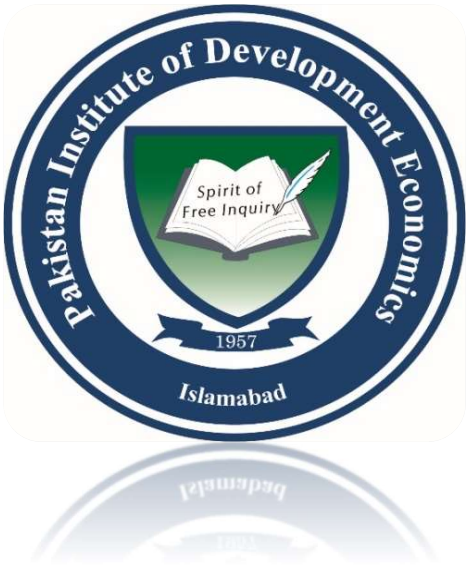
Assessing the Health Impacts of Pesticide Use in Cotton Crop: A Case Study of Tehsil Mian Channu and Tehsil Bhuwana



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CERTIFICATE

This is to certify that this thesis entitled: **"Assessing The Health Impacts of Pesticide Use in Cotton Crop: A Case Study of Tehsil Mian Channu And Tehsil Bhuwana".** submitted by Muhammad Ans Sadiq is accepted in its present form by the Department of Environmental Economics, Pakistan Institute of Development Economics (PIDE), Islamabad as satisfying the requirements for partial fulfillment of the degree in **Master of Philosophy in Environmental Economics**.

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Abstract

This study assesses the impact of pesticide use in cotton crops on sprayer's health in two tehsils: Mian Channu and Bhuwana. Tehsil Mian Channu has a Pest Control Department which overlooks the pesticide use practices while it is absent in Tehsil Bhuwana. This difference is the base of conducting a comparative study to see the differences in the health problems faced and associated health costs incurred by the sprayers of Mian Channu and Bhuwana. The total sample of sprayer respondents was 250 out of which 150 sprayers belonged to Tehsil Mian Channu and 100 belonged to Tehsil Bhuwana. Using Dose Response Function and Health Cost Function, the study finds that increased exposure to fumes, un-observance of protective gears, using banned pesticides, and absence of Pest Control Department greatly increases the incidence of pesticide related diseases and health cost of sprayers of Tehsil Bhuwana compared to sprayer of Tehsil Mian Channu. This study recommends establishment of a pest control department in tehsil Bhuwana and provision of incentives to sprayers to use certified pesticides products instead of the banned pesticides.

Chapter 1: Introduction

Background:

Today, the agriculture sector of Pakistan contributes about 21% to the total GDP employing 44 percent of the total labor force (Sheikh S.A et al. 2011). After the green revolution overall production of food in the world increased from 2 to 3 times between the years 1960 to 2000 (Gollin, 2003). To get the maximum production from the crops, pesticides play a very important role for this purpose. There is no doubt about it that farmers use pesticides to get maximum yield from crops, but one thing that should must remember that pesticides are injurious to human health and poses unavoidable risk to its exposure (Gollin, 2003). Pesticides are injurious to life cycle of organisms living both on land and under water they stay underground for a long period of time, damaging the quality of underground water there by effecting crop yield in the long term. They mix up with the food produced and when consumed seriously affect the human body (Kishi et al. 1995). In the modern times almost 44% of the insecticides, 30% of herbicides, 21% of fungicides and 5% others are used (Mathur et al. 2005). It is a consensus that use of pesticides is linked with many social and environmental problems (Wilson and Tisdell, 2001); (Pimentel, 2009). It indicates towards the pollution spread that can be either direct or indirect, the rural labors are highly exposed to the hazardous fumes emanating from pesticide spray (Moreira et al. 2002).

The smart agriculture escalation can be defined as producing extra crops yield from the same and equal area of land while decreasing the adverse environmental effects (Pretty, 2008); (Conway and Waage, 2010). Pesticides can also be used for agricultural sustainability (Pretty et al. 2011). In other way the Sustainable use of pesticides lowers the negative and bad impacts/risks of pesticide application on the human's health and the environment and encouraging the practices of "Integrated Pest Management". However, IPM technology was not so successful for that level. The adoption of IPM will lead to a decrease in pesticide use but also a complimentary decrease in crop yield that's why mostly the farmers does not prefer the adoption of IPM (Peshin et al. 2009). Intensive use of pesticides invites for formulation of strategies and techniques that take into consideration safe use of pesticides, controlling for adverse impacts on human health, non-target useful organisms and the environment (Peshin et al. 2009).

The handling of pesticides in a managed way and use of those pesticides in suggested concentration in the field requires the use of good and suitable equipment for the personal protection of the farmers as a safety measure against the exposure of pesticide. This equipment also includes the use of gloves for the hands and the masks for the mouth, protective personal hygiene, suitable footwear, and headgear etc. (Khan, 2009).

Due to less knowledge about hazardous effects of pesticides, in developing countries, it was seen that sprayers or farmers do not care about their health and the safety measure, and no necessary protective actions are taken while managing the pesticides (Alavanja et al. 2004) (Cocco, 2002). It was also observed that the farmers mix up different types of pesticide in a container with the water (Cocco, 2002). In developing countries where there is lack of knowledge about the usage of pesticides, farmers combine different types of pesticides in a container with water and transfer them directly in the jars of spraying and mix the pesticide with them directly in the jars of spraying and mix up the pesticides with less precautions (Alavanja et al. 2004) (Cocco, 2002). While spraying pesticides, some of the spraying farmers were observed chewing betel nut, tobacco etc., and some were found smoking. Mostly the farmers use old clothes materials as a mask for their mouth (K. R. Dey, Choudhury P, & Dutta, 2013). The signs and symptoms were informed by a large numbers of spraying farmers and also the non-sprayers stated, some of these symptoms and the signs with a higher rate of occurrence were unnecessary sweating, stinging /itching eyes, dry/sore throat, skin redness/white patches (K. R. Dey, Choudhury P & Dutta, 2013), Chest pain/burning sensation, excessive salivation, Headache, dizziness, muscular twitching, skin allergy, respiratory discomfort, etc., [(Antleand Pingali, 1994); Yasin, Mourad & Safi, 2002)].

Exposure to pesticide leads to multiple costs ranging from self-treatment to hospitalization. Although some cost is borne by the hospitals, yet major portion of cost are borne by the farmers themselves. Indirect costs incurred in forms of transport cost and opportunity cost of time form another set of disadvantages posed by use of pesticide. Expenditures on special diets recommended by doctor's frequent consultancy visits and travel cost put financial burden on the farmers as their profession is like of hired labor. Loss of working hours combined with decrease in working efficiency form another aspect of indirect costs that put strain on financial setup of the farmers. Loss of time is not just one cost experienced by a single person, but it is a cost experienced by the family members who sacrifice their time - either leisure time or work time to look after the patient.

High costs incurred in these situations indirectly increase the cost of production of crops which leads to an overall decrease in total revenue (Atreya K, 2008).

Now in this given content, this study analyzes this topic in case of Pakistan. This study has done a comparison analysis of two Tehsils in the Punjab province. The plant protection department is operational in Tehsil Mian Channu while being absent in Tehsil Bhawana. Consequently, the study has analyzed the knowledge of farmers regarding the hazards of pesticides usage, the costs incurred, and possible impacts on farmer's health. Thus, a reasonable comparison of a Tehsil where farmers are influenced by the working of plant protection department with the one where the department is absent will be done. This has helped to understand that how pesticide usage effects farmers health in both Tehsils.

1.1. Pesticides usage in Pakistan:

Taking into account the formulation and the active substances used in the chemical formula, pesticides are classified as (i) Organochlorine (commonly used in Pakistan include Endosulfan, Dichlorodiphenyle Trichloroethane (DDT), Dieldrin,aldrin, heptachlor, chlordane), (ii) organophosphates (commonly used in Pakistan include Malathion, Parathion, Chlorpyrifos), (iii) Phenoxyacetic acid Herbicides (2.4-D, MCPA), (iv) Carbamate (Carbaryl, Aldicarb, Carbofuran, Carbaryl), (v) Pyridiniumherbicides: (commonly used in Pakistan include Picloram, Paraquat, Diquat),(vi) Triazine Herbicides: (Cyanazine, Simazine, Trietazine, Atrazine are commonly used in Pakistan), and (vii) substitute urea (Chlorotoluron, Isoproturon) (Shahid et al. 2016).

In Pakistan, about 145 active substances have been registered, with pyrethroids having the greatest share (45 %), followed by organophosphates (39 %), Organochlorine (9 %) and carbamates (4 %). Organochlorine and organophosphates are formulated and manufactured.

Locally in Pakistan and are used commonly for cotton protection against insects. Pakistan ranked 19th of per acre usage of pesticide, and its per acre usage is 1.3 kg. (Nation Master, 2000), Derived June 2015)

Table 1: Per Acre Use of Pesticides

CROP	DISEASES, INSECTS/ PESTS	ACTIVE INGREDIENTS	APPLIED DOSE	STAGE OF APPLICATION
COTTON	Narrow & Broad Leaf	Acetachlore	500–650 ml/acre	Within 24 h of Sowing
	Jassid, Thrips, W.Fly	Imadacloprid	8–10 g/kg seed	Seed dressing
	W.Fly, Thrips, Jassid	Imadacloprid	250 ml/acre	3/leaf, 5/leaf, 1.0/plant
	Thrips	Acephate	400–500 g/acre	3/leaf
	Whitefl y	Diafenthiuron	200 ml/acre	3/leaf
	Spotted BW, Pink BW, mites	Bifenthrin	250 ml/acre	Apprence of bud
	American BW, Spotted BW, Army BW	Emmamectin Benzoate	200 ml/acre	Apprence of pest
	Armyworm	Leufenoran	100 ml/acre	Apprence of pest
	Spotted BW, Pink BW	Lambada Cyhalothrin	330 ml/acre	Start of squres
	Spotted BW, Pink BW	Deltamethrin	250–300 ml/acre	Appreance of Bud
	W.Fly, Thrips, Jassid, Aphid	Acetameprid	125 ml/acre	5/leaf, 8–10/leaf, 1.0/leaf, 15/leaf
	Spotted BW, Pink BW	Triazophos	1000 ml/acre	Appreance of roset fl ower
	W.Fly Nymph	Buprofezin	600 g/acre	5/leaf
	Two Spotted, Red Mites	Pyridaben	500 ml/acre	At appreance
	Growth of Plant; escape from virus	Chelated Zinc	500 ml/acre	30–60 days of Crop

(Shahid et al. 2016)

1.2. Banned Pesticides:

Table 2: List of Banned Pesticides in Pakistan

Bhc,	Binapacry,	Bromophos,
Ethyl,	Captafol,	Chloride,
Meform,	Chlorobenzilate,	Chlorthiophos, Cyhexatin,
Dalapon,	DDT,	Dibromo chloro pane,
Dibromo chloropropane,	Dicrotophos,	Dieldrin,
Dislfoton,	Endrine,	Ethylene Chloride,
Carbontetra Chloride,	Leptophos,	Mercury compound,
Mevinphos,	Toxaphene,	Zineb,
Hepta chlor,	Methy Parathion,	Monocrotophos,
Methamidophos,	Endosulfan.	Bromophos,
Bhc,	Binapacry,	Chloride,
Ethyl,	Captafol,	Chlorthiophos, Cyhexatin,
Meform,	Chlorobenzilate,	Dibromo chloro pane,
Dalapon,	DDT,	Dieldrin,
Dibromo chloropropane,	Dicrotophos,	

(Department of plant protection, 2013)

1.3. Focus of the Study:

The focus of this study is to analyze the impact of pesticide usage on farmer's health in short term. A comparison of two Tehsils: Mian Channu and Tehsil Bhawana of Punjab province Pakistan is conducted, where Plant Protection department present in the former spreading awareness is operational while in Tehsil Bhawana it is absent. This study only concerns with the short-term exposure to the chemicals pesticide and their short-term health effect and the health costs that are linked with the pesticides use. It does not take into consideration intentional poisoning; long term chronic illness benefits and social costs of pesticide usage.

The unsystematic use of pesticide result in short term health effects that are injurious to health (Pingali et al. 1994), with this short-term health effects farmers mostly experience some health problems such as headache, skin irritation, eye irritation, and respiratory and throat discomfort (Pingali et al. 1994), including loss of productive hours and expenses on the cost of medical treatment (Devi, 2007). So, the study will examine and analyze farmer's knowledge about pesticide usage, and its impacts on farmer's health in short term health effects, and associated health cost of illness by the extensive pesticide usage. Cotton is the predominantly produced crop in these two Tehsils (Iqbal et al. 2002). Taking Cotton as the choice crop is due to the extensive use of pesticide on fields for gaining maximum yield.

1.4. Research Problems

There are some research problems about why farmers continue to use pesticides in their farms by ignoring the health and environmental affects, and second thing is health cost of illness. Many international studies have reported some examples of the bad effects of pesticide use on human health and environment (Pimental, 2005), (Raven et al. 2008) and their extreme affects are in many forms like the deaths of animals, huge loss of predators of pest, and increased pesticide resistance in pests, birds and fishery loss, also a loss of underground water (Raven et al. 2008).

Short term health effects from pesticide are acute illness, such as headache, skin irritation, eye irritation, and respiratory and throat discomfort that are the main short-term diseases from pesticide use in the farms (Antle et al. 1980). Farmers used pesticide for high production from crops so that the high use of pesticide results in acute health symptoms which will increase the health cost of illness of the farmers such as medical treatment cost and medical bills cost (Pingali et al. 1994), Antle et al. 1980) Devi, 2007).

Usually pesticide exposure faced by the small scale farmers because they want to get high production from small farm (Freeman et al. 1992) and use low quality pesticide which adversely effect on the farmers health and as a result of increased pesticide use it may cause of short term health effects on farmers health that results in the loss of working days and also in increased in treatment expenses for farmers (Freeman et al. 1992) these expenses are considered in the health cost of illness. May be the small-scale farmers are most unsafe to the pesticide use because they are less credible to appreciate the risk connected with the pesticide use, and they mostly apply the

pesticides in the farms without necessary protections equipment's (Freeman et al. 1992). Many studies have been done on the pollution of pesticide and their health impacts on human; however, the main gap is the cost that linked with pesticide use by the household economy is ignored.

Issues and gap:

- Farmers way of pesticide use practices are not health friendly in Pakistan.
- Hazardous fumes put an adverse impact on farmer's health. Furthermore, monetary cost incurred economically distress the farmers as they generally lack resources to go to the hospital and avail medical facilities. Thus, farmer's knowledge and awareness are dependent on attainment of information of which the plant protection department is one source.

1.5. Research Questions:

1. What are the adverse impacts of pesticides usage on farmers' health?
2. What cost is borne by the farmer's due to use of pesticides in the field?

1.6. Objective of the study

1) To investigate the different types of health damages from pesticide exposure.
2) To evaluate the health cost of the farmer's affected by the pesticide use.

1.7. Significance and Plan of the Study:

The significance of the study is that the study focuses on the exposure to the hazardous fumes of pesticides that results in short term health effects on the farmers, and the pesticide cost incurred by the local farmers in an intensive farming system. In addition, the rise in the total production and farm income due to decrease in the crop losses because of pesticide use (Raven et al. 2008) estimated the usage of pesticides globally, stating a percentage use of 85 percent which will rise with every passing year.

While on the other hand in underdeveloped countries including Pakistan, the consumption is only 20% of the world's total chemical pesticide usage (Pimental, 1995). Almost below the 1% level

the pesticides experienced to the farm and crops can achieve their target pests but rest of the 99% pesticides affects adversely on unplanned targets which also includes the public health, and environmental health (Pimentel, 1995). According to World Health Organization from United Nations has determine the extensive use of pesticides on agriculture cause 26 million non-fatal poisoning and in these non-fatal poisoning 3 million poisoning cases are hospitalized 220,000 deaths and about 750,000 suffered chronic illness every worldwide (WHO, 2006).

So, in these circumstances there is a need of a study which analyzes that why famers continue to use pesticides in the farm and why they are ignoring their health affects using pesticides. In this context, the study analyzes this issue for the case of Pakistan. Pakistan is an agricultural country and a large portion of its economy depends on agriculture substantiating the reason that farmers used pesticides for high production from the crops. There is also a need to analyze the hidden cost of pesticide in form of the human health loss to the farmers and their household. That is the main purpose of this study to fulfill this gap by analyzing the situation in the Tehsil Mian Channu and Tehsil Bhuwna, a comparison of two Tehsils where plant protection department is operational and overseeing pesticide usage in field in Tehsil Mian Channu where as it is absent in Tehsil Bhawan.

Chapter 2: Literature review:

2.1. General Background:

The misuse of pesticide is occurring mostly because the actual benefit of pesticides is very high, and this unsystematic use of pesticides negatively effects on the farmers health, and society either directly or indirectly. However, in this study we have only concerned about the farmers who are directly affected by pesticides. The uses of pesticides with such an irresponsible way this results in acute illnesses like stomach pain, vomiting, respiratory problems, skin rashes, headaches, sneezing and eye irritations mostly happens with the farmers. While long term diseases in which disruption, reproductive birth defects, cancer, asthma, dysfunctions, neuron behavioral disorders and dermatitis (Pingali, 1994).

The study estimated the overall costs faced by the affected farmers for which including both direct and indirect costs of consumption of pesticides. While in the direct cost many costs were included like fee to doctor, medicine cost, transportation cost, loss of utility, payment to traditional healer and care taken when they are resting at home (Waibel, 2000). While in case of Pakistan a study was conducted in the cotton belt of the Punjab. He evaluated all the direct and indirect costs from the use of pesticides that were almost Rs7044 and Rs11567 million respectively. The estimated total annually cost was approximately Rs18611 million (Iqbal, 2002). The pesticides defiles mix-up with our food and environments that consequently have bad impacts on human and farmers health. There are millions of cases of pesticides poisoning reported annually from worldwide annually (Richter, 2002). A huge number of deaths reported due to pesticides poisoning from developing countries (Wilson, 2005). Again, and again exposures to hazardous chemical by the farmers are very frequent practices in the under developed countries (Swinton, 2003). It is confirmed by the science that again and again exposure to toxic chemicals results in both acute and chronic disease. The short term acute illnesses are stomach pain, vomiting, respiratory problems, skin rashes, headaches, and coma, sneezing and eye irritations (Pingali, 1994). The long term chronic diseases include endocrine disruption, reproductive dysfunctions, immune mediated toxicity, neuron behavioral disorders, birth defects, cancer, asthma and dermatitis (Burger, 1997). There are some evidences that were found that that due to pesticides exposure it may cause for learning impairment and memory loss (Pimentel, 2002).

Different types of health impairments which may cause by pesticides put on very severe threat to development and it can deduct the benefits made from agriculture growth (Townsend, 2000). There is no doubt about it that pesticides have positive effects on the crop yields, but on the other hand adverse impact on the health of the farmers, as a result bad health have also negative effects on the crop yield (John et al. 1994).

Another study also said the same thing that the pesticides have positive effect on crops productivity and negative effect on health of the farmers (Donald et al. 1994). The unsystematic and irresponsible use of pesticides use resulted in having a very bad effect on the environment and the health of the farmers. When the used amount of pesticides was greater than the prescribed dose that is written on the pesticide bottles (Shende et al. 2013). The pesticides have negatively effects on the environmental elements like soil, water and air contamination. It has also very bad effects on the non- targeted organisms (Burger et al. 2008).

The human health and environment are adversely affected using pesticides this is all because of less knowledge about the handling of pesticides and due to lack of information about the pesticides. Without knowledge about pesticides the use of more toxic chemicals and dangerous practices of are the main reason for the loss of health and environment (Khan, 2010). From these toxic chemicals the livelihood of large amount of birds, animals, honey bees destroy. These are the costs uprising from the usage of pesticides to society are respectable and this study therefore measured its impacts on human health (Khan, 2007).

2.2. Thematic review of literature:

2.1.1. Use of pesticide in agriculture sustainability:

The sustainable agricultural escalation can be defined as producing extra crops yield from the same and equal area of land while decreasing the adverse environmental effects (Pretty, 2008) (Conway and Wage, 2010). The pesticide can also be used for the agricultural sustainability. In other way the sustainable use of pesticides as lowering the negative and bad impacts/risks of pesticide application on the human's health and the environment and encouraging the practices of "Integrated Pest Management" and some other observable techniques in which non-chemical alternatives to pesticides (Horrigan et al. 2002). In 1960s, IPM was encouraged as a way of pest

control system or techniques and at that time, approximately there were only a few types of IPM technologies and techniques available for field experience (Pretty et al. 2011). However, this technology was not so successful for that level. The adoption of IPM will lead to a decrease in pesticide use but also a complimentary a decrease in crop yield that is why mostly the farmers do not prefer the adoption of IPM (Peshin et al. 2009). The use of pesticides invites for formulation of strategies and techniques that take into consideration safe use of pesticides, controlling for adverse impacts on human health, non-target useful organisms and the environment (Peshin et al. 2009) (Wilson et al. 2001).

2.1.2. Short term health affect with direct and indirect exposure to pesticide:

There are main two factors of pesticide exposure in which first one is the direct exposure to the pesticide and the second is the indirect exposure to the pesticide (Grace et al. 2006). Direct exposure attacks only on those farmers who are personally involve in the experience of pesticide in agricultural occupational, or suburban settings and at the end their exposure level to pesticide is very high (Dutta et al. 2004) , while on the other hand the indirect exposures attacks thee farmers and their families who are working out side of the farm through different ways in which the drinking water, the air they breathe in, dust in the environment, and food which they eat and signify routes of long term exposure to pesticide, normally low level exposures (Dutta et al. 2004) .The Indirect exposures is more harmful for the farmers and it may arise more frequently as compared to direct pesticide experience. Personal pesticide exposure in occupational and residential settings is affected by both the pesticide experience features and personal behavior. Unintentional actions such as hazardous pesticide spills also contribute to pesticide exposure. About thirteen years ago, it was predicted that about 25 million agricultural workers all over the world experience unexpected pesticide poisoning each year. (Alavanja, Hoppin, J, A, & Kamel 2004).

2.1.3. Farmer's knowledge about pesticide and safety measure:

The handling of pesticides in a managed way and the use of those pesticides in suggested concentration in the field must requires the use of good and suitable equipment for the personal protection of the farmers as a safety measure against the exposure of pesticide (Cocco, 2002). This equipment also includes the use of gloves for the hand and the masks for the mouth, protective personal hygiene, suitable footwear, and headgear etc. (Sheikh et al, 2011).

While in the field it was seen that sprayers or farmers in many study areas don't care about their health and the safety measure, and no necessary protective actions while managing the pesticides (Khan M, 2009). It was also observed that the farmers mix up different types of pesticide in a container with the water observed that the farmers combine different types of pesticides in a container with water and transfer them directly in the jars of spraying and also mix the pesticide with them directly in the jars of spraying and mix up the pesticides with uncovered handed (Alavanja et al. 2004); Cocco, 2002). The best preparation of pesticide is to mix up in a drum, with a wooden or any type of stick that is often not practiced. Mostly the farmers use old clothes materials as a mask for their mouth. While spraying pesticides, some of the spraying farmers were observed chewing betel nut, tobacco etc., and some were found smoking (K. R. Dey, Choudhury P, & B. K. 2013).

2.1.4. Signs and symptoms of illness among farmers

The signs and symptoms were informed by a large numbers of spraying farmers and also the non-sprayers stated, some of these symptoms and the signs with a higher rate of occurrence were unnecessary sweating, stinging /itching eyes, dry/sore throat, skin redness/white patches, (Antleand Pingali, 1994), Chest pain/burning sensation, excessive salivation, Headache, dizziness, muscular twitching, skin allergy, respiratory discomfort, etc., (Antleand Pingali, 1994); Yasin, Mourad& Safi, 2002), (Dey et al. 2013)

2.1.5. Health cost of illness due to pesticide exposure

Exposure to pesticide leads to multiple costs ranging from self-treatment to hospitalization. Although some cost is borne by the hospitals, yet major portion of cost are borne by the farmers themselves (Khan A; Muhammad. I; Iftikhar A 2002). Indirect cost incurred informs of transport cost and opportunity cost of time for another set of disadvantages posed by use of pesticide. Expenditures on special diets recommended by doctor's frequent consultancy visits and travel cost put financial burden on the farmers as their profession is like of hired labor (Atreya K, 2007-8). Loss of working hours combined with decrease in working efficiency form another aspect of indirect costs that put strain on financial setup of the farmers. Loss of time is not a singular cost experienced by a single person but it's a cost experienced by the family member, other members have to sacrifice their time either leisure time or work time to look after the patient there by

decreasing the efficiency of the whole households (Maumbe M B; Scott M. Swinton, 2002). High costs incurred in these abrupt situations indirectly increased the cost of production of crops which leads to an overall decrease in revenue generation that is no or less profit are made (Atreya K; Fred H; Bishal K, 2012).

2.3. Conclusion of themes

- Pesticides are necessity. Only the pesticide usage practices in an unsustainable manner lead to a negative impact on crop yield and human health. Although it is established fact that the practices such as Integrated pest management are no longer, favorable as they cause a decrease in crop yield which is not suitable for global food and security.
- Pesticide exposure can be either direct or indirect. The indirect exposure has a greater impact scale which not only affect the direct users but also the living organism living in the immediate surroundings.
- Sustainability requires observance of certain practices and habits, when spraying in the field. Use of protective equipment knowledge about the hazardous fumes of pesticides, greatly reduce the magnitude of negative impacts of pesticides.
- Adverse exposure to pesticides results in bearing the multiple health costs. The range from hospital expenses, medical test expenses the transport expenses and many other complimentary cost which put strain on a person's income.

Chapter 3: Methodology:

3.1. Choice crop for study

In Pakistan the cotton crop is the white gold among all major crops, and the back bone for the Pakistan economy which contribute almost 1.4% of GDP and almost 7% of value added in the agriculture of Pakistan (Economic Survey of Pakistan (2010 –2011). It is estimated that from all farmers in Pakistan almost 26% farmers grow cotton in their fields and estimated that more than 15% of total cultivated area is for this crop (Sabir et al. 2011). Generally, in Pakistan the intensive use of pesticides is mostly focused on the cotton crops, that is estimated by (khan et al. 2011) almost 70-85% of total use of pesticide, because cotton crop is the most susceptible crop for the attacks of pests. The spray frequency in Pakistan is 10 sprays per crop season (73 % farmers), which can be up to 16 sprays in one season, especially for B.t cotton (*Bacillus thuringiensi)* (Khan et al. 2011). Mostly the pesticides that are used in Pakistan are insecticides. Whitefly vector of cotton leaf curl virus is considered among the most serious cotton pests.

3.2. STUDY AREA:

3.2.1. Mian Channu:

Located one hundred kilo meters from the city of Multan city, the Tehsil of Mian Channu being part of Khanewal district is home to many agricultural activities having deep historical roots. It is an important agricultural area whose major agricultural products are Cotton, wool, Wheat, Sugarcane, Oil seed, Bajra and Jowar. Being an ancient area, it was made an administrative unit in 1918 which was later developed into an economic zone. Over the years, because of administrative changes and needs it was sub divided into 3 union councils later increasing to 26 union councils comprising of 4 urban and 22 rural union councils (District Pre-InvestmentStudy-2012).

As of the (Census, 2017) the population of Mian Chanu Tehsil is 761,971. There is only one Tehsil Head Quarter Hospital for 175 villages. It is dominantly an agricultural area where out of 244,341 acres of total land 224,274 acres of land is rural with in which 229,047 acres land is cultivated. Against this only 1600 acres of land is categorized as urban city. Cotton crop grown in Mian Channu Tehsil has vast land allocation. It is grown in large numbers in the areas of Vehari,

Sahiwal, Khanewal and Lodhran, these areas usually form the cotton belt where B.T Cotton and non-B. T cotton are largely cultivated. Because of high cotton cultivation there is high usage of pesticides. As a result, more than 80 pesticide companies are operating in the Tehsil. There is high purchase of pesticides due to frequent attacks of whitefly American Ballworm etc.… Unproductive handling of pesticides in Mian Channu Tehsil led to the establishment of plant protection department. Globally 3 million people suffer from pesticide poisoning every year. Over 200,000 reportedly suffer from pesticide poisoning (Sheikh, 2011) as a result the department oversees the purchase usage and handling of pesticides by farmers. In the year 2016, 50,000 Pakistanis suffered from poisoning because of agro-chemicals of which 10,000 died (Shahid et al. 2016). This is the reason why this Tehsil was taken for comparison with Tehsil where there is absence of plant protection department.

3.2.2. Bhawana:

Bhawana is a Tehsil of district Chiniot which was established in 2009 covering a total area of 40 square Kilometers. The urban area is spread on 10 square kilo meters. Its population is 65,000 of which the majority is agri-dependent, largely involved in agricultural activities. The major crops grown in this area are Cotton, Sugar Cane, and Rice. Compared to Tehsil Mian Channu, Bhawana Tehsil is smaller in area size where administrative setup is not as efficient and clearly defined as in the former. Unlike in Tehsil Mian Channu, the plant protection department is absent in Tehsil Bhawana even though majority of people are involved in agricultural activities. The cotton types grown in Tehsil Bhawna are primarily B. T and non-B. T cotton. The total cultivated area in Bhawana is 90,000 acres of which approximately 20,000 acres are used for cotton cultivation (Personal Communication with Mr. Sajjad – Supply Officer FMC Ltd.). Cotton being a cash crop requires intensive use of pesticides. For obtaining high yield of cotton many type of pesticides are used (District Pre-Investment Study- 2012). Consequently, there is a growing pesticide market with 35 to 40 companies operationally marketing their products. Due to absence of plant protection department, there is intensive use of pesticide without taking into consideration the hazardous effect of pesticides. Resultantly, there is high incidence of pesticide related diseases and health problems in farmers who are involved in pesticide usage for all the people living in Bhawana Tehsil for there is only one Tehsil Head Quarter Hospital.

3.3. Sample Size:

Total sample 250 respondents i.e. farmers were taken for conducting this study. A sample of 150 farmers was taken from Tehsil Mian Channu and 100 farmers was taken as respondent from Tehsil Bhawana. The farmers were asked about their pesticide usage practices, types of pesticides used, problem associated with usage, effect on health, economic costs incurred due to health problems information about pesticides usage, and the workings of plant protection department.

3.4. Methods:

The unit of analysis in this study are the farmers who are directly involved with the pesticide applications. To evaluate and analyze the health effects of pesticides and economic effects of pesticides on farmers and human health, there is a need to know two types of information. First one is to recognize the adverse health effects of pesticides on human health, second one is to know about the different health cost of illness maybe they are direct or indirect costs linked to pesticide usage in monetary terms. Two type of model that was used in this study that are: 1. Dose Response function, 2. Health Cost Function, wherein dose response function is used to evaluate the adverse health impacts of pesticides on farmer's health, and to analyze the impacts of different elements of chances of getting ill. Health cost function used in this study for measuring the cost of illness from pesticide exposure.

3.5. Hypothesis:

This study will test the following hypothesis

H_o: Pesticides exposure does not cause illness of pesticides applicators

H_1: Pesticides exposure causes illness of pesticide applicators

3.6. Dose Response Function:

Dose response function is the most appropriate function which applied on this study. The dose response function evaluates the polluted particles including all other adverse factors and to assess their impacts on farmers health. This study measures the possible probability of getting ill after the pesticide experience in the field. This study was collected the primary data and analyze it through the dose response function in case of Tehsil Mian Channu and Tehsil Bhawna (Punjab).

The logit model was used to know that how different factors affect the probability of falling ill (dung, 1999). Dependent variable was used to estimate the probability of falling ill, where dependent variable (Y) is the function of independent variable (Xi). The independent variables are those variables or factors which may affect the probability of illness (Atreya, (2013). The expected signs of that independent variable on illness are given in table. (Env impact Assessment (2011).

Econometric Model of Variable:

$$(Yi) = \beta o + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \beta 6X6 + \beta 7X7 + \beta 8X8 + \beta 9X9 + \varepsilon$$

$$\text{logit [P(Illness)]} = \beta o + \beta 1\, AGE + \beta 2\, education + \beta 3\, working\ hours + \beta 4\, smoke + \beta 5\, meal + \beta 6\, hand\ wash + \beta 7\, toxicity\ level + \beta 8\, precautions + \beta 9\, number\ of\ spray + \varepsilon$$

Table 3: Variable Description

SERIAL NO	VARIABLES	APPENDIX	DESCRIPTION	EXPECTED SIGNS
	Dependent variable (Yi)			
	Y	ill or not ill	If ill=1 if not=0	NA
	Independent variables (Xi)			
1	AGE	Applicator age	How many years old	uncertain
2	EDUCATION	Education in years	In years	Negative
3	WORKING HOURS	Duration in the field	In numbers	Positive
4	SMOKING	Smoking in the field	1= if yes, 0= if not	Positive
5	MEAL	Taking Meal during spray	1= if yes, 0= if not	Positive
6	HAND WASH	Washing hand before personal habits during spray in the field	1=if they do 0=if not	Positive
7	TOXIC LEVELS	Toxicity levels	1= if low 2=if mild 3= if high 4,5,6 if mix	Positive
8	Precautionary Measures	Averting behavior	1= if yes 0=if not	Negative
9	NUMBER OF SPRAYS	Number of spray in peak season	In numbers	Positive

3.7. Description of Variable:

1) Age: The expected sign of age is considered negative/uncertain because with rising age the farmers are more aware about the adverse impacts of pesticide and take precautions. However, the impact may not be significant as age may not be a measure of experience. Therefore, it is possible an aged person may not observe precautionary measure and a young sprayer may observe them (Chitra. A, 2008). As a result, the expected sign of age is taken as uncertain

2) Education: education means awareness when a farmer is aware of the adverse effects of pesticide there is less chances of risk (Khan, 2008). Negative sign is expected for education.
3) Exposure Duration or working hours: Duration variable shows the time that is taken by the farmers to mix up the spray and then use it in their field. The expected sign is positive because more time spent in the field means more exposure to pesticides (Atreya, 2013).
4) Smoking: the expected sign of smoking is positive. Smoking despite being injurious to health has become sprayer's addiction meaning that not smoking causes uneasiness in mood and activity. Sometimes, high addiction to smoking does not negatively impact the sprayer's health due to developed adaptability to smoking (Maumbe. M, 2003).
5) Meal: Meal is also having the bad effects on the farmer's health during the spray. The expected sign is positive with the illness (Atreya, 2007).
6) Washing Hands: Taking meal or drinking water or tea without washing hands and smoking are bad habits of the pesticide workers in the field. These habits pose a serious threat to the workers' health (Sheikh S.A, 2011). The expected sign is negative with illness.
7) Toxicity levels of pesticides: There are some toxicity levels like low, mild, and high-level toxicity. These toxic city levels can affect the sprayers by unsafe usage, it depends on area and usage of pesticides (Chitra. A, 2003). The expected sign is positive
8) Precautions: Application of the proper authorized mitigation gears is effective tool for decreasing the adverse health impacts on the pesticide applicators (Nguyen & Tran, 1999). In this view, the expected sign of precautionary measures is negative.
9) Number of spray: The expected sign of this variable is positive because increase in the number of spray will increase the chances of illness (Nguyen & Tran, 1999).

3.8. Health cost of illness function:

The health cost of illness of the farmers from pesticides experience directly associated with the dose of total pesticide, the number of times when a farmer gets in touch with the pesticide, most toxic categories of pesticide, and some other personal behaviors of the farmers. This model evaluates all types of costs whether they are direct (Atreya, 2013). Direct cost means that the cost that are associated directly like medical treatment, travelling cost, laboratory test fee cost…etc., while indirect cost is the loss of productivity due to sickness, loss of working days…etc.

Based on this environmental economics literature on health production function the linear regression model will be used with the health cost of illness model in (dung, 1999). The dependent and independent variables are…

3.9. Dependent variable:

$$Health\ cost = \beta o + \beta 1\ AGE + \beta 2\ education + \beta 3\ working\ hours + \beta 4\ smoke + \beta 5\ meal + \beta 6\ hand\ wash + \beta 7\ toxicity\ level + \beta 8\ precautions + \beta 9\ number\ of\ spray + \varepsilon$$

Table 4: Variable Description

Serial no	Variables	Appendix	Description	Expected signs
	Dependent variable (Yi)			
	Y	Total health cost		N/A
	Independent variables (Xi)			
1	Predicted value of illness	Estimated value of disease	Value of disease	Positive
2	AGE	Applicator's age	How many years old	uncertain
3	EDUCATION	Education in years	In years	Negative
4	WORKING HOURS	Duration in the field	In numbers	Positive
5	SMOKING	Smoking in the field	1= if yes, 0= if not	Positive
6	MEAL	Taking Meal during spray	1= if yes, 0= if not	Positive
7	HAND WASH	Washing hand before personal habits during spray in the field	1=if they do 0=if not	Positive
8	TOXIC LEVELS	Toxicity levels	1= if low 2=if mild 3= if high 4,5,6 if mix	Positive
9	PRECAUTIONS	Averting behavior	1= if yes0=if not	Negative
10	NUMBER OF SPRAYS	Number of spray in peak season	In numbers	Positive

CHAPTER 4: RESULTS AND DISCUSSION

4.1. Introduction:

This section is divided into following four sub sections. Section one and Three considered for the description the Dose Response Model (DRM); discussing the probability of getting sick. While, Section two and four is about the health cost model and factors involved in it. Detailed explanation is provided for both sections.

4.2: Section 1: Analysis of probability of illness of Tehsil Mian Channu

4.2.1 Descriptive analysis:

Table 5: Descriptive statistics of variables

VARIABLE	OBSERVATIONS	MEAN	STD. DEV.	MINIMUM	MAXIMUM
AGE	150	38.81333	10.65845	20	60
EDUCATION	150	1.533333	1.709298	0	5
WORKING HOURS	150	7.746667	1.443275	4	9
CROP AREA	150	8.3	4.569743	2	25
TOXIC LEVEL	150	3.166667	1.758648	1	6
NUMBER OF SPRAY	150	16.58667	2.935976	10	24

Two types of infestation: harmful insects which destroy the cotton crop; and unwanted plants that grow around the cotton crop and reduce its yield are controlled by the different types of pesticides or chemicals. In Pakistan these infestations are controlled with banned and unbanned pesticides. For this reason, Government of Pakistan has established a department Pest Warning and Quality Control (PW&QC) – this department makes sure that only un-banned pesticides are used by the farmers. These pesticides have some specific toxicity levels which differentiate these pesticides from each other, like high level toxic pesticides, mild level and low-level toxic pesticides. Only un-banned high-level toxic pesticides are used in the area Mian Channu because PW&QC department is functioned in the Tehsil.

The average age of the respondents in sample area was 39 years, which shows that majority of the respondents are of middle age. The minimum age of the Applicators is 20 and maximum 60 years.

The education of the respondents was taken in number of years, the average education of the respondents in the sample is approximately 1.5 years, which shows that majority of the respondents are just first of second standard educated. The maximum education of the respondents in the sample is 5 years, and the minimum years of education is zero meaning that these respondents are illiterate.

The average work hour of the sprayer was 7.74 hours per day which is almost 8 hours daily. The maximum working hours of pesticides workers are 9 and minimum working time of the spray worker recorded is 4 hours per day. In the peak season the sprayer spends more time in the field.

The average crop area is approximately 8 acres in which the sprayer sprays the pesticides. The maximum crop area in the sample is 25 acres and the minimum area is 2 acres in Tehsil Mian Channu.

There are three types of pesticides used in the study area namely: low level toxic mild level and high level toxic chemical, and additionally the sprayers mix these pesticides. So according to the questionnaire these pesticides were categorized in numbers from 1 to 6. The average toxic level is almost 3. The minimum toxic level that is used is 1 and the maximum is 6.

Sprayers respond that when there is peak season their working hours and number of sprays increased. In the field area the minimum number of sprays were 10 and the maximum number of sprays were 24 in a month, so the average number of sprays is approximately 17 in a peak season.

4.3. Wage structure:

For pesticides applicators the reason for accepting this type of work reason is wage structure. sometimes their house hold size is large that is why to fulfill their family needs they adopt this profession. It was observed in the field area that in a village there are only one or two sprayers for, not every agriculture worker is a pesticide worker. The pesticides worker receives more wage than the normal agriculture worker. The average wage of the spray workers is almost 800 rupees per day. On the other hand, agriculture labors received 500 rupees per day. The works taken by spray applicators is comparatively skilled work as compared to non-pesticides labors. The minimum

wage of the sprayers is 500 rupees and maximum wage of the pesticides applicators is 1000 rupees per day respectively depending on their experience.

4.4. Regression analysis:

In this study the first model that is used to estimate the illness is Dose Response function. This model is used to show the effects of independent variables on illness that appear from the use of pesticides. In Dose Response function the technique that is used to estimate the probability of illness is logit Model, because this technique is used for dependent variable which have the binary value like (illness = 0, illness= 1), while the independent variables in this model are Age, Education, Working hours or Duration, Smoking, Hand Wash, Toxicity Level, Precautionary Measures, Number of Spray per Month. Through the dose response model, the results appeared with expected signs except smoking. The variables through the Does Response Model, like education and working hours appeared with the significant influence on the skin allergy. The rest of variables though confirmed the expected signs but remained statistically insignificant as shown in Table for regression results the analysis of the data is made by using Stata SE 14 software.

Table 6: Regression results for Skin allergy

SKIN ALLERGY	DY/DX	COEF	STD. ERROR	Z	P > I Z I
AGE	-.0019271	-.0147408	.00286	-0.67	0.501
EDUCATION	-.0678438	-.5189643	.02404	-2.82	0.005
WORKING HOURS	.0903196	.690891	.03262	2.77	0.006
SMOKING	-.0583813	-.4092278	.08944	-0.65	0.514
MEAL DURING SPRAY	.052284	.4552293	.08272	0.63	0.527
HAND WASH	-.0357781	-.2946176	.06769	-0.53	0.597
TOXIC LEVEL	.0193123	.1477275	.01632	1.18	0.237
PRECAUTIONARY MEASURES	-.1023947	-.6555377	.12606	-0.81	0.417
NUMBER OF SPRAY	.0050834	.0388846	.01012	0.50	0.615

Number of Observation = 150, LR chi^2 = 29.94, R^2 = 0.13763

The regression results show in table: 6 that age is having the negative but insignificant relationship with the probability of skin allergy, this relationship shows that there is uncertainty regarding young aged farmer having greater chances of getting ill. Thus, age does not have a significant relationship with skin allergy. It can occur at any age.

Some factors like education and working hours affect the probability of illness, as results show that education has significant impact on the probability of skin allergy at 1% confidence interval, having negative sign with the probability of illness. It shows the inability to read instructions printed on pesticide bottles. Less knowledge about the pesticides results in 6% increase in chances of contracting illness, thus explaining the negative sign of education.

Working hours also affect the probability of illness. It has positive relationship with illness, meaning that when a sprayer spends more time in the field the chances of illness increases 9%. So, the regression results show that working hours or duration of time in the field has significant impact at the 1% confidence interval.

The probability of illness is very sensitive to the personal characteristics of the sprayers. The personal habits include having meal during spraying, smoking during spraying and hand washing. In this study the results show that the variable Meal shows the positive sign meaning that as a sprayer increases his activities in the field the chances of illness increase. The marginal effects show that there is 5% increase in the probability of illness, but it is statistically insignificant.

Hand wash shows negative sign showing that not washing hands cause a 3% increase in chances of contracting disease. The increase in probability of contracting disease due to not washing of hands is insignificant possibly due to developed immunity to the atmospheric setting of the area.

Smoking shows unexpectedly negative sign because the sprayers responded that they are addicted to smoking and without smoking during work they feel uncomfortable and this un-comfortableness may cause the illness for the sprayer. Resultantly, smoking shows negative result that reduction in smoking causes discomfort to increase.

The regression results show that the toxicity level has positive relationship with illness. In the study area, all toxicity levels are dangerous due to less precautions taken by sprayers. Consequently, they also mix up pesticides with each other without following standardized procedures, so they mix up high dose of toxic pesticides. The regression result shows statistically insignificant impact on skin allergy.

The regression results show positive relationship with the skin allergy but statistically insignificant impact. When number of sprays increases in the peak season the chances of illness also increases, thus explaining positive relationship with each other.

Table 7: Regression result for nose irritation

NOSE IRRITATION	DY/DX	COEF	STD.ERROR	Z	P > I Z I
AGE	-.0010047	-.0040307	.00453	-0.22	0.824
EDUCATION	-.0386367	-.1550021	.03374	-1.15	0.252
WORKING HOURS	.0531907	.2133896	.04125	1.29	0.197
SMOKING	.0543857	.2194712	.11829	0.46	0.646
HAND WASH	.0747208	.2994415	.13132	0.57	0.569
TOXIC LEVEL	.0604366	.02424583	.02687	2.25	0.025
PRECAUTIONS	.0216812	.0871922	.16332	0.13	0.894
NUMBER OF SPRAY	.0397122	.1593168	.01661	2.39	0.017

Number of Observation = 150, Probability > Chi^2 = 0.00072, Pseudo R^2 = 0.3011

The regression results show in the table: 7 that age has negative but insignificant relationship with nose irritation disease. This relationship shows that if age is low then there is less experience and the chances of illness increase, though the case is not strictly applicable.

The regression results show that the education affect the probability of illness, as shown in the table that education has negative but insignificant impact on nose irritation, less knowledge about the pesticides results in an increase of 3% chances of illness. Here, in this study, education means ability to read the precautions about the pesticides.

Regression result show the working hours have the positive but insignificant relationship with the illness. This means that if the sprayer spends more time in the field the chances of illness will increase by 5%.

The probability of illness is very sensitive to the personal characteristics of the sprayers. The result shows that the variable hand wash shows the positive sign, but they do not wash their hands in a

proper way or with sanitizer. So, with positive relationship it is estimated that the chances of illness increase by 7%. The relationship shows statistically insignificant influence on the nose irritation. Smoking shows the expectedly positive relationship with the nose irritation because sometimes smoking also mix up with pesticides and makes reaction in the lungs of sprayer so during breath nose irritation increases.

The result shows that the toxicity level has positive relationship with nose irritation as with any toxic the chances of illness increase due to observance of less precautions. In these results the toxicity levels are statistically significant at 5% confidence interval. While the marginal effect shows that there is 6% increase in the probability of illness.

There are some factors like precautionary measure such as gloves, glasses, mask, etc. If a sprayer adopts these precautions the chances of illness will reduce, in this model the precautionary measure variable shows the unexpected positive sign with insignificant results. These results show that if the sprayer uses the precautionary gadgets the probability of illness decreases but these results shows positive relationship because this sprayer don't use the proper precautions, so with improper precautions the chances of nose irritation increases.

Number of spray in peak season has also positive relationship with significant influence on the nose irritation at 1% confidence interval. The result shows that if there is an increase in the number of spray then there will be an increase of 3% in probability of illness.

Table 8: Regression result for Respiratory discomfort

RESPIRATORY DISCOMFORT	DY/DX	COEF	STD. ERROR	Z	P > I Z I
AGE	-.0029856	-.0173126	.00376	-0.79	0.428
EDUCATION	-.0804197	-.4663251	.03019	-2.66	0.008
WORKING HOURS	.0835163	.4842824	.03873	2.16	0.031
SMOKING	.1396909	.9688044	.07171	1.95	0.051
HAND WASH	.2067136	1.012891	.13107	1.58	0.115
TOXIC LEVEL	.0297623	.1725815	.02094	1.42	0.155
PRECAUTIONS	.1207582	.8687664	.08126	1.49	0.137
NUMBER OF SPRAY	.0352535	.2044229	.0141	2.50	0.012

Number of Sprays = 150, Probability > Chi^2 = 0.0000, Pseudo R^2 = 0.4023

The regression results in table: 8 shows that age has negative but insignificant relationship with the probability of Respiratory illness, this relationship shows that there is uncertainty regarding young aged farmer having greater chances of getting ill. Thus, age does not have a significant relationship with skin allergy. It can occur at any age.

Factors like education and working hours affect the probability of illness, as result shows that education has significant relationship with the probability of illness at 1% confidence interval, having negative sign with the probability of illness, thereby explaining the result of having less knowledge about the pesticides resulting in an increase of 8% in chances of illness.

Working hours also affect the probability of illness. It means that if the sprayer spends more time in the field the chances of illness will increase. Crop area also affect the sprayer. So, results show that working hours or duration of time in the field has positive and significant results at the 5% confidence interval.

The probability of illness is very sensitive to the personal characteristic of the sprayers. The personal habits like smoking during spraying and after spraying. The results show that the smoking has the positive relationship with the illness, also having the significant impact on the illness at the 5% confidence interval, it means that if there is one percent increase in the smoking then here will be a 13 % chance of increase in illness.

Hand wash shows the positive relationship, but they are not washed their hands in a proper way or with sanitizer. So, with positive relationship it is obvious that the chances of illness increase. The relationship shows statistically insignificant influence on the respiratory disease.

The toxicity level shows the positive relationship with the respiratory disease as high the toxicity level will high the chances of illness. After that they also mix up these pesticides, which basically standardized but sprayer having no knowledge about the quantity of mixing the pesticides, so they mix up high dose of these pesticides. In these results the toxicity levels having positive relationship with illness it means that if there is 1% increase in the toxicity level there will be a 2% increase in the chances of illness.

There are some factors like precautionary measure like gloves, glasses, mask, etc., if the sprayer adopt these precautions the chances of illness will reduce, in this model the Precautionary measure variable shows the unexpected sign with insignificant results, the results shows positive sign

because these sprayers don't use the proper precautions, so with improper precautions the chances of diseases increase.

Number of spray in peak season has also positive relationship with the probability of illness. The result shows the significant results with the respiratory disease and shows same thing that if there is 1% increase in the number of spray there will be 3% increase in chances of respiratory disease.

Table 9: Regression result for Skin burn

SKIN BURN	DY/DX	COEF	STD.ERR	Z	P > I Z I
AGE	.000858	.0065821	.00286	0.30	0.764
EDUCATION	-.0332311	-.2549319	.02345	-1.42	0.156
WORKING HOURS	.0712528	.5466144	.03211	2.22	0.026
SMOKING	-.0636165	-.4439099	.09225	-0.69	0.490
HAND WASH	-.002757	-.0212624	.07658	-0.04	0.971
TOXIC LEVEL	-.0084673	-.0649564	.01653	-0.51	0.608
PRECAUTIONS	-.0931394	-.6054581	.12662	-0.74	0.462
NUMBER OF SPRAY	.0098182	.0753205	.01045	0.54	0.347

Number of Sprays = 150, Probability > Chi^2 = 0.0000, Pseudo R^2 = 0.3097

The data showed in Table: 9 that the percentage change in independent variables due to one-unit change in independent variable.

The variables age and education are showing the expected, with insignificant relationship, as age high the chances of illness high as education low the chances of illness will 3% high. The working hours showing positive sign and significant relationship with the skin burn as high the duration in the field the chances of illness high. The chances of illness were also sensitive to personal characteristics of the applicators. Personal habit like smoking during the application of spray, smoking shows negative relationship with illness, smoking is statistically insignificant. It means that majority of the respondents expressed discomfort when they do not smoke because of their addictiveness to excessive smoking. Hand wash also shows the negative sign with the illness skin burn increase due to less hand wash.

The toxicity level shows the negative relationship with the illness as with any toxic level will high the chances of illness due to less precautions. The sprayers also mix up these pesticides, which basically standardized but sprayer having no knowledge about the quantity of mixing the pesticides, so they mix up high dose of these pesticides. In these results the toxicity levels having negative relationship on the illness but statistically insignificant impact on the illness. However, the rest of variables had shown the expected sign but statically insignificant. Less precautions will result the high in the chances of illness, if there is 1% decrease in the precautions there will be 9% increase in the chances of illness.

Table 10: Regression result for Skin Redness

SKIN REDNESS	DY/DX	COEF	STD. ERROR	Z	P > I Z I
AGE	-.0017392	-.012282	.00305	-0.57	0.568
EDUCATION	-.0617418	-.4360084	.02477	-2.49	0.013
WORKING HOURS	.0595015	.4201877	.03344	1.78	0.075
HAND WASH	-.0526903	-.4107032	.07183	-0.73	0.463
TOXIC LEVEL	.0151312	.1068535	.01754	0.86	0.388
PRECAUTIONS	-.0427728	-.2803337	.11493	-0.37	0.710
NUMBER OF SPRAY	.0165286	.1167221	.01131	1.46	0.144

Number of Sprays = 150, Probability > Chi^2 = 0.0029, Pseudo R^2 = 0.1416

The data showed in Table; 10 that the percentage change in independent variables due to one-unit change in independent variable.

The variables age and education showing the expected sign, but age is showing insignificant relationship, as it shows that at young age people are not too concerned about the adverse impacts of pesticides on their health. Education is showing the significant impact on the skin redness, low the education means not able to read the instructions about the pesticides, so the chances of illness increase, the results shows that if 1% decrease in education then there will be 6% increase in the skin redness. The working hours showing positive relationship with skin redness it means that when high the crop area the working hours also high, so the chances of illness increase the results is showing that if 1% increase in the working hours then there will be 6% increase in the chances

of skin redness, having the significant impact on the skin redness. Hand wash also shows the negative relationship with the skin redness but statistically insignificant impact on the skin redness. The result is showing that if there is 1% decrease in the hand wash by the sprayer then there will be 5% increase in the chances skin redness.

The toxicity level is showing the positive relationship with the illness as with high toxicity level will high the probability of illness due to less precautions. They also mix up these pesticides which basically standardized but sprayer having no knowledge about the quantity of mixing the pesticides, so they mix up high dose of these pesticides. In these results the toxicity levels having positive effects on the illness but statistically insignificant impact on the illness. While the marginal effect shows that 1% increase in the chances of illness. However, the rest of variables like precautions and number of spray had shown the expected sign but statically insignificant. Precautions result is showing that if there is 1% decrease in the precautionary behavior there will be 4% increase in the chances of illness. Number of sprays is showing the positive relationship with the illness, if there is 1% increase in the number of sprays there will be 1% increase in the chances of illness.

Table 11: Regression result for Eye Irritation

EYE IRRITATION	DY/DX	COEF	STD.ERR	Z	P > I Z I
AGE	.0076944	.0314367	.00435	1.77	0.077
EDUCATION	-.0409313	-.1672307	.03245	-1.26	0.207
WORKING HOURS	.0753036	.3076636	.04001	1.88	0.060
SMOKING	.0133015	.0544867	.11427	0.12	0.907
WASH HANDS	-.0874624	-.3666714	.12101	-0.72	0.470
TOXIC LEVEL	.0024115	.0098525	.02468	0.10	0.922
PRECAUTIONS	.0805123	.3379536	.14858	0.54	0.588
NUMBER OF SPRAY	.0208788	.0853032	.01512	1.38	0.167

Number of Sprays = 150, Probability > Chi^2 = 0.0000, Pseudo R^2 = 0.0.4710

The data showed in Table: 11 that the percentage change in independent variables due to one-unit change in independent variable.

The variables age and education showing the expected sign but with different relationships, when age is high the chances of eye irritation high age has the significant impact on the eye irritation at 10% confidence interval. Education is showing the negative sign, low the education the chances of illness high due to not able to read the instructions about the pesticides the marginal affect shows that if 1% decrease in the education then there will be 4% increase in the chances of illness. The working hours is showing positive relationship with the eye irritation and has significant impact on the eye irritation at 10% confidence interval as high the duration in the field the chances of illness high. The marginal affect shows that if 1% increase in the duration of spray in the field then there will be 7% increase in the chances of illness. The probability of sickness was also sensitive to personal characteristics of the applicators. Smoking has positive relationship with the illness. However, smoking is showing statistically insignificant impact on the illness. Increase in the number of cigarettes in the field will increase the eye irritation. Hand wash also shows the negative relationship with the illness eye irritation increase due to less hand wash. If there is 1% decrease in the hand wash there will be 8% increase in the chances of illness.

The toxicity level is showing the positive relationship with the illness as with high toxicity level will high the probability of illness due to less precautions. After that they also mix up these pesticides, which basically standardized but sprayer having no knowledge about the quantity of mixing the pesticides, so they mix up high dose of these pesticides. In these results the toxicity levels having positive effects on the illness but statistically insignificant impact on the illness. While the marginal effect shows that .07% increase in the chances of illness.

However, the rest of variables like precautions and number of spray has shown the expected sign but statically insignificant. Precautions result is showing that if there is 1% decrease in the precautionary behavior there will be 8% increase in the chances of illness. Number of sprays is showing the positive relationship with the illness, if there is 1% increase in the number of sprays there will be 2% increase in the chances of illness.

Table 12: Regression result for Chest Pain

CHEST PAIN	DY/DX	COEF	STD. ERROR	Z	P > I Z I
AGE	-.0038895	-.0422682	.00247	-1.58	0.115
EDUCATION	-.0192358	-.2090417	.01926	-1.00	0.318
WORKING HOURS	.0348656	.3788972	.02542	1.37	0.170
MEAL	.1463929	1.11958	.133374	1.09	0.274
SMOKING	.009589	.1070098	.06186	0.16	0.877
HAND WASH	-.059853	-.5546273	.08267	-0.72	0.469
TOXIC LEVEL	-.0029669	-.032242	.01311	-0.23	0.821
PRECAUTIONS	-.1666054	-1.228594	.13453	-1.24	0.216
NUMBER OF SPRAY	.01157676	.1713521	.00915	1.72	0.085

Number of Sprays = 150, Probability > Chi^2 = 0.0029, Pseudo R^2 = 0.4047

The data showed in Table: 12 that the variables age and education showing the expected sign, age is showing insignificant relationship, when age is low the chances of chest pain increase because the inexperienced sprayers being young of age incorrectly mix the pesticides. This in experience sometimes lead to contracting chest diseases. Education showing the insignificant impact on the chest pain, low the education chances of illness high, because they are unable to read the precautions about the pesticides. The working hours showing positive relationship and insignificant impact on the chest pain as high the duration in the field the chances of illness high. The marginal results show that if 1% increase in the working hours there will be 3% increase in the chances of illness.

The probability of sickness was also sensitive to personal characteristics of the applicators. Personal habits such are taking meal and smoking during the application of spray. Smoking and meal has positive relationship with the chest pain. The marginal affect shows .09% increase in the chest pain. However, smoking was statistically insignificant, because smoking has direct relationship with the chest pain because this pain can be of lungs or stomach, its results are insignificant, but sign is positive. While meal has insignificant impacts on the Chest pain, positive relationship with the chest pain because the respondents do not practice sanitary practices such

washing hand, as a result they must suffer in form of chest pain infections. The marginal affect shows that 14% increase in the chest pain. Hand wash also shows the negative sign with the illness chest pain increase due to less hand wash. The marginal affect shows that the 5% increase in the chest pain.

The toxicity level shows the negative relationship with the illness as with any toxic level will high the probability of illness due to less precautions and sprayer having no knowledge about the quantity of mixing the pesticides, so they mix up high dose of these pesticides. In these results the toxicity levels having negative effects on the illness but statistically insignificant. The marginal affect shows that .02% increase in the illness. However, the rest of variables like precautions and number of spray had shown the expected sign but statically insignificant, if there is 1% decrease in the precautions there will be 16% increase in the Chest Pain.

4.5. Section:2 Health cost of illness

Table 13: Descriptive Statistics of total Health Cost

VARIABLE	OBSERVATION	MEAN	STD. DEV.	MIN	MAX
TOTAL EXPENDITURE	150	797.1867	628.8096	0	2424
LOSS OF WORKING HOURS	150	14.24333	14.79352	0	48
COST OF LOSS OF HOURS	150	525.48	442.2547	0	1800
DR. FEE	150	7.186667	21.62908	0	100
MEDICAL EXPENDITURE	150	195.9667	185.3726	0	800
TRAVELLING EXPENDITURES	150	52.93333	61.62832	0	220

There are two types of treatment the first is the hospital treatment and the second is the self-treatment. Self-treatment mostly have very low expenditures but the hospital treatment results different types of expenditures like doctor fee, medicinal expenditure, travelling cost, cost of loss of working hours, etc. while

from total of the 150 observations 63 respondents having self-treatment and 87 having hospital treatment, the average fee they pay for treatment in hospital is Rs: 2 to 100 and 0 is for those respondents who are not getting any treatment. The average medicinal expenditures are 196 rupees and the minimum medicinal expenditures is 0 rupees and the maximum are 800 rupees, similarly another cost that is related with the hospital treatment is the travelling cost, this study estimates the average travelling cost RS: 0 to 220. Cost which is some time indirect is the cost of the loss of working hours, when the sprayer is getting ill then he is sacrificing his working days or hours due to illness. The average cost of loss of working hours is 525 rupees, the minimum cost of loss of working hours is 0 and maximum is 1800 rupees. These all costs merge into one cost that is total health cost the minimum total health costs is 0 and the maximum health cost is 2424 rupees, the average cost of health that farmers pay for their treatment is approximately 800 rupees per season.

Table 14: Regression result for health cost

HEALTH COST	COEF	STD.ERR	T	P > I Z I
SKIN ALLERGY	225.2273	103.6776	2.17	0.032
AGE	-.9429517	4.241386	-0.22	0.824
EDUCATION	-84.04659	32.5066	-2.59	0.011
WORKING HOURS	137.8008	38.67244	3.56	0.001
SMOKING	151.3255	112.014	1.35	0.179
MEAL	82.15543	150.9154	0.54	0.587
HAND WASH	65.0479	125.4416	0.52	0.605
TOXIC LEVEL	-.5625597	24.64269	-0.02	0.982
PRECAUTIONS	-16.61994	153.6136	-0.11	0.014
NUMBER OF SPRAY	28.31838	14.84358	1.91	0.058

Number of Sprays = 150, Probability > F = 0.0000, R^2 = 3888

The regression result shows in table: 14 that if the increases in the Skin allergy the health cost will increase approximately 226 rupees. This variable has a great significant impact on health cost, with that results illness shows the expected positive sign, just as the discomfort rate increases the type of treatment will also increases then the sprayer must go to the doctor that way the health cost will increases.

The health cost was also sensitive to personal characteristics of applicators. Personal habit such

as having meal during the application of spray caused 82 rupees increase in health cost the results also shows the positive sign with the health cost because when the sprayer having meal during the application of spray then also the chances of illness increases so these chances of illness affect the health cost. Another factor that influence the health cost is education for pesticide application the sprayer must have the ability of read the label written on the pesticide packets.

Education shows the significant Impact on the health cost at the level is on 1% confidence interval. The result shows that if one-unit decrease in education there is 84 rupees increase in the health cost.

Similarly, the study shows the results of working hour's significant impact on health cost at the 5% confidence interval, also having positive relationship with the health cost, as increase in the working hours there will be increase in the chances of illness, so the health cost also increases. The result shows that 137 rupees increase in the health cost.

The results show that the smoking has the insignificant impact on the skin allergy but has positive relationship with the skin allergy. Smoking increase the chances of illness increase then health cost automatically increases. The result shows that if the sprayer is smoking health cost increase 151 rupees respectively.

Toxicity level result shows the insignificant influence with health cost but with the negative sign as with any toxic level the chances of illness increases due to less precautions. Less toxic results less chances the illness but with proper precautions, which decreases the health cost.

Less proper precautions result the increase in the chances of illness. So, the result shows the significant impact on the health cost with the negative sign relationship it means that if the sprayer adopts less precautions the chances of illness increase which increase the health cost.

Number of sprays per month shows the significant impacts on the health cost at the 5 % confidence interval, With the expected positive sign. If the number of sprays in the peak season increases the chances of illness increases it will result the 28 rupees increase in the health cost.

Table 15: Regression result for health cost

HEALTH COST	COEF	STD. ERR	T	P > I Z I
RESPIRATORY DISCOMFORT	303.4658	99.11875	3.06	0.003
AGE	-.9987108	4.170901	-0.24	0.811
EDUCATION	-.79.25515	31.97102	-2.48	0.014
WORKING HOURS	133.844	38.04579	3.52	0.001
SMOKING	103.2215	110.986	0.93	0.354
MEAL	130.6584	148.8872	0.88	0.382
HAND WASH	3.661175	124.4694	0.03	0.977
TOXIC LEVEL	-13.16699	24..32739	-0.54	0.589
PRECAUTIONS	-72.7942	151.2562	-0.48	0.631
NUMBER OF SPRAY	20.79122	14.86835	1.40	0.164

Number of Sprays = 150, Probability > F = 0.0000, $R^2 = 0.4059$

The regression result in table: 15 shows that if there is an increase in Skin allergy the health cost will increase by approximately 226 rupees. This variable has a significant impact on health cost by showing the expected positive sign.

The health cost is also sensitive to personal characteristics of applicators, such as age in these results is showing the negative relationship with the respiratory disease, meaning that with lower age the chances of illness increase due to less experience so health cost increases. Education is showing the negative relationship with significant impact on the respiratory disease: less education will increase the chances of illness thereby increasing the health cost increase. The results show there is an increase of 79 rupees in the health cost. Education has significant impact with disease at 1% confidence interval. While the working hours show the positive sign with significant relationship at the 1% confidence interval. This increases the health cost by133 rupees respectively.

Personal habit such as taking meal during the application of spray caused 130 rupees increase in total health cost. Hand washing is showing the unexpected positive sign because the sprayer is not washed hand with sanitizer or properly, so the chances of illness remain same in this condition. Smoking also shows positive relationship with health cost. The increase in the health cost is 103 rupees respectively.

The regression results show that the toxicity level is showing the negative sign with insignificant impact, because with any toxicity level the chances of illness increase due to less precautions.

The rest of the variables like precautions and number of spray are showing the expected sign with insignificant influence, precautions increases the 72 rupees in health cost. While number of spray shows the positive sign and sign which means health cost increase.

Table 16: Regression result for health cost

HEALTH COST	COEF	STD. ERROR	T	P > I Z I
CHEST PAIN	344.7097	121.861	2.83	0.005
AGE	.0131728	4.217793	0.00	0.998
EDUCATION	-92.34455	31.62282	-2.92	0.004
WORKING HOURS	140.3035	38.02789	3.69	0.000
SMOKING	138.1714	110.7178	1.25	0.214
MEAL	142.3179	150.0723	0.95	0.345
HAND WASH	30.5852	124.2216	-0.25	0.806
TOXIC LEVEL	-3.999027	24.2889	0.16	0.869
PRECAUTIONS	36.48927	153.8528	0.24	0.813
NUMBER OF SPRAY	23.76279	14.80294	1.61	0.111

Number of Sprays = 150, Probability > F = 0.0000, $R^2 = 0.4001$

The regression result in table 16 shows that chest pain showing the significant relationship because chest pain is the disease which take the sprayer to the hospital and in hospital the treatment can be expensive. This cost increases the health cost 344 rupees respectively. The health cost was also

sensitive to personal characteristics of applicators. Such as age in these results showing the positive relationship as high the age chances of chest pain increase, then the health cost increase, education is showing the negative sign as low the education will result the chances of illness increase due to less knowledge about pesticides that will increase in the health cost. Education having the significant impacts on the disease at 1% confidence interval this increases the health cost 92 rupees respectively. While the working hours showing the positive sign with significant relationship. This increases the health cost 140 rupees respectively

Personal habit such as taking meal during the application of spray caused 142 rupees increase in total health cost, also showing the positive relationship. Hand wash is showing the unexpected positive sign because the sprayer is not washed hand with sanitizer or properly, so the chances of illness remain same in this condition, so this shows the insignificant relationship. Smoking also shows the positive relationship with health cost, with insignificant relationship. The results show that if smoking increase the health cost increase 138 rupees respectively.

The rest of the variables like precautions and number of spray are showing the expected sign with insignificant influence, if there is less precaution the cost will increase 36 rupees. The number of spray shows the positive relationship with the disease because if number of sprays increase the chances of illness increase then the health cost also affects.

Table17: Regression result for health cost

HEALTH COST	COEF	STD. ERROR	T	P > I Z I
SKIN BURN	429.1986	103.1135	4.16	0.000
AGE	-1.711178	4.061543	-0.42	0.673
EDUCATION	-84.68035	30.76124	-2.75	0.007
WORKING HOURS	128.2819	37.08229	3.46	0.001
SMOKING	161.7243	107,4083	1.51	0.134
HAND WASH	51.43233	120.1559	0.43	0.669
TOXIC LEVEL	-2.492284	23.55356	-0.11	0.916
PRECAUTIONS	-3.682018	147.1685	-0.03	0.980
NUMBER OF SPRAY	24.58728	14.2675	1.72	0.087

Number of Sprays = 150, Probability > F = 0.0000, R^2 = 0.4397

The regression result in table 17 that the disease skin burn having the significant impacts on health cost because this is big problem sprayer cannot treat this problem with themselves, so this disease can also be a reason of increase in health cost. This increase in the health cost approximately 430 rupees respectively. The age in these results showing the negative as low the age chances of illness increase due to less experience so the health cost increase, education is showing the negative sign relationship with the disease low the education will result the chances of illness increase so health cost increase. Education having the significant impact on the disease at 1% confidence interval. This increases the health cost approximately 84 rupees. The working hours is showing the positive relationship with significant impact on the Skin Burn. This increases the health cost 128 rupees.

Hand wash is showing the unexpected positive sign because the sprayer is not washed hand with sanitizer or properly, so the chances of illness remain same in this condition. Smoking shows the positive relationship with health cost, with insignificant relationship. This increase in the health cost 51 rupees.

The regression result shows that the toxicity level is showing the negative relationship with the insignificant impact, because any toxic chemical is harm for the skin, so the chances of illness present in any condition.

The rest of the variables like precautions and number of spray are showing the expected sign with insignificant influence on the Skin burn. The number of spray shows the positive relationship with the disease because if number of sprays increase the chances of illness increase then the health cost increases 24 rupees.

Table 18: Regression result for health cost

HEALTH COST	COEF	STD. ERROR	T	P > I Z I
SKIN REDNESS	136.1934	105.7149	1.29	0.200
AGE	-1.209608	4.284834	-0.28	0.778
EDUCATION	-90.02036	32.76343	-2.75	0.007
WORKING HOURS	144.2316	38.91829	3.71	0.000
SMOKING	163.523	114.1881	1.43	0.154
HAND WASH	63.62948	126.9093	0.50	0.617
TOXIC LEVEL	-3.246146	24.86227	-0.13	0.896
PRECAUTIONS	-34.94498	154.9768	-0.23	0.822
NUMBER OF SPRAY	27.15068	15.09965	1.80	0.074

Number of Sprays = 150, Probability > F = 0.0000, $R^2 = 0.3753$

The regression result in table 18 that the disease having insignificant influence because according to sprayers it is not a big disease, so they do not want to go to hospital, but this can be a reason of increase in health cost. This increases the health cost 136 rupees. The health cost was also sensitive to personal characteristics of applicators. Such as age in these results showing the negative relationship as low the age chances of skin redness increase due to less experience and sensitive skin so health cost increase, education is showing the negative sign as low the education will result the chances of illness increase so health cost increase. Education having the significant influence with disease at 1% confidence interval. This increase the health cost 90 rupees. While the working hours showing the positive relationship with significant impact on the Skin Redness. This increase in the health cost 144 rupees respectively.

Hand wash is showing the unexpected positive relationship with the Skin Burn because the sprayer is not washed hand with sanitizer or properly, so the chances of illness remain same in this condition. Smoking shows the positive relationship with health cost, with insignificant relationship. This increases the health cost 163 rupees.

The rest of the variables like precautions and number of spray are showing the expected sign with insignificant influence on the Skin redness. This increase the health cot 34 rupees respectively. The number of spray shows the positive relationship with the disease because if number of sprays increase the chances of illness increase then the health cost increases 27 rupees.

Table 19: Regression result for health cost

HEALTH COST	COEF	STD. ERROR	T	P > I Z I
EYE IRRITATION	-65.97687	88.33195	-0.75	0.456
AGE	-.9228229	4.34991	-0.21	0.832
EDUCATION	-94.72799	32.58264	-2.91	0.004
WORKING HOURS	153.2777	39.39463	3.89	0.000
SMOKING	144.5263	113.6346	1.27	0.206
MEAL	86.32986	153.4284	0.56	0.575
HAND WASH	48.87352	127.4459	0.38	0.702
TOXIC LEVEL	-4.661146	24.93188	-0.19	0.852
PRECAUTIONS	-33.39565	155.7191	-0.21	0.831
NUMBER OF SPRAY	30.70375	15.15376	2.03	0.045

Number of Sprays = 150, Probability > F = 0.0000, $R^2 = 0.3705$

The regression result in table 19 that the disease having insignificant influence because according to sprayers this disease also not a big disease, so they don't want to go to hospital, but this can be a reason of increase in health cost in long term. This increase the health cost 65 rupees. The health cost was also sensitive to personal characteristics of applicators, age in these results showing the negative relationship as low the age chances of eye irritation increase due to less experience and sensitive body temperament so health cost increase, education is showing the negative sign as low the education will result the chances of illness increase so health cost increase. This increase in the health cost 94 rupees respectively. Education having the significant impact on the eye irritation with disease at 1% confidence interval. While the working hours showing the positive sign with significant relationship. This increase in the health cost 153 rupees respectively.

Hand wash is showing the unexpected positive sign because the sprayer is not washed hand with sanitizer or properly, so the chances of illness remain same in this condition, this shows the insignificant relationship. Smoking also shows the positive relationship with health cost, with insignificant impacts on eye health cost.

The rest of the variables like precautions and number of spray are showing the expected sign with insignificant influence on the Skin redness. This increase the health cot 33 rupees respectively. The number of spray shows the positive relationship with the disease because if number of sprays increase the chances of illness increase then the health cost increases 30 rupees.

Table 20: Regression result for health cost

HEALTH COST	COEF	STD. ERROR	T	P > I Z I
NOSE IRRITATION	96.70718	91.00018	1.06	0.290
AGE	-1.342594	4.290914	-0.31	0.755
EDUCATION	-94.094	32.47888	-2.90	0.004
WORKING HOURS	144.1666	39.07109	3.69	0.000
SMOKING	140.5688	113.4467	1.24	0.217
MEAL	94.13641	152.7458	0.62	0.539
HAND WASH	48.33409	127.0914	0.38	0.704
TOXIC LEVEL	-9.746796	25.30929	-0.39	0.701
PRECAUTIONS	-39.13551	155.2477	-0.25	0.801
NUMBER OF SPRAY	26.21568	15.32471	-1.40	0.163

Number of Sprays = 150, Probability > F = 0.0000, $R^2 = 0.3728$

The regression result in table: 20 that the nose irritation is the disease which consider by the sprayer a small disease, so the sprayer doesn't take it seriously but some time they respond that this can be harmful for them in these results it shows the insignificant results but positive signs. Only two variables like education and working hours shows the significant relationship with the nose irritation the rest of the variables shows the same result as above regression are showing.

Section 3: Analysis of probability of illness of Tehsil Bhawana

Table 21: Descriptive analysis:

VARIABLE	OBSERVATIONS	MEAN	STD. DEV.	MINIMUM	MAXIMUM
AGE	100	38.81333	10.65845	20	60
EDUCATION	100	1.533333	1.709298	0	5
WORKING HOURS	100	7.746667	1.443275	4	9
CROP REA	100	3.53	4.569743	1	5
TOXIC LEVEL	100	3.496667	1.758648	1	6
NUMBER OF SPRAY	100	16.27667	2.935976	10	22

Table 22: Regression analysis of respiratory illness

RESPIRATORY DISCOMFORT	DY/DX	COEF.	STD. ERR	Z	P > I Z I
AGE	.0007040	.0046415	.00418	0.17	0.866
EDUCATION	-.0654858	-.4316893	.0322	-2.03	0.042
WORKING HOUR	.116224	.7661605	.04366	2.66	0.008
SMOKING	.1188216	.9441597	.08713	1.36	0.173
HAND WASH	.0974496	.56577795	.1644	0.59	0.553
TOXIC LEVEL	.0122024	.0804394	.02433	0.50	0.616
PRECAUTIONS	.1083535	.09041205	.0821	1.32	0.187
NUMBER OF SPRAY	.0274839	.181177	.01612	1.71	0.088

Number of Observation = 100, probability > Chi^2 = 0.0009, Pseudo R^2 = 0.3160

The regression result in table: 22 that the age is having the negative relationship with the respiratory discomfort disease, while also having the insignificant impact on the illness, this relationship shows that increasing corresponds an increase damage to lungs and respiratory system because of which there is high incidence of disease in people of higher age. Age is not a proxy for experience, but it shows which age group is most involved in pesticide activity, also it shows which age group most prone to contracting diseases.

Factors like education and working hours affect the probability of illness, result shows that the education has significant relationship with the probability of illness at 1% confidence interval, while having negative sign with the probability of illness, less knowledge about the pesticides results the 6% increase in chances of illness.

Working hours also affect the probability of illness. It means that if the sprayer spends more time in the field the chances of illness will increase. Crop area also affect the sprayer. So, results show that working hours or duration of time in the field has significant impact at the 5% confidence interval, also working time shows the positive relationship that increase the 11% increase in the illness.

The probability of illness is very sensitive to the personal characteristic of the sprayers. The personal habits like smoking during spraying and after spraying. The results show that the smoking has the positive relationship with the illness, also having the insignificant impact on the illness, it means that if there is one percent increase in the smoking then here will be a 11 % chance of increase in illness.

Hand wash shows the positive relationship, but they are not washed their hands in a proper way or with sanitizer. So, with positive relationship it is obvious that the chances of illness increase. The relationship shows statistically insignificant impact on the respiratory disease.

The Dose Response Model results shows that the toxicity level shows the positive relationship with the respiratory disease as high the toxicity level will high the chances of illness. Sprayer having no knowledge about the quantity of mixing the pesticides, so they mix up high dose of these pesticides. It means that if there is 1% increase in the toxicity level there will be a 1% increase in the chances of illness.

There are some factors like precautionary measure like gloves, glasses, mask, etc., if the sprayer adopt these precautions the chances of illness will reduce, in this model the Precautionary measure variable shows the unexpected sign with insignificant results, the results shows positive sign because these sprayers don't use the proper precautions, so with improper precautions the chances of diseases increase.

Number of spray in peak season has also positive relationship with the probability of illness. The result shows the significant results with the respiratory disease and shows same thing that if there is 1% increase in the number of spray there will be 2% increase in chances of respiratory disease.

Table 23: Regression results for Skin Burn

SKIN BURN	DY/DX	COEF.	STD. ERR	Z	P > I Z I
AGE	.0012991	0.103592	.00376	0.35	0.730
EDUCATION	-.0181407	-.1446619	.0o2724	-0.67	0.505
WORKING HOUR	.0579062	.4617699	.03594	1.61	0.107
SMOKING	-.1072849	-.7319621	.13694	-0.78	0.433
HAND WASH	.0027703	0.21962	.10683	0.03	0.979
TOXIC LEVEL	.0326	.2599668	.0226	1.44	0.150
PRECAUTIONS	-.0824807	-.5638122	.14546	-0.57	0.571
NUMBER OF SPRAY	.0219573	.1750974	.014	1.57	0.117

Number of Observations = 100, probability > Chi^2 = 0.000, Pseudo R^2 = 0.4156

The data showed in Table; 23 that the percentage change in independent variables due to one-unit change in independent variable.

The variables age and education showing the expected sign but with insignificant relationship, as age high the chances of illness high as education low the chances of illness 1% high. The working hours showing positive relationship and significant impact on the skin burn as high the duration in the field the chances of illness will 5% high. The chances of illness were also sensitive to personal characteristics of the applicators. Personal habit like smoking during the application of spray, smoking shows negative relationship with illness, smoking was statistically insignificant. It means that majority of the respondents expressed discomfort when they do not smoke because of their addictiveness to excessive smoking. Hand wash shows the positive relationship with skin burn it increase due to less hand wash.

The toxicity level shows the positive relationship with the illness as with high toxic level will high the chances of illness due to less precautions. The sprayers also mix up these pesticides, which basically standardized but sprayer having no knowledge about the quantity of mixing the

pesticides, so they mix up high dose of these pesticides. In these results the toxicity levels having positive relationship with the illness which increase the 3% in the illness, having statistically insignificant impact on the illness. However, the rest of variables had shown the expected sign but statically insignificant. Less precautions will result the high the chances of illness, if there is 1% decrease in the precautions there will be 8% increase in the chances of illness.

Table 24: Regression results for Eye Irritation

EYE IRRITATION	DY/DX	COEF.	STD. ERR	Z	P > I Z I
AGE	.0094754	.0392733	.00539	1.76	0.079
EDUCATION	-.0617275	-.2558464	.03821	-1.62	0.106
WORKING HOUR	.0861514	.3570942	.04797	1.80	0.072
SMOKING	-.0109194	-.045144	.14914	-0.07	0.942
HAND WASH	-.0061067	-.0253572	.17438	-0.04	0.972
TOXIC LEVEL	.0171169	.0709457	.03238	0.53	0.597
PRECAUTIONS	.0742174	.316736	.1741	0.43	0.670
NUMBER OF SPRAY	.0376003	-8.075686	.01957	1.92	0.055

Number of Observation = 100, probability > Chi^2 = 0.0000, Pseudo R^2 = 0.7498

The data showed in Table: 24 that the percentage change in independent variables due to one-unit change in independent variable.

The variables age and education showing the expected sign but with different relationships, as age high the chances of eye irritation high age has the significant impact on the eye irritation at 10% confidence interval. Education is showing the negative sign, low the education the chances of illness high due to not able to read the instructions about the pesticides the marginal affect shows that if 1% decrease in the education then there will be 6% increase in the chances of illness. The working hours is showing positive relationship with the eye irritation and has significant impact on the eye irritation at 10% confidence interval as high the duration in the field the chances of illness high. The marginal affect shows that if 1% increase in the duration of spray in the field then there will be 8% increase in the chances of illness. The probability of sickness was also sensitive to personal characteristics of the applicators. Smoking has positive relationship with the illness.

The chances of illness were also sensitive to personal characteristics of the applicators. Personal habit like smoking during the application of spray, smoking shows negative relationship with illness, smoking is statistically insignificant. It means that majority of the respondents expressed discomfort when they do not smoke because of their addictiveness to excessive smoking. Hand wash also shows the negative relationship with the illness eye irritation increase due to less hand wash. If there is 1% decrease in the hand wash there will be .06% increase in the chances of illness.

The toxicity level is showing the positive relationship with the illness as with high toxicity level will high the probability of illness due to less precautions. The sprayers mix up these pesticides, having no knowledge about the quantity of mixing the pesticides, so they mix up high dose of these pesticides. In these results the toxicity levels having positive effects on the illness but statistically insignificant impact on the illness. While the marginal effect shows that .01% increase in the chances of illness. However, Precautions result is showing the positive relationship with illness, but those precautions are not good enough for the sprayers that's why the chances of illness remain same in this condition. Number of sprays is showing the positive relationship with the illness, if there is 1% increase in the number of sprays there will be 3% increase in the chances of illness.

Table 25: Regression results for Nose irritation

NOSE IRRITATION	DY/DX	COEF	STD.ERROR	Z	P>|Z|
AGE	.0008909	.0035663	.00542	0.16	0.869
EDUCATION	-.0320668	-.1283699	.03799	-0.84	0.399
WORKING HOURS	.0577832	.2313181	.04728	1.22	0.222
SMOKING	.0165099	.066144	.14729	0.11	0.911
HAND WASH	.1046223	.4211459	.1717	0.61	0.542
TOXIC LEVEL	.0223813	.0895969	.03327	0.67	0.501
PRECAUTIONARY MEASURE	-0483053	-.1933925	.19002	-0.25	0.799
NUMBER OF SPRAY	.0299967	.1200831	.01951	1.54	0.124

Number of Observation = 100, probability > Chi^2 = 0.0009, Pseudo R^2 = 0.4372

The regression results show in the Table: 25 that the age is having the positive relationship with the nose irritation disease, while also having the insignificant impact on it, this relationship shows that if age is high then there are chances of illness increase, but age can be uncertain also.

The regression results show that the education affect the probability of illness, the result shows that the education has insignificant impact on the nose irritation having negative sign with it, less knowledge about the pesticides results the 3% increase in chances of illness, education means ability to read the precautions about the pesticides.

Regression result shows that the working hours having positive relationship with the illness, also having the insignificant impacts on the illness. This means that if the sprayer spends more time in the field the chances of illness will 5% increase.

The probability of illness is very sensitive to the personal characteristics of the sprayers. The result shows that the variable hand wash shows the positive sign, but they are not washed their hands in a proper way or with sanitizer, with positive relationship it is obvious that the chances of illness will 10% increase. The relationship shows statistically insignificant influence on the nose irritation.

Smoking shows the expectedly positive relationship with the nose irritation because sometimes smoking also mix up with pesticides and makes reaction in the lungs of sprayer so during breath nose irritation increases.

The result shows that the toxicity level shows the positive relationship with the nose irritation as with any toxic level will high the chances of illness due to less precautions. In these results the toxicity levels having the statistically insignificant impact on the nose irritation. While the marginal effect shows that 2% increase in the probability of illness.

There are some factors like precautionary measure like gloves, glasses, mask, etc. if the sprayer adopt these precautions the chances of illness will reduce, in this model the Precautionary measure variable shows the negative relation with insignificant results, these results shows that if the sprayer use improper or less precautionary gadgets the probability of illness increase 4% respectively.

Number of spray in peak season has also positive relationship with significant influence on the nose irritation at 1% confidence interval. The result shows the same thing that if there is increase in the number of spray there will be increase of 2% in probability of illness.

Table 26: Regression results for Chest Pain

CHEST PAIN	DY/DX	COEF	STD.ERR	Z	P > I Z I
AGE	-.0049884	-.0485652	.00324	-1.54	0.123
EDUCATION	-.0331755	-.3229845	.02401	-1.38	0.167
WORKING HOURS	.0300153	.292218	.03206	0.94	0.349
SMOKING	-.019896	-.1853146	.09358	-0.21	0.832
HAND WASH	.0084259	.0801359	.09621	0.09	0.930
TOXIC LEVEL	-.0036551	-.0355846	.01784	-0.20	0.838
PRECAUTIONARY MEASURE	-.1934247	-1.296624	.17032	-1.14	0.256
NUMBER OF SPRAY	.0150889	.1468999	.0121	1.25	0.212

Number of Observation = 100, probability > Chi^2 = 0.0059, Pseudo R^2 = 0.2609

The regression results show in the Table: 26 that the variables age and education showing the expected sign, age is showing insignificant relationship, as low the age the chances of chest pain because the inexperienced sprayers being young of age incorrectly mix the pesticides. This inexperience sometimes leads to contracting chest diseases. Education showing the insignificant impact on the chest pain, low the education chances of illness high, because they are unable to read the precautions about the pesticides. This increase the illness 3%.

The working hours showing positive relationship and insignificant impact on the chest pain as high the duration in the field the chances of illness high. The marginal results show that if 1% increase in the working hours there will be 3% increase in the chances of illness. The probability of sickness was also sensitive to personal characteristics of the applicators. Smoking has positive relationship with the chest pain. The marginal affect shows .01% increase in the chest pain. However, smoking was statistically insignificant, but smoking has direct relationship with the chest pain because this pain can be of lungs or stomach, its results are insignificant with positive relationship with illness. Hand wash shows the unexpected negative sign with the chest pain, it increases due to less hand wash. the respondents do not practice sanitary practices such washing hand, as a result they must suffer in form of chest pain infections. The marginal affect shows that the 5% increase in the chest pain.

The toxicity level shows the negative relationship with the illness as with any toxic level will high the probability of illness due to less precautions and sprayer having no knowledge about the quantity of mixing the pesticides, so they mix up high dose of these pesticides. In these results the toxicity levels having negative effects on the illness but statistically insignificant. The marginal affect shows that .03% increase in the illness. However, the rest of variables like precautions and number of spray had shown the expected sign but statically insignificant.

Table 27: Regression results for Skin Redness

SKIN REDNESS	DY/DX	COEF.	STD. ERR	Z	P > I Z I
AGE	-.0015751	-.0111913	.00378	-0.42	0.677
EDUCATION	-.0738289	-.5245778	.029	-2.55	0.011
WORKING HOUR	.0380513	.2703666	.03753	1.01	0.311
SMOKING	-.1638104	-.968308	.14268	-1.15	0.251
HAND WASH	-.0883766	-.7635745	.08101	-1.09	0.275
TOXIC LEVEL	-.0069304	-.0492427	.02231	-0.31	0.756
PRECAUTIONS	-.1110129	-.6681261	.15226	-0.73	0.466
NUMBER OF SPRAY	.0064427	.0457773	.01393	0.46	0.644

Number of Observation = 100, probability > Chi^2 = 0.0070, Pseudo R^2 = 0.3443

The data showed in Table: 27 the percentage change in independent variables due to one-unit change in independent variable.

The variables age and education showing the expected sign, but age is showing insignificant relationship, as it shows that at young age people are not too concerned about the adverse impacts of pesticides on their health. Education is showing the significant impact on the skin redness, low the education means not able to read the instructions about the pesticides, so the chances of illness increase, the results shows that if 1% decrease in education then there will be 7% increase in the skin redness.

The working hours showing positive relationship with skin redness it means that when high the crop area the working hours also high, so the chances of illness increase the results is showing that if 1% increase in the working hours then there will be 3% increase in the chances of skin redness, having the significant impact on the skin redness. Hand wash shows the negative relationship with the skin redness but statistically insignificant impact on the skin redness. The result is showing that if there is 1% decrease in the hand wash by the sprayer then there will be 8% increase in the chances skin redness.

The toxicity level is showing the negative relationship with the illness as with high toxicity level will high the probability of illness due to less precautions. The sprayer mixes up these pesticides with each other which basically standardized but sprayers having no knowledge about the quantity of mixing the pesticides, so they mix up high dose of these pesticides. In these results the toxicity levels show the unexpected sign with the illness but statistically insignificant impact on the illness because with any toxic level the chances of illness remain same due to less proper precautions. However, the rest of variables like precautions and number of spray have shown the expected sign but statically insignificant. Precautions result is showing that if there is 1% decrease in the precautionary behavior there will be 11% increase in the chances of illness. Number of sprays is showing the positive relationship with the illness, if there is 1% increase in the number of sprays there will be .06% increase in the chances of illness.

Table 28: Regression results for Skin Allergy

SKIN ALLERGY	DY/DX	COEF	STD.ERR	Z	P > I Z I
AGE	-.0003424	-.0026754	.00346	-0.010	0.921
EDUCATION	-.0739663	-.2582905	.02834	-2.61	0.009
WORKING HOURS	.0494359	.3224459	.03812	1.30	0.195
SMOKING	.0526509	.7817913	.11621	-0.45	0.650
HAND WASH	-.0485088	.8704221	.08845	-0.55	0.583
TOXIC LEVEL	.0000942	.1600143	.02047	0.00	0.996
PRECAUTIONARY MEASURE	-.1571286	.7942967	.16071	-0.98	0.328
NUMBER OF SPRAY	.0100734	.1061681	.01349	0.75	0.455

Number of Observation = 100, probability > Chi^2 = 0.00, Pseudo R^2 = 0.5848

The regression results show in the Table: 28 that the age is having the negative relationship with the probability of skin allergy, also having the insignificant relationship with it, this relationship shows that a small age farmer having greater chances of getting ill, but this disease can be uncertain against hazardous fumes of pesticides.

Some factors like education and working hours affect the probability of illness, as result shows that the education has significant impact on the probability of skin allergy at 1% confidence interval, having negative sign with the probability of illness, education means that the ability of read the instruction that are written on the pesticide bottles. Less knowledge about the pesticides results the increase in chances of illness, education shows negative sign.

Working hours also affect the probability of illness. It has positive relationship with illness, it means that when sprayer spends more time in the field the chances of illness will increase. So, the regression results show that working hours or duration of time in the field has significant impact at the 1% confidence interval.

The probability of illness is very sensitive to the personal characteristics of the sprayers. Hand wash shows that negative sign which is expected that decrease in the hand wash the probability of illness will increase. As marginal effects show that the hand wash 4% increase in the probability of illness but statistically insignificant.

The results show that the smoking has the positive relationship with the illness, also having the insignificant impact on the illness, it means that if there is one percent increase in the smoking then here will be a 11 % chance of increase in illness.

The regression results show that the toxicity level shows the positive relationship with the illness. In the study area all toxicity levels are dangerous due to less precautions. After that they also mix up these pesticides, which basically standardized but sprayer having no knowledge about the quantity of mixing the pesticides, so they mix up high dose of these pesticides. The regression result shows statistically insignificant impact on skin allergy.

The regression results show the positive relationship with the skin allergy but statistically insignificant impact. When number of sprays increases in the peak season the chances of illness also increases, so they have positive relationship with each other's.

Section 4: Health cost of illness of Tehsil Bhawana

Table 29: Descriptive statistics of health cost:

VARIABLE	OBS	MEAN	STD. DEV	MIN	MAX
LOSS OF WORKING HOURS	100	14.24333	14.79352	0	48
COST OF LOSS OF HOURS	100	525.48	442.2547	0	1700
DR. FEE	100	7.186667	21.62908	0	100
MEDICINAL EXPENDITURE	100	195.9667	185.3726	0	700
TRAVELLING EXPENDITURE	100	52.93333	61.62832	0	200

4.4. Wage structure:

For pesticides applicators the reason for accepting this risky type of work reason was wage Structure, but sometimes their house hold size is high that's why to fulfill their family needs they adopt this profession. It was observed in the field area that in a village there is only one or two sprayers existed, not every agriculture worker is a pesticide worker. The pesticides worker received higher wage than a normal agriculture worker. The average wage of the spray workers were almost 800 rupees per day, in which agriculture labors received 500 rupees per day. The works taken by spray applicators are comparatively skilled work as compared to non-pesticides labors. The minimum wage of the sprayers is 550 and maximum wage of the pesticides applicators is 1000 rupees per day respectively depending on their experience.

Table 30: Regression analysis of health cost

TOTAL HEALTH EXPENDITURE	COEF	STD.ERR	T	P > I Z I
CHEST PAIN	399.4248	140.9083	2.83	0.006
AGE	2.775802	5.072976	0.55	0.586
EDUCATION	-79.26219	36.10514	-2.20	0.031
WORKING HOURS	141.4146	42.91274	3.30	0.001
SMOKING	32.51401	136.0334	0.24	0.812
MEAL	142.7441	180.0391	0.79	0.430
HAND WASH	-.8822588	163.6714	-0.01	0.996
TOXIC LEVEL	25,78286	30.8532	0.84	0.406
PRECAUTIONARY MEASURE	-22.30865	178.8396	-0.12	0.901
NUMBER OF SPRAY	32.75913	17.83711	1.84	0.070

Number of Observations: 100, Probability > F = 0.000, R2 = 0.4183

The regression results show in the Table: 30 that the chest pain showing the significant relationship because chest pain is the disease which take the sprayer to the hospital and in hospital the treatment can be expensive. This cost increases the health cost approximately 400 rupees respectively. The health cost was also sensitive to personal characteristics of applicators. Such as age in these results showing the positive relationship as high the age chances of chest pain increase, then the health cost increase. Education is showing the negative sign as low the education will result the chances of illness increase due to less knowledge about pesticides that will increase in the health cost. Education having the significant impacts on the disease at 1% confidence interval this increases the health cost 79 rupees respectively. While the working hours showing the positive sign with significant relationship. This increases the health cost 141 rupees respectively

Smoking shows the positive relationship with health cost, with insignificant relationship. The results show that if smoking increase the health cost increase 32 rupees respectively.

The regression result shows that the toxicity level is showing the expected positive sign with the insignificant relationship, because when the toxicity level is high the chances of illness is high the health cost will be high. This increase in the health cost 25 rupees.

The rest of the variables like precautions and number of spray are showing the expected sign with insignificant influence, if there is less precaution the cost will increase 22 rupees. The number of spray shows the positive relationship with the disease because if number of sprays increase the chances of illness increase then the health cost also affects. This increase in the health cost 32 rupees.

Table 31: Regression results for health cost

TOTAL EXPENDITURE	COEF	STD.ERR	T	P > I Z I
SKIN BURN	404.3829	135.3284	2.99	0.004
AGE	-.2105528	4.985978	-0.04	0.966
EDUCATION	-87.17402	35.73829	-2.44	0.017
WORKING HOURS	125.1731	43.35109	2.89	0.005
SMOKING	76.19428	136.2532	0.56	0.577
HAND WASH	3.726855	162.8943	0.02	0.982
TOXIC LEVEL	8.939327	31.24433	0.29	0.775
PRECAUTIONARY MEASURE	-71.58178	175.9324	-0.41	0.684
NUMBER OF SPRAY	28.69224	17.94618	1.60	0.113

Number of Observations: 100, Probability > F = 0.000, R2 = 0.4419

The regression results show in the Table: 31 that the disease skin burn having the significant impacts on health cost because it is the big disease sprayer cannot treat this disease with themselves, so this disease can also be a reason of increase in health cost. This increase in the health cost approximately 400 rupees respectively. The age in these results showing the negative as low the age chances of illness increase due to less experience, so the health cost 21 rupees increase, education is showing the negative sign relationship with the disease low the education will result the chances of illness increase so health cost increase. Education having the significant impact on the disease at 1% confidence interval. This increases the health cost approximately 90 rupees. The working hours is showing the positive relationship with significant impact on the Skin Burn, this increases the health cost 125 rupees.

Hand wash is showing the unexpected positive sign because the sprayer is not washed hand with sanitizer or properly, so the chances of illness remain same in this condition. Smoking shows the positive relationship with health cost, with insignificant relationship.

The regression result shows that the toxicity level is showing the negative relationship with the insignificant impact, because any toxic chemical is harm for the skin, so the chances of illness present in any condition.

The rest of the variables like precautions and number of spray are showing the expected sign with insignificant influence on the Skin burn. The number of spray shows the positive relationship with the disease because if number of sprays increase the chances of illness increase then the health cost increases 28 rupees.

Table 32: Regression results for health cost

TOTAL EXPENDITURE	COEF	STD.ERR	T	P > LZL
RESPIRATORY DISCOMFORT	361.7384	122.1335	2.96	0.004
AGE	.0655507	4.986969	0.01	0.990
EDUCATION	-69.37264	36.45459	-1.90	0.060
WORKING HOURS	123.6562	43.49351	2.84	0.006
SMOKING	-13.20251	136.3244	-0.10	0.923
MEAL	133.5163	179.3637	0.74	0.459
HAND WASH	-14.79296	163.1916	-0.09	0.928
TOXIC LEVEL	20.46364	30.79462	0.66	0.508
PRECAUTIONARY MEASURE	-162.43	175.6746	-0.92	0.358
NUMBER OF SPRAY	30.32023	17.87089	1.70	0.093

Number of Observations: 100, Probability > F = 0.000, R2 = 0.4271

The regression result shows in the Table: 32 that if there is an increase in the respiratory disease the health cost will increase approximately 226 rupees. This variable has a great significant impact on health cost, with that results illness shows the expected positive sign.

The health cost was also sensitive to personal characteristics of applicators. Such as age in these results is showing the positive relationship with the respiratory disease, it means that high the age the chances of illness increase. Education is showing the negative relationship with significant impact on the respiratory disease, as low the education will result the chances of illness increase so health cost increase, the result shows the 70 rupees increase in the health cost. Education having the significant impact with the disease at 10% confidence interval. While the working hours showing the positive sign with significant relationship at the 1% confidence interval. This increases the health cost 123 rupees respectively.

Personal habit such as taking meal during the application of spray caused 133 rupees increase in total health cost. Hand wash is showing the expected negative sign because the sprayer is not washed hand with sanitizer or properly, so the chances of illness remain same in this condition. Smoking also shows the positive relationship with health cost. This increase the health cost 13 rupees respectively.

The regression result shows that the toxicity level is showing the negative sign with the insignificant impact, because with any toxicity level the chances of illness increase due to less precautions.

The rest of the variables like precautions and number of spray are showing the expected sign with insignificant influence, precautions increases the 162 rupees in health cost. While number of spray shows the positive sign and sign which means health cost increase.

Table 33: Regression results for health cost

TOTAL EXPENDITURE	COEF	STD.ERR	T	P > I Z I
SKIN REDNESS	153.2717	131.247	1.17	0.246
AGE	.6197372	5.190743	0.12	0.905
EDUCATION	-80.79353	38.11952	-2.12	0.037
WORKING HOURS	144.5841	44.53719	3.25	0.002
SMOKING	49.55842	141.9313	0.35	0.728
MEAL	121.7414	187.3017	0.65	0.517
HAND WASH	23.05533	170.1846	0.14	0.893
TOXIC LEVEL	26.81796	31.98938	0.84	-.404
PRECAUTIONARY MEASURE	-98.47374	182.8227	-0.54	0.592
NUMBER OF SPRAY	37.86503	18.37715	2.06	0.042

Number of Observations: 100, Probability > F = 0.000, R2 = 0.3824

The regression results show in the Table: 33 that the disease having insignificant influence because according to sprayers it's not a big disease, so they don't want to go to hospital, but this can be a reason of increase in health cost. This increases the health cost 153 rupees. The health cost was also sensitive to personal characteristics of applicators. Such as age in these results showing the positive relationship as high the age chances of skin redness increase so health cost increase, but this ca be uncertain at the age because pesticides are harm for every age group, education is showing the negative sign as low the education will result the chances of illness increase so health cost increase. Education having the significant influence with disease at 1% confidence interval. This increase the health cost 80 rupees. While the working hours showing the positive relationship with significant impact on the Skin Redness. This increase in the health cost 144 rupees respectively.

Hand wash is showing the unexpected positive relationship with the Skin Burn because the sprayer is not washed hand with sanitizer or properly, so the chances of illness remain same in this condition. Smoking also shows the positive relationship with health cost, with insignificant relationship. This increases the health cost 49 rupees.

The rest of the variables like precautions and number of spray are showing the expected sign with insignificant influence on the Skin redness. This increase the health cot 94 rupees respectively. The number of spray shows the positive relationship with the disease because if number of sprays increase the chances of illness increase then the health cost increases 37 rupees.

Table 34: Regression results for health cost

TOTAL EXPENDITURE	COEF	STD. ERROR	T	P > I Z I
SKIN ALLERGY	60.88326	133.7104	0.46	0.650
AGE	.4171534	5.22187	0.08	0.937
EDUCATION	-86.72333	38.35312	-2.26	0.026
WORKING HOURS	146.7504	44.86745	3.27	0.002
SMOKING	32.31385	141.9793	0.23	0.820
MEAL	140.1471	187.8556	0.75	0.458
HAND WASH	10.96981	170.9498	0.06	0.949
TOXIC LEVEL	25.83595	32.19919	0.80	0.424
PRECAUTIONARY MEASURE	-104.3859	185.4518	-0.56	0.575
NUMBER OF SPRAY	38.01258	18.53971	2.05	0.043

Number of Observations: 100, Probability > F = 0.000, R2 = 0.3725

The regression result shows in the Table: 34 that if there is an increase in the Skin allergy the health cost will increase approximately 60 rupees. This variable has a great significant impact on health cost, with that results illness shows the expected positive sign, just as the discomfort rate increases the type of treatment will also increases then the sprayer must go to the doctor that way the health cost will increases. In addition to it.

The health cost was also sensitive to personal characteristics of applicators. Personal habit such

as having meal during the application of spray caused 140 rupees increase in health cost the results also shows the positive sign with the health cost because when the sprayer having meal during the application of spray then also the chances of illness increases so these chances of illness affect the health cost.

Education shows the significant Impact on the health cost at the level is on 1% confidence interval. The result shows that if one-unit decrease in education there is 86 rupees increase in the health cost.

Similarly, the study shows the results of working hour's significant impact on health cost at the 5% confidence interval, also having positive relationship with the health cost, as increase in the working hours there will be increase in the chances of illness, so the health cost also increases. The result shows that 146 rupees increase in the health cost.

The results show that the smoking has the insignificant impact on the skin allergy but has positive relationship with the skin allergy. Smoking increase the chances of illness increase then health cost automatically increases. The result shows that if the sprayer is smoking health cost increase 32 rupees respectively.

Less proper precautions result to an increase in the chances of illness. So, the result shows the significant impact on the health cost with the negative sign relationship it means that if the sprayer adopts less precautions the chances of illness increase which increase the health cost 104 rupees.

Number of sprays per month shows the significant impacts on the health cost at the 5 % confidence interval, With the expected positive sign. If the number of sprays in the peak season increases the chances of illness increases it will result the 38 rupees increase in the health cost.

COMAPRATIVE ANALYSIS OF BOTH TEHSILS: MIAN CHANNU AND BHUWAN:

Table: 35 Regression Results for Comparison

VARIABLES	Nose Irritation	Head Ache	Skin Redness	Skin Burn	Skin Allergy	Chest Pain
Age	-0.00275	0.00535	-0.0139	0.000701	0.00109	-0.0433**
	(0.0137)	(0.0138)	(0.0164)	(0.0170)	(0.0148)	(0.0200)
Working Hours	0.184	0.0282	0.362*	0.485**	0.251*	0.355
	(0.120)	(0.125)	(0.186)	(0.198)	(0.144)	(0.217)
Education	-0.148	-0.0874	-0.450***	-0.216	-0.232**	-0.240
	(0.0997)	(0.104)	(0.144)	(0.138)	(0.115)	(0.157)
Smoking	0.211	0.245	0.784*	-0.157	0.696*	0.118
	(0.358)	(0.357)	(0.412)	(0.433)	(0.371)	(0.508)
Hand wash	-0.376	0.0672	-0.391	-0.356	-0.0758	-0.208
	(0.409)	(0.415)	(0.480)	(0.451)	(0.425)	(0.513)
Toxicity Level	0.180**	-0.142*	-0.0886	0.00309	0.106	0.0148
	(0.0834)	(0.0841)	(0.0977)	(0.0982)	(0.0892)	(0.111)
Precautionary Measure	-0.0388	-0.447	-0.359	-0.415	-0.388	-1.297**
	(0.493)	(0.464)	(0.505)	(0.510)	(0.475)	(0.536)
Number of Spray	0.150***	0.0453	0.0900	0.103	0.0305	0.172**
	(0.0503)	(0.0493)	(0.0611)	(0.0629)	(0.0527)	(0.0756)
Department	-0.0569	-0.105	-0.0150	-0.0519	-0.672**	-0.197
	(0.277)	(0.282)	(0.331)	(0.338)	(0.298)	(0.381)
Constant	-4.450***	-0.655	-3.276	-6.260***	-1.444	-4.201*
	(1.676)	(1.657)	(2.142)	(2.328)	(1.803)	(2.548)
Observations	250	250	250	250	250	250

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The comparison of both tehsils that is Mian Channu and Bhuwana is conducted in which tehsil Mian Channu was assigned a binary numbers 1 where the PEST Control Department is functional and tehsil Bhuwana number 0 where the department is absent. For comparison purposes a regression was run through logit model using the same variables taken previously except the "Department" variable. The regression results table:35 show that no major difference was observed in the terms of the activity of Pest warning and quality control department. Apart from skin allergy disease which shows significant results for tehsil Mian Channu, all other diseases show insignificant results for the said tehsil. The significant factor in the case of skin allergy can be attributed to broader industrial activities in the area. The industrial waste in the form of smog, liquid effluents released into the water channels and improper disposal of solid waste can be possible determinants of causing skin allergy. Therefore, the entire blame cannot be put on the activities of the sprayers and inefficient functioning of the Pest Control Department. The establishment of the department is new in Tehsil Mian Channu. Due to the incessant nature of the department, its functions and operations are not wide ranging. As a result, its role in mitigating the hazardous effects of pesticide will take some time to be observed in the future. Thus, in the present moment the non-effectiveness of the departments role is because of it being a newly established entity.

Chapter: 5 conclusion and policy recommendation

5.1. Conclusion:

The total population of Tehsil Mian Channu is 761971 and Tehsil Bhawana is 65000 was reported (according to 2017 Census), only male workers are engaged in the spray and field work in both the Tehsils. The average working hours of the farmers in the tehsil Mian channu are 7.74 and tehsil Bhawana are 7.65 per day in a peak season. The study showed that more exposure to pesticides have increased health impairment and it also increased in the health cost. The estimated average health cost of the applicator of Mian Channu was Rs 800 per season and Tehsil Bhawana is Rs 760. Where, the average estimated loss of working hours of tehsil Mian Channu are 14.23 and Tehsil Bhawana are 13.41, and the cost of the loss of working hours that are bore by the sprayer indirectly of Tehsil Mian Channu is Rs. 529 and Tehsil Bhawana cost is Rs. 500. Mostly, these costs resulted from using highly toxic pesticides or mixing the pesticides with each other's and use of banned pesticides whether they are low toxic or high toxic. The applicators were not aware about the scientific use of toxic chemicals as well as its consequences. The exposure to toxic chemicals is common practice in the agriculture workers of the study area. Applicators select hazardous chemicals and used that chemical more than recommended quantity. In handling the pesticides, the pesticides were mixed and sprayed in traditional way and no any scientific tools were used in the field. In averting behavior, the use of protective gears in both tehsils was completely inappropriate they are not used properly in the field, while in many cases the protection measures were neglected, it was seen in the field that the farmers are not using any precaution to save their selves by the pesticides. Thus, these kinds of behaviors resulted in serious health issue. However, these precautionary measures were often neglected due to poverty and lack of awareness and education. This study discovered that the individual's probability of getting sick depend on toxicity and dose of the pesticides after spray. It also finds that health cost can be decreased by reducing the quantity of toxic chemicals or replaced by safe chemicals and with the usage of recommended precautions.

5.2. Policy Recommendation

1. Govt should help the sprayer financially, increase in the work affect the sprayers health so some incentives should be provided to the sprayers.
2. The high toxic pesticides are cheaper in price compared to mild toxic pesticides. As a result, sprayers tend to buy high toxic pesticides making them useful through mixing them with water or any other chemical. Resultantly, the exposure to high toxic fumes adversely affects the health of sprayers. It should be government policy to either ban the high toxic pesticides to levy taxes on them making them more expensive than the mild-toxic pesticides. The tax should be charged according to the level of toxicity so that more toxic pesticide must be more expensive to buy, thereby discouraging its purchase. The revenue that is generated from tax should be spent on monitoring cost and promote alternative activities or methods.
3. As proven from this study, people who do not have any or adequate information about pesticides and their composition, normally do guess work in their spraying activity. Therefore, inadequate knowledge coupled with unprotective handling of pesticides do more damage than benefit to people. Thus, imparting of knowledge and awareness is a necessity to educate people regrading proper handling of pesticides. With this view, awareness programs in local languages should be launched along with establishment of PEST Control Departments that will oversee and monitor the activity of the sprayers in the field.
4. Media can play an important role to motivate consumers for safe products. The consumers can bring the attention of suppliers for safe crops practices. This could have done through different awareness programs. awareness creation and provide protective tools to farm workers by the private fertilizers and pesticide companies.

REFERENCES

Alanvanja, M. C., Hoppin, J. A., & Kamel, F. (2004). HEALTH EFFECTS OF CHRONIC PESTICIDE EXPOSURE: CANCER AND NEUROTOXICITY. *Annual Review Public Health*, 97-155.

Andersson, H., Tago, D., & Treich, N. (2014). Pesticides and health: A review of evidence onhealth effects, valuation of risks, benefit-cost analysis. *Advances in Health Economics and Health Services Research*, 95-203.

Antle, M., & Pingali, P. (1994) . pesticide productivity and farmer health: Aphilippine case study. *american journal of agriculture economics*, 418-430

Atreya, K. (2007). Pesticide Use in Nepal: Understanding Health Costs from Short-term Exposure. *The South Asian Network for Development and Environmental Economics*, 1-33.

Atreya, K. (2007). Pesticide use knowledge and practices: A gender differences in Nepal. *Elsevier*, 305-311.

Atreya, K. (2007). Pesticide use knowledge and practices: A gender differences in Nepal. *Elsevier*.

Atreya, K. (2008). Health costs from short-term exposure to pesticides in Nepal. *Elsevier*, 511-519.

Atreya, K. (2013). *Pesticide use in Nepal: Health effects and economic costs for farmers in the central mid-hills.* Noragic: Norwegian University Of Life Sciences.

Atreya, K., Johnsen, F. H., & Sitaula, B. K. (2011). Health and environmental costs of pesticide use in vegatable farming in Nepal. *Springer*, 477-493.

Binswange, H., & Townsend, R. (2000). The growth performance of agriculture in Subsaharan Africa. *Americon Journal of agriculture Economics* , 1075-1086.

Chitra, G. A., Muraleedharan, V. R., Swaninathan, T., & Veeraraghavan, D. (2006). Use of Pesticides and Its Impact on Health of Farmers in South India. *International journal of Occupational and Environmental Health*, 228-233.

Cole, D. C., Sherwood, S., Crissman, C., Barrera, V., & Espinosa, P. (2002). Pesticides and Health in Highland Ecuadorian Potato Production: Assessig Impacts and Developing Responses. *International Jouranl of Occupational and Environmental Health*, 182-190.

Dey, K. R., Choudhury, P., & Dutta, B. K. (2013). Impact of pesticide use on the health of farmers: A study in Barak valley, Assam (India). *Journal of Environmental Chemistry and Ecotoxicology*, 269-277.

Devi, I. (2007). pesticide use in the rice bowl of kerla: health cost and policy options. *sandee* .

District Pre-Investment Study - 2012

Dung, N. H., & Dung, T. T. (1999). *"Economic and Health Consequences of Pesticide Use in Paddy Production in the Mekong Delta, Vietnam.* Economy and Environment Program for Southeast Asia .

Evenson, R., & Gollin, D. (2003). crop genetic improvement in developing countries. Overview and summary, crop Variety improvment and its effect on productivity ,the impactof international agriculture research. *CABI Publishing, Wallingford, uk* , 7-38.

Forget, G. (1990). Balancing the need for pesticides with the risk to human health. *Proceedings of a Symposium* (pp. 2-16). Ottawa: Health Sciences Division, International Development Research Centre, Ottawa, Ontario, Canada.

Khan, M. (2010). Using the health belief model to understand pesticide use decisions. *The Pakistan Development Review* , 941-956.

Khan, D. A., Shabbir, S., Majid, M., Naqvi, T. A., & Khan, F. A. (2010). Risk assessment of pesticide exposure on health of Pakistani tobacco farmers. *Journal Of Exposure Science and Environmental Epidemiology*, 196-204.

Khan, M. (2009). Economic Evaluation of Health Cost of Pesticide Use: Willingness to Pay method. *The Pakistan Development Review*, 459-472.

Khan, M. (2009). Economic Evaluation of Health Cost of Pesticide Use: WILLINGNESS TO PAY METHOD. *The Pakistan Development Review*, 459-470.

Khan, M. A., Iqbal, M., Ahmad, I., & Soomro, M. H. (2002). Economic Evaluation of Pesticide Use Externalities in the Cotton Zones of Punjab, Pakistan. *The Pakistan Developmet Review*, 683-698.

Khan, M., & Damalas, C. A. (2015). Farmers' willingness to pay for less health risks by pesticide use: A case study from the cotton belt of Punjab, Pakistan. *Elsevier*, 297-303.

Economic Survey of Pakistan 2010–11. Ministry of Finance, Government of Pakistan. http://www.fi nance.gov.pk/survey_1112.html

Khan HAA, Akram W, Shehzad K, Shaalan EA (2011) First report of fi eld evolved resistance to agrochemicals in dengue mosquito, Aedesalbopictus (Diptera: Culicidae), from Pakista.
Parasit Vectors 4:146

Khooharo, A. A., Memon, R. A., & Mallah, M. U. (2008). AN EMPIRICAL ANALYSIS OF PESTICIDE MARKETING IN PAKISTAN. *Pakistan Economic and Social Review*, 57-74.

Maumbe, B. M., & Swinton, S. M. (2003). Hidden health costs of pesticide use in Zimbabwe's smallholder cotton growers. *Social Science and Medicine, Elsevier*, 1559-1571.

Nguyen, H. D., & Tran, T. T. (1999). *Economic and Health Consequences of Pesticide Use in peddy producrion in the Mekong Delta, Vietnam.* EEPSEA RESEARCH REPORT SERIES.

Pingali, P., & Antle, J. (1994). Pesticides, productivity, and farmer health: A Philippine case study. *American journal of agriculture Economics* , 418-430.

Pimentel, D. (2005). ENVIRONMENTAL AND ECONOMIC COSTS OF THE APPLICATION OF PESTICIDES PRIMARILY IN THE UNITED STATES. *Springer*, 229-252.

Pimentel, D., Acquay, H., Biltonen, M., Rice, P., Silva, M., Nelson, J., . . . D'Amore, M. (1992). Environmental and Economic Costs of Pesticide Use. *Oxford Journals*, 750-760.

Pimentel, D., McLaughlin, L., Zepp, A., Lakitan, B., Kraus, T., Kleinman, P., . . . Selig, G. (1993). Environmental and economic effects of reducing pesticide use in agriculture. *Elsevier*, 273-288.

Pingali, P. L., Marquez, C. B., & Palis, F. G. (1994). Pesticides and Philippine Rice Farmer Health: A Medical and Economic Analysis. *Oxford Journals*, 587-592.

Pretty, J. (2008). Agricultural sustainability: concepts, principles and evidence. *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, *363*(1491), 447-465.

Prabhu, L. P., Cynthia, B. M., & Florencia, G. P. (1994). Pesticides and Philippine Rice Farmer Health: A Medical and Economic Analysis. *OXFORD JOURNALS* , 1-7.

Peshin, R., Bandral, R. S., Zhang, W., Wilson, L., & Dhawan, A. K. (2009). Integrated pest management: a global overview of history, programs and adoption. In *Integrated pest management: innovation-development process* (pp. 1-49). Springer Netherlands.

Rajendran, D. S. (2003). ENVIRONMENT AND HEALTH ASPECTS OF PESTICIDES USE IN INDIAN AGRICULTURE. *Proceedings of the Third International Conference on Environment and Health, Chennai, India* (pp. 353-373). Chennai, India: Department of Geography, University of Madras and Faculty of Environmental Studies, York University.

Richter, E. D. (2002). Acute human pesticide poisonings. *Encyclopedia of pest management*, 3-6.

Raschke, A., & Burger, A. (1997).). Risk assessment as a management tool used to assess the effect of pesticide use in an irrigation system, situated in a semi-desert region. *Archives of enviornmental contamination and toxicology* , 42-49.

Sabir HM, Tahir SH, Khan MB (2011) BT Cotton and its impact on cropping pattern in Punjab. PJSS 31:127–134

Shiekh, S., Nizamani, S. M., Jamali, A. A., & Kumbhar, M. I. (2011). Pesticides and Associated Impact on Human Health: A Case of Small Farmers in Southern Sindh, Pakistan. *Journal Of Pharmacy and Nutirition Sciences*, 82-86.

Shahid, M., Ahmed, A., Khalid, S., Siddique, H., Saeed, M., & Ashraf, M. (2016). Pesticides Pollution in Agricultural Soils. *Springer International Publishing Switzerland* , 199-223.

Tehsils & Unions in the District of Khanewal - Government of Pakistan Archived 2011-08-07

World Health Organization. (2006). *The world health report 2006: working together for health*. World Health Organization.

Wilson, C., & Tisdell, C. (2001). Why farmers continue to use pesticides despite environmental, health and sustainability costs. *Elsevier*, 449-462.

Wilson, C. (2005). Exposure to pesticides, ill-health and averting behaviour: costs and determining the the relationships. *international journal of Social Economics* , 1020-1034.

Enviornmental impact Aseessment for socio-Economic Analysis of chemicals:. brussels: issn (2011)

Nguyen, H. D., & Tran, T. T. (1999). *Economic and Health Consequences of Pesticide Use in peddy producrion in the Mekong Delta, Vietnam.* EEPSEA RESEARCH REPORT SERIES.

Prabhu, L. P., Cynthia, B. M., & Florencia, G. P. (1994). Pesticides and Philippine Rice Farmer Health: A Medical and Economic Analysis. *OXFORD JOURNALS* , 1-7.

Appendix I

Serial No. _____.

Date: _____.

Survey Questionnaire

I am M Phil Research student department of Environmental Economics at Pakistan Institute of Development Economics (PIDE) Islamabad. Mainly my focus is to **"Assessing the Health Impacts of Pesticide Use in Cotton Crop- A Case Study of Tehsil Mian Channu and Tehsil Bhawna".** This is the part of my M.Phil. thesis and this information will be very helpful to me. I request you to kindly respond to the questionnaire.

I would like to assure you that the information given by you will be kept strictly confidential and will be used for research purpose only.

I am hopeful to receive your co-operation

Muhammad Ans Sadiq

Section I:
Personal Information

Name: _____. Gender: _____. Age: _____ House hold Size: _____.

Education Completed Years: _____. Daily wage: _____.

Marital Status

a. Married b. Divorced c. Single

Address: _____.

Section II:
Working habits

2. For how many hours do you work in the field?

S. No	Seasons	Hours
1	In the peak season	
2	In off Season	

(**Note: Data collection time is peak season)**

3. Do you smoke? a. Yes. b. No.

4. If yes, how many cigarettes do you smoke daily? _____

5. Do you smoke while spraying? a. Yes. b. No.

6. If yes, how many cigarettes do you smoke while spraying in the field? _____

7. Do you eat meal after spraying in the field? a. Yes. b. No.

8. Do you wash your hands with a sanitizer when consuming? a. Yes. b. No.

9. What amount of water mixed with pesticide (liter)? _____.

10. What is the method of mixing pesticides in water?

    i. hand mixing

    ii. equipment uses

11. What is the duration of spraying in the field (hrs.)? _____.

Section III
Use of Pesticide

12. Total area covering the crop (Acres). _____.

13. What types cotton is mostly cultivated in the area? _____.

14. Which cotton type requires extensive use of pesticides? _____.

15. Sprayer status

Owner	
Hired	

16. Describe the level of pesticides you use:

S. No	Pesticides Type	Response	Cost (Rs.)
1	Low Toxic		
2	Mild Toxic		
3	High Toxic		
4	Low mild		
5	Low high		
6	Mild high		

17. Who purchases the pesticides?

    a. Owner of the field b. Hired sprayers c. Others

18. Source of purchase:

a. Licensed Dealer
b. Private
c. other

Section V:
Precautionary Behavior

19 Do you use any precaution? a. Yes b. No

20. What type of safety measure you followed while spraying?

S. No	Safety Measure	Yes	No	If Yes (Cost)
1	Gloves			
2	Glasses			
3	Mask			
4	Dress			
5	Any other			
6	Any other			

21. Number of spray in a peak season _____?

22. Source of equipment:

a. Self-purchase b. Company provided

Section VI

Health Affect

23. Do you feel any discomfort when spraying? a. Yes. b. No.

24. If yes, what type of discomfort do you experience?

S. No	Discomfort
1	Unnecessary sweating
2	Headache
3	Eye Irritation
4	Nose Irritation

5	Skin redness
6	Skin burn
7	Skin allergy
8	Chest pain
9	Others….

25. For how much time does the identified discomfort is experienced: _____.

26. Do you get any treatment? a. Yes. b. No.

27. If yes, what type of treatment?

    a. Self-treatment
    b. Hakeem
    c. Hospital

Section VII:

Health costs incurred

28. (for hospital treatment) doctor fee paid? Rs. _____.
29. Medicinal expenditures Rs. _____.
30. Lab test expenditures Rs. _____.
31. Travelling expenses Rs. _____.
32. Distance to doctor/Hospital? km._____.
33. Loss of working hours multiplied with average wage: hrs. _____.
34. Total expenditures on health (monthly) Rs. _____.

Section VIII

Farmer's Knowledge

35. Are you aware of spraying methods? a. Yes. b. No.
36. (if yes) What is the source of learning this method: _____.
37. Are you aware of the harms posed by pesticide use? a. Yes. b. No.
38. Do companies provide you information and training to effectively handle pesticides
    a. Yes. b. No.
39. Do you know that pesticide spraying affects your health and of those working in the field? a. Yes. b. No.

Appendix: II

Frequency Table and cross tabs of Tehsil Mian Channu:

Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	68	45.3	45.3	45.3
	1	17	11.3	11.3	56.7
	2	19	12.7	12.7	69.3
	3	20	13.3	13.3	82.7
	4	15	10.0	10.0	92.7
	5	11	7.3	7.3	100.0
	Total	150	100.0	100.0	

Majority of the respondents are illiterate having no year of formal schooling, secondly only 20 respondents have 3 years of education, while only 11 respondents have 5 year of education which is the maximum record.

Working Hours

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4	5	3.3	3.3	3.3
	5	12	8.0	8.0	11.3
	6	17	11.3	11.3	22.7
	7	6	4.0	4.0	26.7
	8	52	34.7	34.7	61.3
	9	58	38.7	38.7	100.0
	Total	150	100.0	100.0	

Minimum number of hours recorded are 4 hours, and the maximum hours that are 9 hours constituting 38.7% of total sample. Secondly 52 respondents making up 34.7% of total sample, work 8 hours. Only 6 respondents said that they work 7 hours and only 5 respondents said that they work 4 hours.

Smoking					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	28	18.7	18.7	18.7
	1	122	81.3	81.3	100.0
	Total	150	100.0	100.0	

Majority of the respondents that 122 out of total sample responded yes claiming the smoke regularly during the field activity. They make up 81.3% of total sample while the remaining who do not smoke make up 18.7% of total sample.

Meal During Spray					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	14	9.3	9.3	9.3
	1	136	90.7	90.7	100.0
	Total	150	100.0	100.0	

Majority of the workers spend much of the time in the field as evident from frequency table which shows that 136 respondents consume their meal while being in the field. Only 14 respondents said that they do not consume meal in the field.

Hand wash					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	129	86.0	86.0	86.0
	1	21	14.0	14.0	100.0
	Total	150	100.0	100.0	

Only 14% of respondents that is 21 out of total sample wash hand before consuming meal. Majority of the respondents that is 129 do not wash their hands before consuming the meal.

Toxicity level					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	38	25.3	25.3	25.3
	2	29	19.3	19.3	44.7
	3	11	7.3	7.3	52.0
	4	33	22.0	22.0	74.0
	5	20	13.3	13.3	87.3
	6	19	12.7	12.7	100.0
	Total	150	100.0	100.0	

Precautionary Measure					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	13	8.7	8.7	8.7
	1	137	91.3	91.3	100.0
	Total	150	100.0	100.0	

Majority of the respondents do take any kind of available precautionary measures, that is 91.3% of total sample. Only 13 respondents said that they do not take precautions of any kind.

Number of spray					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	10	8	5.3	5.3	5.3
	11	2	1.3	1.3	6.7
	12	6	4.0	4.0	10.7
	13	7	4.7	4.7	15.3
	14	10	6.7	6.7	22.0
	15	18	12.0	12.0	34.0
	16	14	9.3	9.3	43.3
	17	16	10.7	10.7	54.0
	18	30	20.0	20.0	74.0
	19	16	10.7	10.7	84.7
	20	15	10.0	10.0	94.7
	21	5	3.3	3.3	98.0
	22	2	1.3	1.3	99.3
	24	1	.7	.7	100.0
	Total	150	100.0	100.0	

In peak season the number of sprays range from 10 to 24 depending upon the crop area, the type of soil and the kind of pest that is damaging the crops.

Education * Working hours Crosstabulation								
Count								
		Working hours						Total
		4	5	6	7	8	9	
Education	0	0	1	1	3	36	27	68
	1	0	1	0	0	6	10	17
	2	0	1	0	0	6	12	19
	3	1	3	6	3	2	5	20
	4	2	4	5	0	1	3	15
	5	2	2	5	0	1	1	11
Total		5	12	17	6	52	58	150

According to the data obtained to survey the least educated work the most in the field compared to those who are more educated. The maximum hours put in by the least educated sprayers are 8 while the minimum hours spend working hours are 4.

Education * hand wash Crosstabulation				
Count				
		Hand Wash		Total
		0	1	
Education	0	57	11	68
	1	13	4	17
	2	16	3	19
	3	18	2	20
	4	14	1	15
	5	11	0	11
Total		129	21	150

Despite being marginally educated majority of the respondents do not wash their hands before consuming meal. The ones having no education at all that is 57 having highest incidence of not washing hands. In contrast only 21 respondents said that they wash hands. There is no respondent who has 5 years of education and do wash their hands.

Meal * Hand wash Crosstabulation				
Count				
		Hand Wash		Total
		0	1	
Meal	0	14	0	14
	1	115	21	136
Total		129	21	150

The cross-tab shows that majority of the respondents do not wash properly their hands that is 129 respondents.

Education * Precautionary Measures Crosstabulation				
Count				
		Precautionary Measures		Total
		0	1	
Education	0	9	59	68
	1	2	15	17
	2	0	19	19
	3	2	18	20
	4	0	15	15
	5	0	11	11
Total		13	137	150

Majority of the respondents do take the precautions, out of which 59 respondents who do not have any year of schooling observes the most precautionary measures.

Frequency table and cross tabs of Tehsil Bhuwana:

Education					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	48	48.0	48.0	48.0
	1	8	8.0	8.0	56.0
	2	11	11.0	11.0	67.0
	3	16	16.0	16.0	83.0
	4	11	11.0	11.0	94.0
	5	6	6.0	6.0	100.0
	Total	100	100.0	100.0	

Majority of the respondents are illiterate having no year of formal schooling, secondly only 16 respondents have 3 years of education, while only 6 respondents have 5 year of education which is the maximum record.

Working hours					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4	3	3.0	3.0	3.0
	5	10	10.0	10.0	13.0
	6	12	12.0	12.0	25.0
	7	4	4.0	4.0	29.0
	8	36	36.0	36.0	65.0
	9	35	35.0	35.0	100.0
	Total	100	100.0	100.0	

Minimum number of hours recorded are 4 hours, and the maximum hours that are 9 hours constituting 35% of total sample. Secondly 36 respondents making up 36% of total sample, work 8 hours. Only 4 respondents said that they work 7 hours and only 3 respondents said that they work 4 hours.

Smoking					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	19	19.0	19.0	19.0
	1	81	81.0	81.0	100.0
	Total	100	100.0	100.0	

Majority of the respondents that 81 out of total sample responded yes claiming the smoke regularly during the field activity. They make up 81% of total sample while the remaining who do not smoke make up 19% of total sample.

Meal					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	10	10.0	10.0	10.0
	1	90	90.0	90.0	100.0
	Total	100	100.0	100.0	

Majority of the workers spend much of the time in the field as evident from frequency table which shows that 90 respondents consume their meal while being in the field. Only 10 respondents said that they do not consume meal in the field.

Hand wash					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	88	88.0	88.0	88.0
	1	12	12.0	12.0	100.0
	Total	100	100.0	100.0	

Only 12% of respondents that is 12 out of total sample wash hand before consuming meal. Majority of the respondents that is 88 do not wash their hands before consuming the meal.

Toxicity Level					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	15	15.0	15.0	15.0
	2	12	12.0	12.0	27.0
	3	29	29.0	29.0	56.0
	4	8	8.0	8.0	64.0
	5	25	25.0	25.0	89.0
	6	11	11.0	11.0	100.0
	Total	100	100.0	100.0	

Precautionary Measures					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	10	10.0	10.0	10.0
	1	90	90.0	90.0	100.0
	Total	100	100.0	100.0	

Majority of the respondents do take any kind of available precautionary measures, that is 90% of total sample. Only 10 respondents said that they do not take precautions of any kind.

Number of sprays					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	10	6	6.0	6.0	6.0
	11	1	1.0	1.0	7.0
	12	6	6.0	6.0	13.0
	13	4	4.0	4.0	17.0
	14	10	10.0	10.0	27.0
	15	12	12.0	12.0	39.0
	16	10	10.0	10.0	49.0
	17	8	8.0	8.0	57.0
	18	19	19.0	19.0	76.0
	19	12	12.0	12.0	88.0
	20	8	8.0	8.0	96.0
	21	2	2.0	2.0	98.0
	22	2	2.0	2.0	100.0
	Total	100	100.0	100.0	

In peak season the number of sprays range from 10 to 24 depending upon the crop area, the type of soil and the kind of pest that is damaging the crops.

Education * working hours Crosstabulation

Count

		Working hours						Total
		4	5	6	7	8	9	
Education	0	0	1	1	2	26	18	48
	1	0	1	0	0	4	3	8
	2	0	1	0	0	4	6	11
	3	1	3	4	2	1	5	16
	4	1	3	4	0	1	2	11
	5	1	1	3	0	0	1	6
Total		3	10	12	4	36	35	100

According to the data obtained to survey the least educated work the most in the field compared to those who are more educated. The maximum hours put in by the least educated sprayers are 9 while the minimum hours spend working hours are 4.

Education * Hand wash Crosstabulation

Count

		Hand wash		Total
		0	1	
education	0	42	6	48
	1	6	2	8
	2	10	1	11
	3	14	2	16
	4	10	1	11
	5	6	0	6
Total		88	12	100

Despite being marginally educated majority of the respondents do not wash their hands before consuming meal. The ones having no education at all that is 42 having highest incidence of not washing hands. In contrast only 12 respondents said that they wash hands.

Meal * Hand Crosstabulation				
Count				
		Hand wash		Total
		0	1	
Meal	0	5	2	7
	1	83	10	93
Total		88	12	100

The cross-tab shows that majority of the respondents do not wash properly their hands that is 83 respondents.

Education * precautionary measures Crosstabulation				
Count				
		Precautionary Measure		Total
		0	1	
Education	0	7	41	48
	1	2	6	8
	2	0	11	11
	3	1	15	16
	4	0	11	11
	5	0	6	6
Total		10	90	100

Majority of the respondents do take the precautions, out of which 41 respondents who do not have any year of schooling observes the most precautionary measures.

Appendix III

Frequency Tables of Different Diseases

Head Ache

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	102	68.0	68.0	68.0
	1	48	32.0	32.0	100.0
	Total	150	100.0	100.0	

Headache makes one of the most common side effects of frequently pesticide application. Headache often occurs after long term work with pesticides. (Antleand Pingali, 1994). Farmers mostly work in the field without mask on their mouth, with that they inhale pesticide fumes through nose, that cause severe headache.

EYE Irritation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	85	56.7	56.7	56.7
	1	65	43.3	43.3	100.0
	Total	150	100.0	100.0	

Eye membranes absorb pesticide faster than any other external part of the body, resulting in high increase of immediate damage depending upon the toxicity level of the pesticide.

Respiratory Discomfort

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	103	68.7	68.7	68.7
	1	47	31.3	31.3	100.0
	Total	150	100.0	100.0	

Respiratory disease mostly observed due to longer spray period normally include asthma, exercise induced longing and strain on mental health inform of severe headache.

Chest Pain

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	127	84.7	84.7	84.7
	1	23	15.3	15.3	100.0
	Total	150	100.0	100.0	

Lungs are mostly affected as the pesticide vapers when inhaled, it reacts with the internal surface of the lungs causing chest tightness extreme coughing and shortness of breath. (Antleand Pingali, 1994). In case of long term exposure, a person may become allergic to the pesticide fumes resulting in high sensitivity to exposure to low concentration of pesticide fumes.

Nose Irritation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	78	52.0	52.0	52.0
	1	72	48.0	48.0	100.0
	Total	150	100.0	100.0	

High exposure to pesticide and particularly to a certain specific pesticide may cause nose irritation to inform of itching.

Skin Allergy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	112	74.7	74.7	74.7
	1	38	25.3	25.3	100.0
	Total	150	100.0	100.0	

Skin Burn

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	118	78.7	78.7	78.7
	1	32	21.3	21.3	100.0
	Total	150	100.0	100.0	

Skin Redness					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	114	76.0	76.0	76.0
	1	36	24.0	24.0	100.0
	Total	150	100.0	100.0	

Normally pesticides handled without using protective gear or less protective gear of which hands come directly into contact with the pesticides. The toxicity of pesticide determines the damage to the skin resulting in the skin allergy produced by chemical substances causing in the skin irritation and skin redness (Yasin, Mourad & Safi, 2002). If the amount of pesticide absorbed is in high concentration, then the reaction with the skin may cause serious skin to burn with the possibility of causing death.