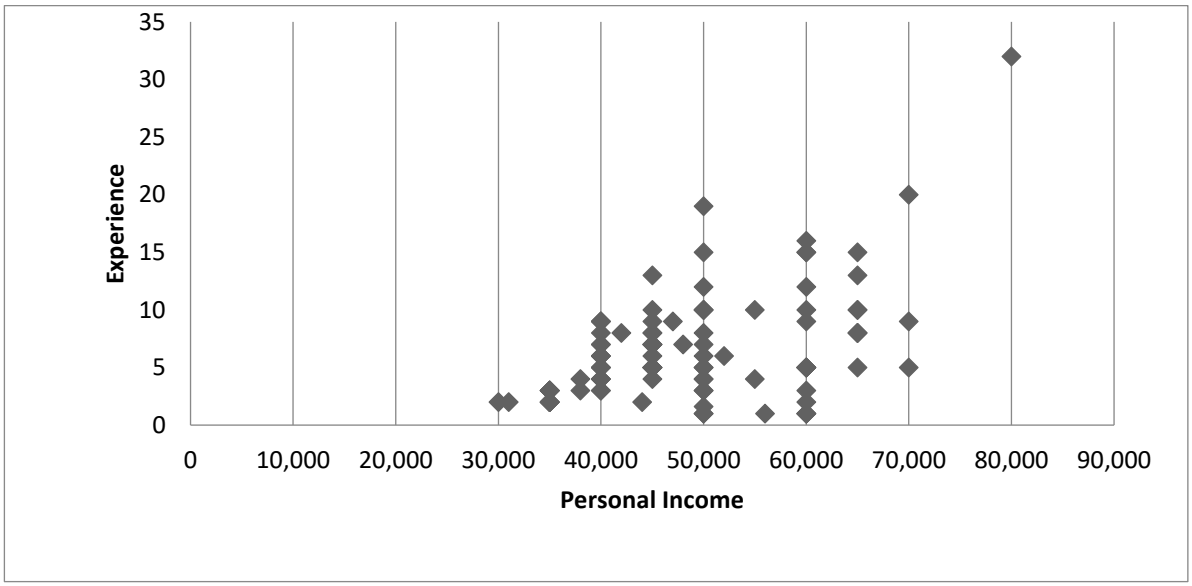

Figure 4.5 Frequency distribution of income into the experience

The frequency distribution of Islamabad and Rawalpindi traffic police is shown in fig. out of 100 respondents 51 subjects are found to have experience up to 5 years and have minimalistic experience serving this department while they lie in an age group of 25 to 28 years. Among the subjects, 37 respondents are having experience of up to10 years while they lie in the age group of 29 to 32 years. As we go from left to right, the frequency of respondents decreases as the experience increase, one respondent is found to have an experience of 32 years while he lies in the age group of 49 to 54 years as shown in figure 4.6.

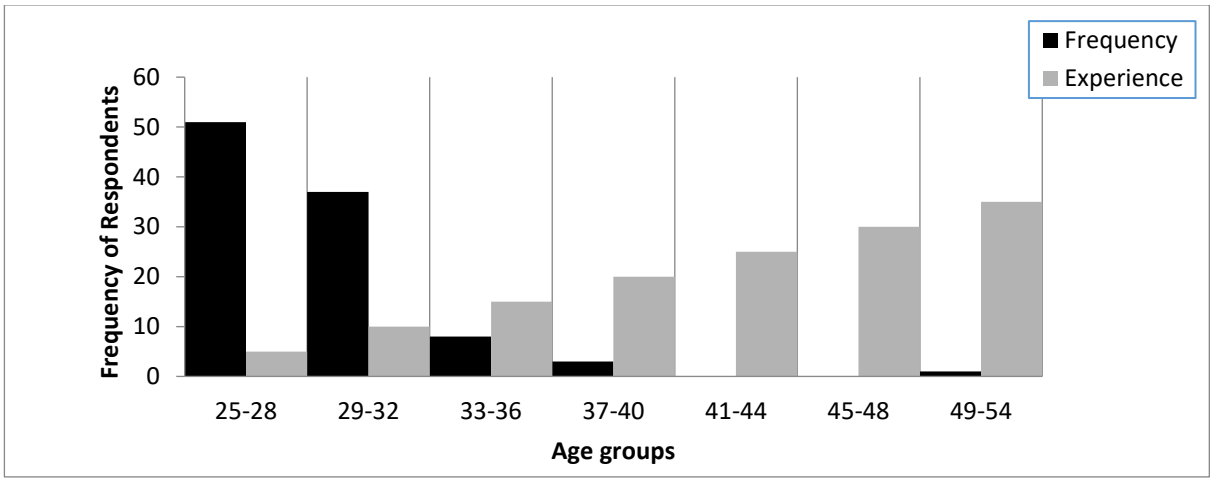

Figure 4.6 Frequency distribution of age into the number of respondents

Some of the most common genetic diseases mentioned below whose ratio are comparatively higher than other diseases. Traffic police have a higher incidence of diabetes which is 25% as shown in table 4.1. Asthma is a genetic disease that is also found to be 22% among respondents followed by BP which is 21%. Obesity is also very common among traffic police and it is 11%, COPD also transfers genetically but traffic police are found to be least affected with it genetically which is 4%.

Table 4.1: Descriptive statistics of Sample

Socio Economic Variable					
Variable	Observation	Mean	Std. Deviation	Minimum	Maximum
Age (No of years)	100	41.18	5.93	28	54
Education (No of years)	100	12.84	1.63	10	18
Income (Rupees per month)	100	48960	10489.94	30000	80000
Working hours (No of hours)	100	9.1	1.85	8	16
Co-morbidities Statistics					
COPD	100	.4	.49	0	1
Hypertension/BP	100	.21	.40	0	1
Obesity	100	.11	.31	0	1
Diabetes	100	.25	.43	0	1
Asthma	100	.22	.41	0	1

The respiratory illnesses studied among Islamabad and Rawalpindi traffic show results in the frequency histogram in figure 4.7. As shown in figure it can be seen that personnel that lies in the age group of 25 to 28 years are the one having the least incidence of respiratory illnesses. Traffic personnel who are in the age of 37 to 40 years are the respondents suffering from a number of respiratory illnesses. The respiratory illnesses which are inquired from subjects are cough, tuberculosis, bronchial inflammation, pneumonia while they self about dry cough, phlegm etc. It is well apparent from the frequency distribution that Rawalpindi personnel suffered more from the incidence of any of respiratory illnesses as compare to Islamabad traffic personnel.

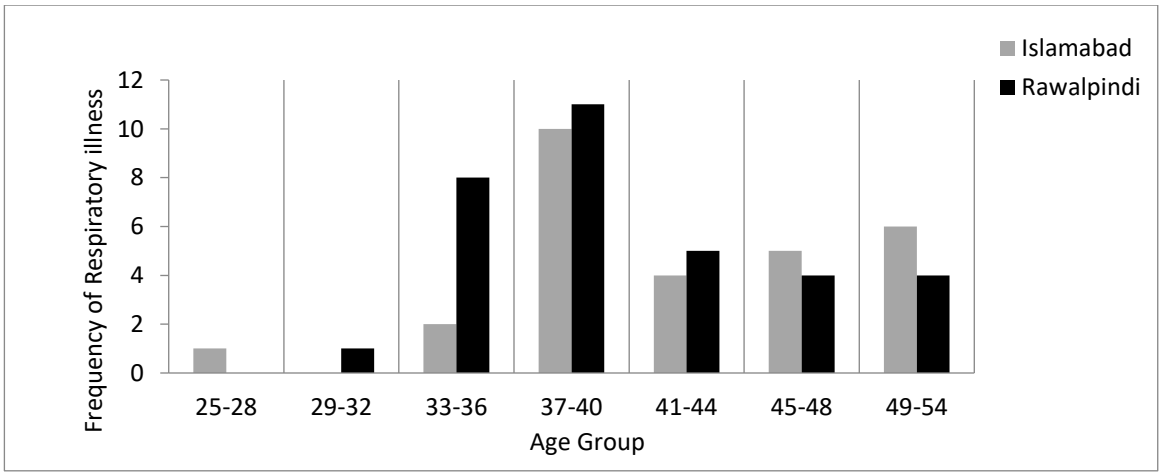

Figure 4.7 Frequency distribution respiratory illnesses and age of respondents

The incidence of ophthalmic illnesses among traffic personnel is shown in figure 4.8. Among traffic police that lie in the age group from 37 to 40 years are the highest sufferers from ophthalmic illnesses and are having experience of up to 10 years. Ophthalmic illnesses inquired from subjects are redness, burning eyes, cataract, and teary eyes while they self-reported about vision reduction/visibility loss etc. As a whole, it can be seen that Rawalpindi traffic police suffer more from occupational ophthalmic illness.

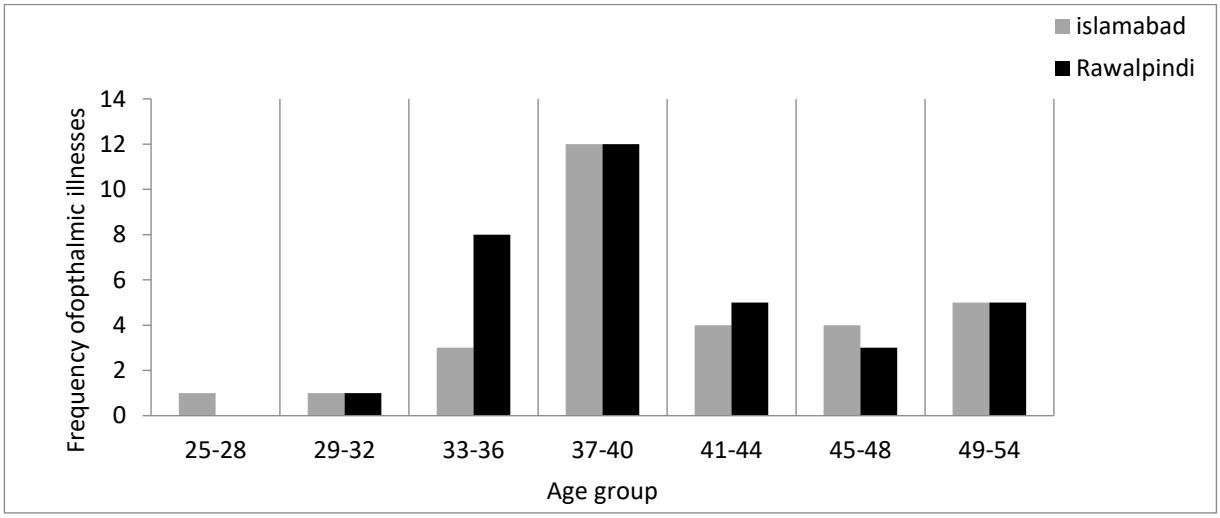

Figure 4.8 Frequency distribution of age of respondents and ophthalmic illness

The frequency of auditory illnesses among personnel is shown in frequency distribution in figure 4.9.Traffic personnel suffers a lot from auditory illnesses especially the personnel that lies within the age group from 37 to 40 years. Auditory illnesses inquired from subjects are ear discharge, tinnitus, partial hearing loss and hearing difficulty while they self-reported pus formation and headache due to loud noises. As it is well apparent that Rawalpindi traffic police suffer more from unpleasant noises which they have to face due to their occupation. Traffic police have some awareness regarding self-barriers against all these form of pollution but they are seen to use gloves, masks only, they do not use ear protective buds which seem to be an alarming issue. Since their occupation bound them to perform their duty sedentary with minimalistic movement results in musculoskeletal problems, neck ache, backache etc. which a lot of personnel claim to have these.

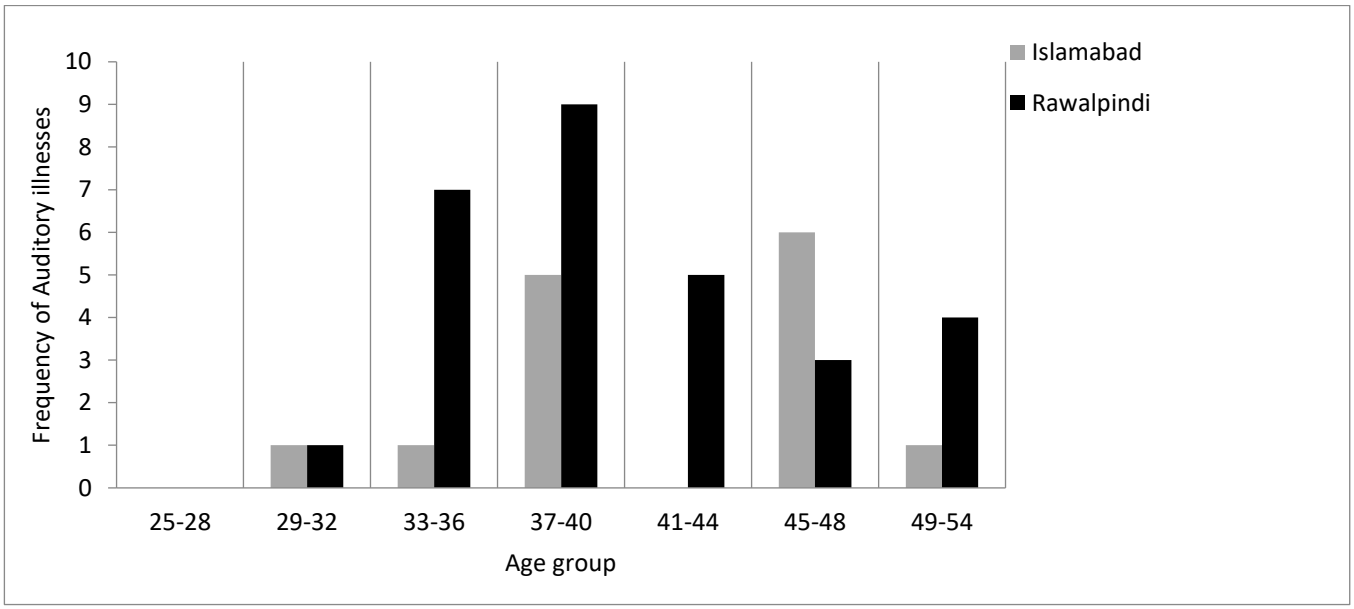

Figure 4.9 Frequency distribution of age of respondents and auditory illnesses

4.2 Estimation Results & Analysis:

Regression results of health cost in respondents from Islamabad and Rawalpindi are as below:

Table 4.2 Health cost of Islamabad traffic police & Rawalpindi traffic police

Variable Name	Coefficient	t-value	P-value
Education	**-29.24***	-3.21	0.002
Working year	**10.64***	2.76	0.007
Drug use	**55.09****	1.78	0.078
Occupational disease	**135.79***	2.60	0.011
dummy	**90.65****	1.76	0.082
Co-morbidities	17.63	1.24	0.220
Averting measure	-0.71	-0.02	0.981
Age	**-6.70***	-2.10	0.038
Family size	-1.09	-0.16	0.871
BMI	5.21	0.23	0.821
Income	0.00	0.76	0.449
*, **shows significance at 1 and 10%.			

No of obs=94, Prob>F = 0.0001, R-squared = 0.3553 Adj R-squared = 0.2689

In the above regression explanatory variables are regressed on health cost from which some are socio-demographic variables age, family size while others are related to occupation working years, use of personal protective equipment and health variable like BMI (it's a categorical variable i.e. underweight=0,normal weight=1, over-weight=2, obese=3) co-morbidities, the incidence of occupational disease which includes respiratory, auditory and ophthalmic illnesses can affect health cost and drug use can positively alter health cost. The dummy variable (Islamabad=0, Rawalpindi=1) is also regressed so as to check that respondent who is facing a different amount of pollution borne a higher cost in terms of health.

In regression results dummy variables (Islamabad= 0, Rawalpindi= 1), the working year, drug use and occupational disease, education and age have a statistically significant impact on health cost. Income, family size, BMI and co-morbidities are statistically insignificant. In the dummy variable respondents from Rawalpindi are compared to Islamabad using dummy variables it is statistically significant which means that traffic police from Rawalpindi is borne more health cost because they are exposed to higher emission level.

Respondents were found to be addicted to drugs, each rupee spend on addiction can significantly increase health costs by 55, it is well apparent that drugs are no good for health. It can lead to an increase in health costs and respondents are already facing vehicles smoke, dust etc. but they are worsening their health by using drugs. Respondents suffering from any occupational respiratory (cough, bronchial inflammation and pneumonia) auditory (ear discharge, partial hearing loss, tinnitus, hearing difficulty) and ophthalmic (redness, burning eyes, teary eyes) significantly increase health cost by 135it highlights suffer from an occupational illness which might be due to air pollution and it prevail more in summer than in winter and it is very consistent with Ingle et al., 2005. Respondents' working year is highly significant with health cost 1-year increase in experience increases health cost by 10 which means that respondents who are facing this pollution exposure issue for the longest time develop illnesses due to occupation and it adds to their health cost. Additionally, one-year increase in age decreases health cost by 6 it means that older people tend not to spend money on their health rather they try to use the money on something else or someone they care for. The education of respondents also significantly reduces the health cost by 29 which means that qualified persons adopt precautionary measures and avoid contact with unnecessary pollution qualified person really helps in developing an understanding of health and tries to emphasize the use of personal barriers to avoid any occupational illness. Further, one-rupee increase in income will significantly decrease health costs by 0.0006 it tries to imply that respondents having a higher income can invest more in their health by opting for better food and having a better lifestyle. Respondents having one or more than one co-morbidities (diabetes, BP, obesity, asthma etc.) increases health cost by 17.63 it corresponds that having a background of genetic illness adds to health cost.

4.3 Determinants of occupational disease:

This model highlights the effect of the independent variable on the occurrence of illness (respiratory, auditory and ophthalmic) that might be due to their occupation, dependent variable is in the form of a dummy, it means that having an illness (yes=1, no=0). The independent variables which are used in this model age, household size, education, working hours, working years, working days, co-morbidities, use of personal protective equipment (yes=1, no=0) and quality of personal protective equipment (very good=1, good=2, poor=3, very poor=4), it means that they take averting measure and what is the quality of personal barrier against the pollution that they faced due to their occupation.

Table 4.3 Logistic Regression Model

Variable	Logistic coefficient	Marginal coefficient	Standardized coefficient
Age	0.02** (.052)	0.030** (.010)	0.02* (.314)
Family size	0.01*** (.196)	0.018*** (.040)	0.01*** (.369)
Education	0.48 (.194)	0.48 (.038)	0.48 (.319)
Hour of exposure	0.00*** (.180)	0.006*** (.036)	0.005*** (.329)
Working year	0.21* (.258)	0.21 * (.051)	0.21* (.301)
Working days	0.01*** (.805)	0.00*** (.168)	0.01*** (.304)
Co-morbidities	0.15* (.602)	0.14* (.116)	0.15* (.302)
Averting measure	-0.06** (1.78)	0.01*** (.208)	-0.06* (.865)
Quality of averting measure	0.04** (.884)	0.03* (.172)	1.86* (.915)
Log-likelihood	-43.075		-43.075
LR Chi2(9)	40.68		40.68
R Squared	0.320		0.3208

***, **, * indicate the significance level at 1% 5% and 10% respectively and standard error in parentheses.

The above regression model has been tested for total disease and its possible independent variable. The age of the respondent shows a significant positive relationship with disease, a 1-year increase in age results in a 3% likelihood of incidence of disease. Household size shows a significant negative relationship with the total disease this implies that bigger families have more qualifies people and have a better understanding of the occupational illness. An increase in working hours, working days and working year shows a positive relationship with total disease. It means that subjects will be more exposed to a number of pollutants and will be more prone to the incidence of disease. Co-morbidities are also positively and significantly related to the total disease. Subjects having a genetic history of the disease are more affected by occupational illness. Quality of personal protective equipment is taken in continuous form i.e. Very good=1, good=2, poor=3, very poor=4, so increase in the number refers to a decrease in the quality of personal barrier (gloves, mask, shades, earplugs etc.) as it decreases leading to increase in disease. The use of personal protective equipment is positively linked to total disease. The education of respondents is insignificant to the likelihood of disease it means that no matter their education they are bound to their duty and emission from vehicles and traffic burden remains the same.

4.3.1 Standardized regression model:

Since the independent and dependent variables are not in the same unit i.e. age is taken in years, HHS is taken as a number of family members which makes it difficult to explain the relation. In this way, the dependent variable cannot be compared to the explanatory variable. So we standardize the model in order to remove units and to better explain the relation.

This regression model removes the dependent and independent variable and regress both variables on the same unit that makes them more comparable. It helps to explain the variables per standard error for understanding. Since the units have been removed, the sign and number of the coefficient of the independent variable indicate the direction and strength of the explanatory variable with the explained variable. As we can see from the table age, HHS, WY, WH, WD, CM, PPE and Q_PPE affect the dependent variable i.e. total disease.

Chapter V

Summary, conclusion & Recommendations

This chapter has a summary derived from the findings based on objectives; the conclusion is drawn and then the recommendation is written. Study strengths and limitation is also given in this chapter.

5.1 Summary:

Air pollution is a major concern in the present world and vehicular emission contributes a lot to it. Although hybrid cars are introduced to curb this issue in a developing country like Pakistan people can't really afford such cars and to use fuel which has the lowest emission of harmful gasses plus people are ignorant towards that impact of poisonous gasses on the overall population. Rapid urbanization, industrialization and mobile sources of air pollution i.e. vehicular emission exhausting a number of allergens and is believed that some respiratory diseases are an offset of traffic pollution.

An Individual's occupation really determines his/her physical and psychological health, hence no one is really safe from occupational illnesses no matter if it's the safest, an indoor job there might be some factor that can deteriorate health. In developing countries workers are more affected due to several factors which include the presence of an informal workforce, weak or absent regulatory framework and low awareness.

Traffic police play a significant role in maintaining law & order and to maintain the necessary discipline in the city. Their profession bound them to be on frequent communication and on continuous exposure to pollutants which has numerous health outcomes e.g. depression, musculoskeletal and cardiovascular problems, skin allergy, eye problems, ear problems, fatigue and a number of contagion disease. Among all creature of Almighty God, human beings are only who has mastered in the art of disturbing the natural balance by contributing through different forms of pollutions.

5.2 Conclusion:

The overall prevalence of occupational illness is higher within age groups of 25-55 years in Rawalpindi traffic police as compare to Islamabad. They also self-reported about

back pain, neck pain and also suffer from genetic illnesses. A number of factors determine the likelihood of profession related ailment, from which we can control or maintain certain factor to eliminate the likelihood of disease but pollution is seeming to be not in control i.e. use of unleaded fuel or fuel that have high emission of CO2, traffic jams, traffic noise etc.

5.3 General Policy Recommendations:

Traffic police help the public and their presence eliminate the chances of accidents; their health is of primary concern and the prevalence of occupational morbidity may hinder their work and efficiency.

- In order to improve the working environment for traffic police the necessary personal protective barriers i.e. gloves, mask, ear plus, eye aid goggles should be supplied by respective department. Such intervention will improve the overall health and productivity of critical work force like traffic police.
- High prevalence of respiratory followed by auditory and ophthalmic morbidities is a matter of serious concern. In order to address it per-employment and during their service medical surveillance could be made more structured including serial lung function measurement using validated and standardized tests to detect those at risk and initiate appropriate preventive measures. Monthly health checkups need to be adopted for the protection of traffic police working at heavy traffic roads. Rotation of duty among the employees to overcome the effects of exposure to pollution while working in a congested area.
- The federal government and local governments should improvise the existing laws to ensure the health and safety of the employees.
- Using selective force strategies to target particular risk behavior and also choosing a specific location will improve the effectiveness of enforcement.
- Prevention of certain kinds of traffic on roads may effectively reduce pollution e.g. Bed Ford trucks are on roads for more than forty years.

The above recommendations are based upon the basis of the existing data, literature reviews and fact findings. Improvements can be made upon doing more research to make the work environment of every employee more health-centric.

5.4 Strengths

It is the first study to emphasize the importance of the health of traffic personnel of twin cities due to the risks and hazards they face on an everyday basis. The study was conducted in the times of COVID-19 Pandemic; proper protective care was ensured during the survey by maintaining the social distance.

5.5Future studies:

While going through the literature review of my research I found that there is a huge gap for research. No detailed study was available on the occupational health and safety of traffic police personnel. The increasing traffic congestion resulting from more motorized individual transport will yield more pollution in the future, so intensive research is required to make policies more environment and worker-friendly. A lot of secondary data regarding registered vehicles and pollutants are available which can be utilized and this study can be expanded to provincial level.

5.6 Constraints:

The study was conducted with limited resources available. The health costs were determined through a questionnaire survey. There is no data available or document relating to the health costs beard by the employees. The questionnaire was based on the literature reviews and the test survey. Data size was quite low due to pandemic so data quite lack variability.

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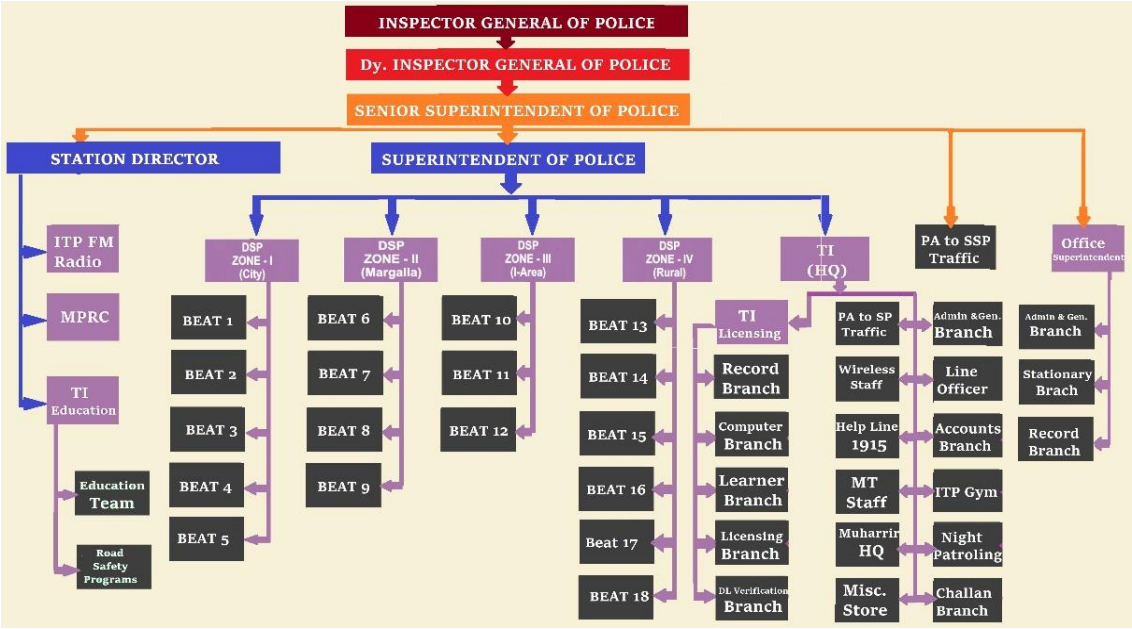
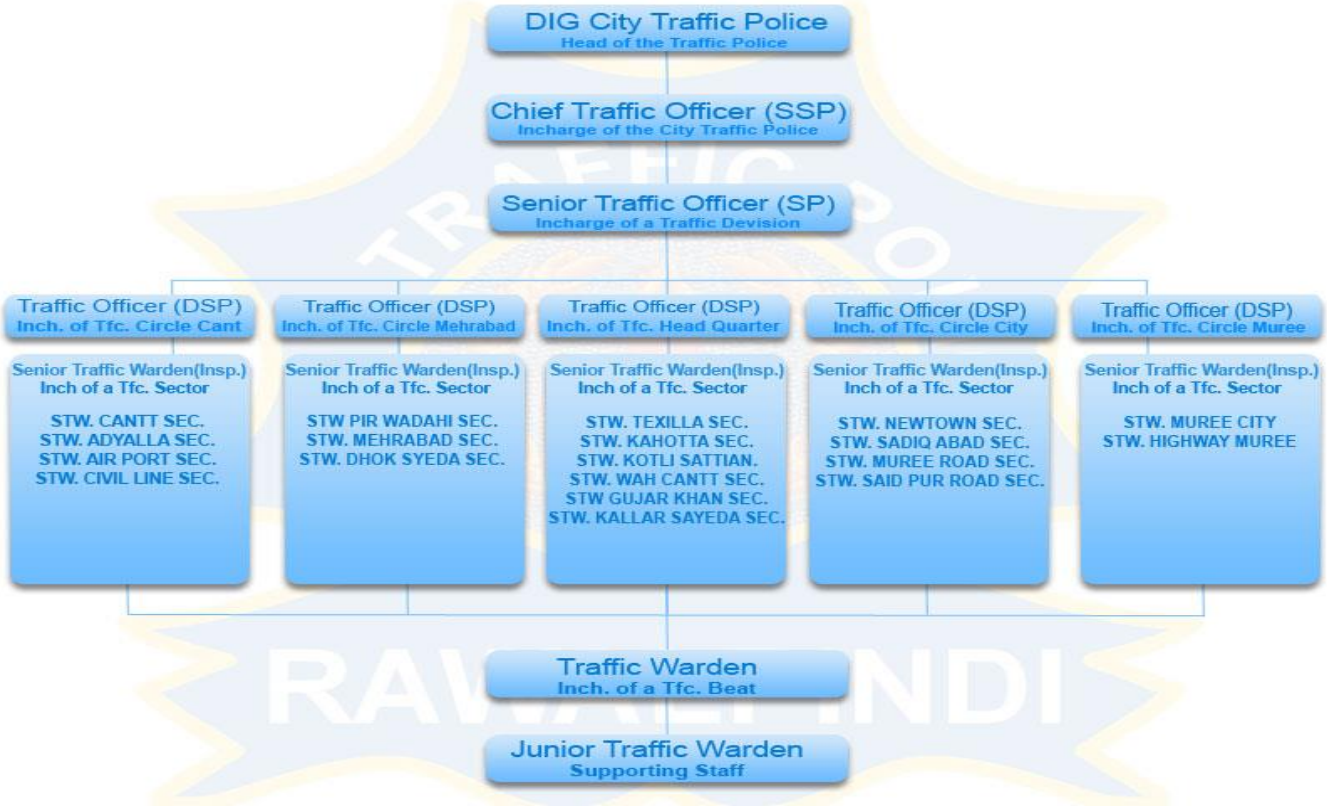
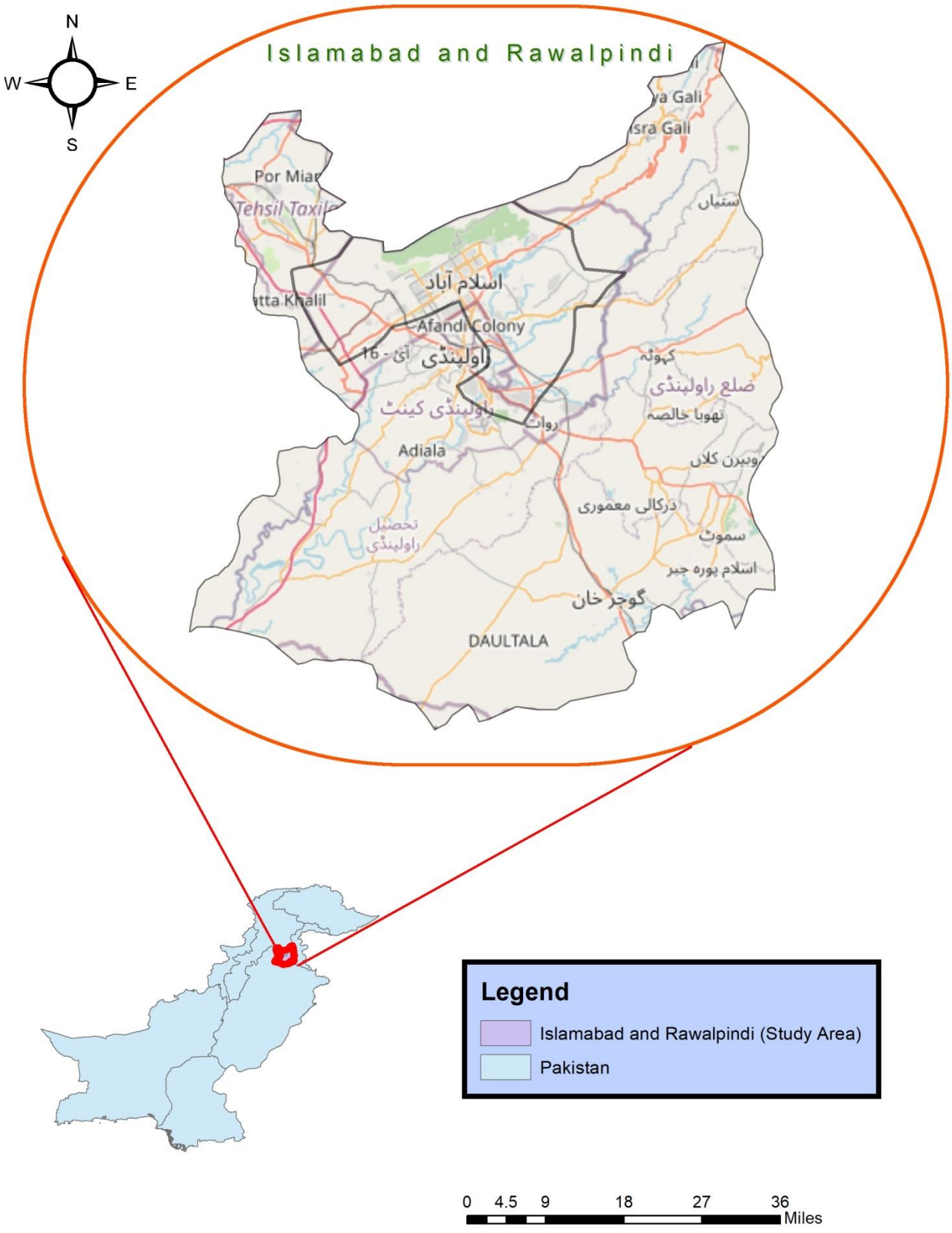


Islamabad Traffic police organizational structure



City Traffic police organizational structure


Islamabad and Rawalpindi
N
W
E
S
Por Mia
Tehsil Taxila
اسلام آباد
Afandi Colony
راولپنڈی
آئی - 16
راولپنڈی کینٹ
Adiala
DAULTALA
گوجر خان
ضلع راولپنڈی
Legend
Islamabad and Rawalpindi (Study Area)
Pakistan
0 4.5 9 18 27 36
Miles

Appendix A: OLS Estimation Regression

```
. regress Healthcost Age familySize Edu Income Workingyear BMI Druguse comorbidities Avertingmeasure Occupationadisease dummy
```

Source	SS	df	MS		
Model	735238.363	11	66839.8511	Number of obs	= 94
Residual	1333839.3	82	16266.3329	F(11, 82)	= 4.11
				Prob > F	= 0.0001
Total	2069077.66	93	22248.1469	R-squared	= 0.3553
				Adj R-squared	= 0.2689
				Root MSE	= 127.54

Healthcost	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Age	-6.708803	3.188574	-2.10	0.038	-13.05189	-.3657145
familySize	-1.098018	6.749363	-0.16	0.871	-14.52465	12.32862
Edu	-29.24375	9.113453	-3.21	0.002	-47.37331	-11.11419
Income	.0020729	.002722	0.76	0.449	-.0033421	.0074879
Workingyear	10.64192	3.858516	2.76	0.007	2.966099	18.31773
BMI	5.21564	22.96964	0.23	0.821	-40.47829	50.90957
Druguse	55.09779	30.91084	1.78	0.078	-6.393721	116.5893
comorbidities	17.63748	14.26293	1.24	0.220	-10.73602	46.01099
Avertingmeasure	-.7119809	29.82882	-0.02	0.981	-60.05101	58.62705
Occupationadisease	135.7906	52.12825	2.60	0.011	32.09085	239.4903
dummy	90.65907	51.55458	1.76	0.082	-11.8994	193.2175
_cons	534.0909	183.4527	2.91	0.005	169.1449	899.0368

Appendix b: Questionnaire

Occupational health impacts on traffic police. A case study of

Islamabad and Rawalpindi

I am Azeema Siddiqi student of M.Phil. Environmental Economics at Pakistan Institute of Development Economics (PIDE) Islamabad. I am doing thesis entitles **Occupational health impacts on traffic police. A case study of Islamabad and Rawalpindi**, as a partial fulfillment of M.Phil. Degree requirement. I do hereby request you to participate in this survey. Feel free to express whatever you feel appropriate. I assure you that you will be not to receive any suffering or loss due to what you have expressed in this survey.Thank you!

Name _____ Date _____Contact no/email_____

Section I- Socio-Demographic Questions	
Sr.no	**Questions**
1.	Age (in years) _____
2.	Gender (0) Female (1) Male
3.	Weight _____kg
4.	Height _____
5.	Marital Status: (0) Unmarried (1) Married (2) Single (3) Divorced
6.	If married, then how much children do you have? _____
7.	What is your qualification? _____
8.	What is the highest education in your family? _____
9.	You are the head of your family? (0) No (1) Yes
10.	How many number of household in your family? _____
11.	How many numbers of earners in your family? _____
12.	What is your family income? _____
13.	Your Income _____
14.	Number of year's you're working as a traffic policeman? _____
15.	Your duty timing? _____
16.	How many years in the current city you are working? _____
17.	How many days in a week you work? _____
18.	How many hours in a day you work? _____

سوالنامہ

برائے

ٹریفک پولیس کی صحت پر پیشہ ورانہ اثرات۔اسلام آباد اور راولپنڈی کی ایک کیس سٹڈی۔

میں عظیمہ صدیقی پاکستان انسٹیٹیوٹ آف ڈیولپمنٹ اکنامکس اسلام آباد میں ایم فل انویرمنٹل اکنامکس کی طالبہ ہوں۔ایم فل ڈگری کی شرائط کے جزوی تکمیل کے طور پر (ٹریفک پولیس کی صحت پر پیشہ ورانہ اثرات۔اسلام آباد اور راولپنڈی کی ایک کیس سٹڈی) پر تھیسیس کر رہی ہوں۔میں آپ سے درخواست کرتی ہوں کہ اس سروے میں حصہ لیں اور آپکو جو مناسب لگے اس کا بلا جھجک اظہار کیجئے۔میں آپکو یقین دلاتی ہوں کہ اس سروے میں آپ نے جس بات کا اظہار کیا ہو اس سے آپکو کسی تکلیف یا نقصان کا سامنا نہیں کرنا پڑیگا اور آپکے دیئے ہوئے معلومات صرف اور صرف تعلیمی تحقیق میں استعمال ہونگی۔

شکریہ۔

نام________________تاریخ____________________رابطہ نمبر__________________

سیکشن الف

سوال نمبر ۱:۔عمر______________(سال)

سوال نمبر ۲: ۔جنس______________(0)فیمیل (1)میل

سوال نمبر ۳ :۔ وزن :____________ کلوگرام

سوال نمبر ۴:۔ قد :__________________

سوال نمبر ۵ :۔ (0) غیر شادی شدہ (1) شادی شدہ (3)طلاق یافتہ

سوال نمبر ۶:۔ اگر شادی شدہ ہیں تو آپکے کتنے بچے ہیں؟____________________________

سوال نمبر ۷:۔تعلیمی قابلیت :۔ (0) ان پڑھ (1)پرائمری پاس (2)میٹرک پاس (3)گریجویٹ (4) پوسٹ گریجویٹ یا اس سے زیادہ

سوال نمبر ۸:۔آپکے خاندان میں اعلیٰ تعلیم کتنے ہیں

سوال نمبر ۹:۔کیا آپکے خاندان کے سربراہ ہیں ؟ (0) نہیں 1۔ہاں

سوال نمبر ۱۰:۔آپکے خاندان میں کتنے افراد ہیں؟____________________________________

سوال نمبر 11:۔آپکے خاندان میں کتنے افراد کام رہے ہیں؟_______________________________

سوال نمبر 12:۔ آپ کے خاندان کی ماہانہ آمدنی کتنی ہیں؟ _______________________________

سوال نمبر :13:۔آپکی ماہانہ آمدنی کتنی ہیں؟

سوال نمبر 14 :۔ آپ کتنے عرصے سے ٹریفک پولیس میں خدمات سرانجام دے رہے ہیں؟________________________

سوال نمبر 15:۔ آپ کے ڈیوٹی کے اوقات کیا ہیں؟

سوال نمبر 16:۔آپ اس شہر میں کب سے فرائض انجام دے رہے ہیں؟

سوال نمبر 17:۔آپ ہفتے میں کتنے دن کام کر رہے ہیں؟

سوال نمبر 18:۔ آپ دن میں کتنے گھنٹے کام کر رہے ہیں؟

سوال نمبر 19:۔آپ کا عہدہ اور سکیل کیا ہیں؟ بی پی ایس :________________عہدہ:_____________

سوال نمبر 20 :۔ آپ مندرجہ ذیل میں کیا کیا استعمال کرتے ہیں؟ (1) تمباکو چبانا 2۔ سگریٹ 3۔شراب 4۔بھنگ

5۔کوئی اور (واضح کریں) ____________________

19.	What is scale of your designation? BPS_____
20.	Do you use any kind of drug mentioned below? (tick as many) [1] Chewing tobacco [2] Cigarette [3] Alcoholic drinks [4] Marijuana/ weed (bhang) [5] Any other (specify) _____
22.	If yes to the above, then at what time you use more drugs? [1] During duty[2] leisure [3] Any other _____
23.	How much you spend on your addiction? Please specify amount (daily)Rs._____
24.	Do you have any chronic diseases mentioned here? (tick as many) [1] COPD, [2] Hypertension, [3] Obesity, [4] High Cholesterol, [5] Diabetes, [6] BP
25.	If tick to any of the above diseases, then is it your family disease? (0) No (1)Yes
26.	Since how many years you have this disease? _____years_____months
27.	How many times in a month do you visit to doctor for this disease?
28.	Do you use safety equipment during work such as masks, gloves, hats etc.? (0) No (1) Yes
29.	If No to Q28, then what are the reasons for the non-use of safety equipment? (0) Unavailable (1) Uncomfortable (2) Unnecessary (3) Others (specify)_____
30.	If Yes to Q28, then what is the quality of protective measure? (0) Very good (1) Good (2) Poor (3) Very poor
31.	Who is providing you safety equipment? (0) Government (1) NGOs (2) Self-purchasing
32.	Do you undergo routine medical checkups? (0) No(1) Yes
33.	Where you got your health treatment from? (0) Government (1)Private checkups
Disease information(*from last 6 months*)	
Respiratory	
34.	Are you suffering from any following mentioned diseases? (tick as many) [1] Cough[2] Tuberculosis[3]Asthma[4] Bronchial inflammation [5] Pneumonia
35.	Are you aware of occupational respiratory disease? (0) No (1) Yes
36.	Are you suffering from the above-mentioned diseases before joining traffic police? (0) No (1) Yes
37.	What is the duration you have been suffering from the above-mentioned disease? _____years_____months
38.	How much do you spend on your treatment?
	Registration Rs._____
	Consultation (doctor fee) Rs._____
	Lab test Rs._____
	Medicines Rs._____
	Any other (specify) Rs._____

سوال نمبر 21:۔اگر ہاں تو کب استعمال کرتے ہیں 1۔دوران ڈیوٹی 2۔ فارغ اوقات میں
3۔ کوئی اور (واضح کریں) ----------

سوال نمبر 22:۔ آپ منشیات کے استعمال پر روزنہ کتنے خرچہ کرتے ہیں؟ ----------روپے

سوال نمبر 23:۔کیا آپ کو مندرجہ ذیل کوئی دائمی بیماری ہیں؟ 1۔پھیپھڑوں کی دائمی روکاوٹ 2۔ذہنی دباو
3۔ موٹاپا 4۔ہائی کولیسٹرول 5۔شوگر
6۔بلڈ پریشر

سوال نمبر 24:۔اگر اوپر والی بیماریوں میں آپ کو کوئی بیماری ہیں تو کیا یہ آپ کی خاندانی بیماری ہیں. (0) نہیں 1۔ہاں

سوال نمبر :25:۔ آپ کو یہ بیماری کتنے عرصے سے ہیں؟----------سال------مہینے ----------

سوال نمبر 26 :۔ آپ مہینوں میں کتنے مرتبہ ڈاکٹر کے پاس جاتے ہیں؟

سوال نمبر 27: کیا آپ حفاظتی سامان مثلاً ماسک ،دستانے ، یا ٹوپی وغیرہ استعمال کرتے ہیں ۔ (0) نہیں 1۔ہاں

سوال نمبر 28 :۔اگر نہیں تو کیا وجوہات ہیں؟ 1۔دستیاب نہیں 2 ۔ بے آرامی ہوتی ہیں 3۔غیر ضروری ہیں 4 ۔کوئی اور (واضح کریں)

سوال نمبر 29 :۔ اگر سوال نمبر 27 کا جواب ہاں ہے تو حفاظتی سامان کی کوالٹی کیا ہیں؟ 0۔بہت اچھی 1۔اچھی 2۔خراب 3۔بہت خراب

سوال نمبر 30:۔ آپ کو حفاظتی سامان کون مہیا کرتا ہے ؟ 0۔حکومت 1۔این جی اوز 2۔خود خریدتے ہیں

سوال نمبر 31:۔کیا آپ روٹین میں طبعی معائنہ کرواتے ہیں؟ (0) نہیں 1۔ہاں

سوال نمبر 32: آپ اپنا علاج کہا سے کرواتے ہیں؟ 0۔سرکاری ہسپتال 1۔پرائیوٹ (نجی ہسپتال)

بیماریوں کے متعلق معلومات

ا۔سانس کی بیماریاں

سوال نمبر 33:۔کیا آپ کو مندرجہ ذیل میں کوئی بیماری ہیں ؟ 1۔کھانسی 2۔ٹی بی 3۔دمہ 4۔پھیپھڑوں کی سوجن 5۔نمونیہ

سوال نمبر 34:۔کیا آپ کو پیشہ ورانہ سانس کی بیماریوں کے بارے میں معلومات ہیں؟ (0) نہیں 1۔ہاں

سوال نمبر 35:۔،کیا آپ ٹریفک پولیس میں شمولیت سے پہلے ان بیماریوں میں مبتلا تھے؟ (0) نہیں 1۔ہاں

سوال نمبر 36:۔آپ کتنے عرصے اس بیماری میں مبتلا ہیں؟----------سال------مہینے ----------

سوال نمبر 37:۔ آپ اپنے علاج معالجہ پر کتنے پیسے خرچ کرتے ہیں؟ رجسٹریشن ---------روپے
ڈاکٹر کی فیس ---------روپے
لیب ٹیسٹ ----------روپے
ادویات----------روپے
کوئی اور واضح کریں----------

Eye related problem	
39.	Are you having any of the following diseases (tick as many) [1] Red eyes[2] Burning eyes[3] Cataract [4] Tearful/itching eyes
40.	Are you aware of ear-related diseases in your profession? (0) No (1) Yes
41.	Are you suffering from the above-mentioned diseases before joining traffic police? (0) No (1)Yes
42.	What is the duration you have been suffering from the above-mentioned disease? _____years_____months
43.	How much do you spend on your treatment?
	Registration Rs._____
	Consultation (doctor fee) Rs._____
	Lab test Rs._____
	Medicines Rs._____
	Any other (specify) Rs._____
Ear related problem	
44.	Are you suffering from any of the following diseases? (tick as many) [1] Ear discharge[2] Tinnitus[3] Partial Hearing loss[4] Hearing difficulty
45.	Are you aware of ear-related diseases in your profession? (0) No (1) Yes
46.	Are you suffering from the above-mentioned diseases before joining traffic police? (0) No (1) Yes
47.	What is the duration you have been suffering from the above-mentioned disease? _____years_____months
48.	How much do you spend on your treatment?
	Registration Rs._____
	Consultation (doctor fee) Rs._____
	Lab test Rs._____
	Medicines Rs._____
	Any other (specify) Rs._____
Financial Assistance:	
49.	What is source of financing for treatment [1] Self [2] Pension [3] Remittance [4] Private insurance [5] Health card [6] Bait ul mal [7] Sadqaat [8] Health card [9] Relative [10] Others (specify) _____
50.	Are you getting any kind of insurance or additional benefit from Govt. or any Firm? (0) No (1)Yes
Direct Non- Medical Cost(*each visit to the hospital*)	
51.	Travel cost (each trip) Rs._____
52.	Food and drink during visit Rs._____
53.	Communication cost (call, internet, 3G etc.) Rs._____
54.	Any other (specify) Rs. _____
55.	How many days in a month you are unable to perform duty?
Indirect Cost	
56.	How many days in a month you are absent from your work due to your disease? _____days

۲۔آنکھوں کی بیماریاں

سوال نمبر 38:۔ کیا آپ کومندرجہ ذیل میں کوئی بیماری ہیں ؟ 1 ۔آنکھوں کی سرخی 2 ۔ جلن 3۔موتیاں 4۔آنسوں بہنا/سوزش

سوال نمبر 39:۔کیا آپ کو پیشہ ورانہ آنکھوں کی بیماریوں کے بارے میں معلومات ہیں؟ (0) نہیں 1۔ہاں

سوال نمبر 40:۔،کیا آپ ٹریفک پولیس میں شمولیت سے پہلے ان بیماریوں میں مبتلا تھے؟ (0) نہیں 1۔ہاں

سوال نمبر 41:۔آپ کتنے عرصے سے اس بیماری میں مبتلا ہیں؟----------سال------مہینے ----------

سوال نمبر 42:۔ آپ اپنے علاج معالجہ پر کتنے پیسے خرچ کرتے ہیں؟ رجسٹریشن ---------روپے

ڈاکٹر کی فیس ---------روپے

لیب ٹیسٹ ---------روپے

ادویات----------روپے

کوئی اور واضح کریں----------

۳۔کانوں کی بیماریاں

سوال نمبر .43 آپ کومندرجہ ذیل میں کونسی بیماریاں ہیں؟ 1۔کان کا بہنا 2۔گھنٹی بجنا یا آوازیں آنا 3۔جزوی طور پر سماعت سے محروم ہونا 4۔ سننے میں دشواری

سوال نمبر 44:۔کیا آپ کو پیشہ ورانہ کانوں کی بیماریوں کے بارے میں معلومات ہیں؟ (0) نہیں 1۔ہاں

سوال نمبر 45:۔،کیا آپ ٹریفک پولیس میں شمولیت سے پہلے ان بیماریوں میں مبتلا تھے؟ (0) نہیں 1۔ہاں

سوال نمبر 46:۔آپ کتنے عرصے سے اس بیماری میں مبتلا ہیں؟----------سال------مہینے ----------

سوال نمبر 47:۔ آپ اپنے علاج معالجہ پر کتنے پیسے خرچ کرتے ہیں؟ رجسٹریشن ---------روپے

ڈاکٹر کی فیس ---------روپے

لیب ٹیسٹ ---------روپے

ادویات----------روپے

کوئی اور واضح کریں----------

مالی معاونت

سوال نمبر 48:۔آپ کے علاج کی مالی معاونت کیا ہیں؟ 1۔خود ادا کرتے ہیں 2۔پنشن 3۔ترسیلات زر

4۔پرائیوٹ انشورنس 5۔صحت کارڈ 6۔بیت المال

7۔صدقات 8۔رشتہ دار 9۔کوئی اور ----

سوال نمبر 49۔کیا آپ کو حکومتی یا غیر حکومتی یا انشورنس کمپنی سے کسی قسم کی امداد ملتی ہیں؟ (0) نہیں 1۔ہاں

ڈائریکٹ نان میڈیکل کاسٹ

سوال نمبر 50 ۔سفری اخراجات (فی ٹریپ)

سوال نمبر 51:۔ کھانے پینے کے اخراجات

سوال نمبر 52۔مواصلاتی اخراجات (فون ،انٹرنیٹ وغیرہ)

Attendant's cost (*Person accompanying patient*)	
57.	How many days in a month you have to be with the patient to go to the hospital? _____days
58.	What are you doing: [1] Student [2] Employee [3] Any other (specify) _____
69.	If you are doing a job, then how much you earn?
60.	How many hours in a day did you spend with the patient for caring for it?

سوال نمبر 53 ۔کوئی اور وضاحت کریں

سوال نمبر 54:بیماری کی وجہ سے آپ مہینے میں کتنے دن چھٹی کرتے ہیں؟

ڈائریکٹ کاسٹ ان ڈائریکٹ کاسٹ

سوال نمبر 55 :۔بیماری کی وجہ سے آپ مہینے میں کتنے دن چھٹی کرتے ہیں؟

سوال نمبر :56:۔آپ کو علاج کے لئے کتنا عرصہ درکار ہیں؟

تیمارداری کے اخراجات

سوال نمبر 57 :۔ آپ مہینے میں کتنے دن مریض کے ساتھ ہسپتال جاتے ہیں؟ _____دن

سوال نمبر :58:۔آپ کیا کرتے ہیں؟ 1۔طالب علم 2۔نوکر پیشہ 3۔کوئی اور وضاحت کریں۔

سوال نمبر 59:۔ اگر آپ نوکر پیشہ ہیں تو آپ کی ماہانہ آمدن کیا ہیں؟

سوال نمبر 60:۔آپ مریض کے ساتھ دن میں کتنے گھنٹے گزارتے ہیں؟