Adverse health effects, risk perception and pesticide use behavior

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23 June 2009

2009

Adverse health effects, risk perception and pesticide use behavior

Evidence from Pakistan

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Abstract

The use of pesticides on the farm is largely governed by voluntary behavior. It is important to understand what drives farmer's behavior of pesticide use. Health belief models in public health and social psychology argue that persons who have had adverse health experiences are likely to undertake greater preventive behavior which was tested here. We drew a survey of 163 farmers in, Vehari and Lodhran District of southern Punjab. Almost all the farmers were found, using pesticides extensively and covering their body partially. Resultantly more than 77% farmers experienced at least one health symptom. The analysis appeared to confirm the hypothesis that Farmers who have experienced health problems from pesticide are having heightened concern about health effects of pesticides, than farmers who have not experienced such problems. Farmers who report experiencing such problems are also more likely to report using protective clothing than farmers who do not report having such problems. The study however, does not support the hypothesis that Farmers who have had experienced health problems from pesticides are likely to use alternative pest management practices. Finally study concludes that to improve practices of pesticide use, specific and relevant information through training programs should be provided to farmers focusing health and environmental risks of pesticide use.

Key words: Health experiences, risk perception, health belief, pesticide use behavior

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INTRODUCTION

All over the world, it has been seen that the use of synthetic pesticides in agriculture is the most familiar way of controlling pests. The extensive use of such pesticides results in substantial health and environmental threats. According to WHO, 1990 "Pesticides use causes 3.5 to 5 million acute poisonings a year with roughly 20,000 workers dying from exposure every year"[1], most of them in developing countries. Latest studies showed that the actual deaths may be around 300 000 (Gunnell & Eddleston 2003) and (Buckley 2004; Srinivas 2005). Residues in air2, water and foods, have led to much more concern over the undesirable effects on environment and human health (al-Saleh IA 1994).

The use of pesticide is largely directed by self behavior. In a "political environment in which regulations do not cover how farmers apply pesticides, it is important to know what drives farmer's voluntary behavior of pesticide use"(Lichtenberg & Zimmerman; 1999). The factors that affect Whether or not farmers adopt safe behavior of pesticide use are not well understood. Contrary to number of studies in different geographical settings showing Pesticide intoxications appear to be due to lack of knowledge and information (Forget, 1991; Koh and Jeyaratnam, 1996) in developing countries, latest Studies such as Kishi (2002) Clarke (1997), McCauley (2004) and Yassin (2002) have shown that personal safety measures were poor and very high risk practices were common, despite

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[1] The United Nations has estimated that about 2 million poisonings and 10,000 deaths occur each year from pesticides, with about three-fourths of these occurring in developing countries (Quijano R, 1993). About 67,000 pesticide poisonings and resulting in an estimated twenty-seven accidental fatalities are reported each year in the US. Due to gaps in the demographic data, however, this figure may represent only 73% of the total number of poisonings. Some sources have reported up to 25,000,000 cases per year (Pimentel and Greiner 1996).

[2] Pesticides remain in the air for long time, bioaccumulate and travel globally, leading to ever increasing levels in humans, wildlife and also affect the biodiversity (WHO, 1990).

high levels of knowledge on the health impact of pesticides. Similarly Damalas (2006) noted that although farmers' knowledge of possible hazards by pesticide use was high, the reported safety measures were poor. All these studies however unable to provide satisfactory answer to the questions that why some farmers, despite high level of knowledge of health risks, do not respond to health promotion and what factors influence how those exposed to pesticide risk transform that risk into self protective behavior? One of the factors that affect whether or not farmers adopt environmentally sound behavior of pesticide use is Whether or not they have experienced a personal health effect" (Lichtenberg & Zimmerman; 1999) which is the topic of this study. Basically, Concrete knowledge (personal experiences or observations) is more meaningful than abstract knowledge (being listened) to change behaviors regarding health risk. As health psychology literature says most of our knowledge in our lives comes from actual personally relevant experiences, rather than from intellectual exercises. The study aims to explore how farmers respond to information about and perceived experience with the threat of pesticide. It attempts to evaluate whether or not farmers' experience with adverse health effects from pesticides would influence: Their beliefs or attitudes about the seriousness and importance of health and environmental problems from pesticides and their willingness to adopt measures to reduce the incidence of those problems.

The study has number of purposes; it expands the health belief literature into broader context of farmer's pesticide use behavior. To the best of my knowledge farmer's actual health experiences to change pesticide use behavior, have not been studied in developing countries. Study also offers an opportunity for policy makers to understand attitude and behavior of farmers regarding pesticide use and underlying factors such that they can easily identify what shapes farmer's choices of pesticide use and then to focus capacity building efforts in the area. From a researcher's perspective, it gives opportunity for insights into the factors that motivate voluntary self protection in rural communities in general, and that shed light on the match between risk-reducing interventions and the people they are intended to benefit(Severtson; 2006).

Coming lines highlight research questions of the paper. In section II trend of pesticide use in Pakistan is listed. This follows theoretical framework in section III and information on research methodology is briefly touched in section IV. The survey findings and analytical model are discussed in section V and VI respectively. Concluding remarks and policy implications are placed in section VII.

1. Research questions

The main research questions of the study are:

1. Whether or not farmers who believe they have had adverse health experiences from pesticides are likely to have heightened concerns about pesticides hazard?

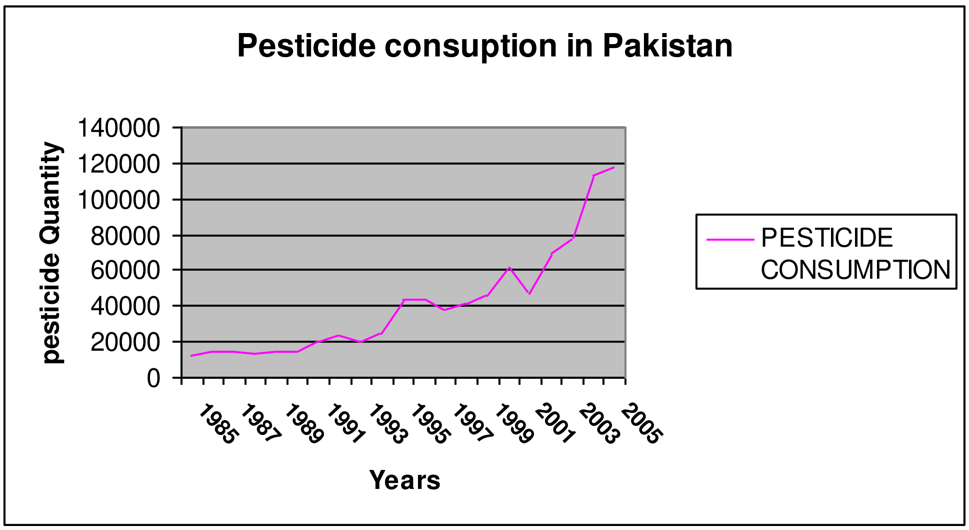
2. Whether or not farmers, experiencing adverse health effect from pesticides take more protective measures?

3. Whether or not farmers, experiencing adverse health effect from pesticides adopt alternative pest management practices?

Section II. Pesticide Use in Pakistan at a Glance

Use of pesticides has increased considerably in recent years, reaching 117513 metric tons in 2005 which was only 12530 metric tons in 1985. (See Figure 1 below)

FIGURE1. ***Pesticide consumption between1985 to 2005 in Pakistan***



Source: Department of plant protection Karachi 2007

Pesticides are intensively used on cotton in Pakistan followed by paddy, fruits and vegetables. Cotton alone accounts for about 80 percent of the total consumption of active ingredient of pesticides (NFDC pesticide use survey report; 2002).Given the Pakistan's agriculture settings and cash crops security situation, it can be expected that current crop protection trend will likely continue to be the main practice in the country. The trust on pesticides for plant protection is expected to lead to more dependence on (Huang, et al., 2003) and to rising use of pesticides due to rapid development of resistance among pests.

Section III. Conceptual Framework

Social cognitive models provide a theoretical framework for the study of health or illness behavior and motivation to self-protective techniques. One of such theories is health belief model. This study applies health belief model to explain relationships between information, risk perceptions and protective behavior.

Health-belief model postulates that persons who have had adverse health experiences will likely to adopt protective behavior; If he/she (1) Believe that a negative health problem can be avoided (2) Has a positive anticipation that by taking a suggested action, he/she will avoid a negative health problem and (3) Sure that he/she can effectively take a suggested health action. Basically "Health Belief Model" encourages a person to adopt positive health actions using the desire to avoid a negative health outcome as the key inspiration. For example, pesticide exposure has negative health effect, and the desire to avoid direct exposure from pesticide can be used to motivate farmers to undertake safety measures. Broadly "Health Belief Model" is based on six key concepts which are explained in the context of present study.

Perceived Susceptibility: Farmer's own examination or view of the risk of receiving a health problem from pesticides or their self-confidence or self-belief of the chances of contracting a health condition from pesticides. "The susceptibility component is most closely analogous to the health experiences" (Lichtenberg and Zimmerman 1999).

Perceived Severity: Farmer's personal belief of how severe a health condition and its cost (health and economic) is? Or their beliefs regarding the impact of the illness on overall quality of life or how it may affect functional capacity (e.g. an illness prevents farmers doing certain things).

Perceived Benefits: Farmer's belief and confidence of the effectiveness of strategy/plan proposed to decrease pesticide exposure and promotion of health.

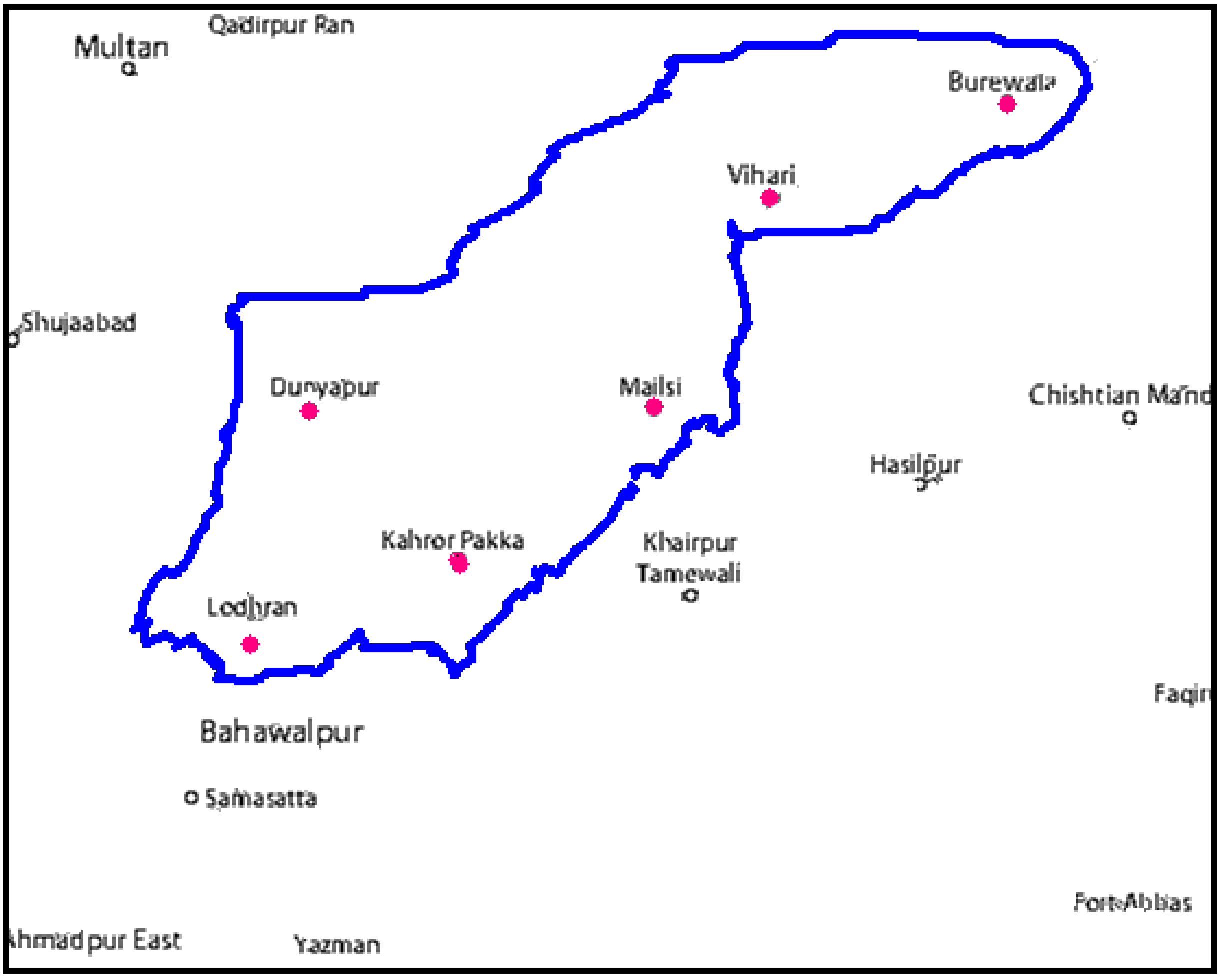
Perceived Barriers: The possible hindrance or negative consequences that may result from adopting certain health actions, such as physical, psychological, and economic stress.

Cues to Action: Events, either physical symptoms of a health condition or environmental incidents from pesticide use that stimulate farmers to take action/adopt protective measures.

Self-Efficacy: The farmer's belief in being able to effectively and successfully carry out the protective measures necessary to turn out the desired result.

Section IV. Research Methodology

Study Area and Justification: Because of differences in the use of pesticide in different geographical areas and crops, Data from the Pakistan agriculture statistics were collected to find the composition of pesticide use in different crops and geographical areas. Cotton has been identified as the major crop, which accounts more than 80% of total pesticide use in Pakistan (NFDC pesticide use survey report; 2002). Whereas more than 80% of cotton is produced in Punjab province and being the center of cotton crop the cotton zone of the Punjab has been recognized as the most intensive with respect to pesticide use. Over all two districts (Lodhran & Vehari) of the cotton belt in Punjab province is selected for the study.



The study area represents 17.5 % of total area under cotton crop in Punjab. Because of same culture and agricultural practices the results obtained from the study can safely be generalized to represent the whole set-up in cotton producing areas in Punjab.

V. Data Methodology and Research Design:

The method of meeting interview was used for filling in the questionnaire and all interviews were conducted face to face. The questionnaire is based on United States Environmental Protection Agency questions and on that used in the similar World Bank studies in Bangladesh and Vietnam. An investigation visit was carried out for general familiarization with the research area and the key players in pest management in the area. The familiarization process was assisted by the use of some informant interviews to obtain information about the general set-up. The questionnaire was then modified using the background knowledge from the reconnaissance visit. Final version of the questionnaire was used to collect information on pesticide use and practices, applicator precautions/ averting behavior and health/ environmental effects. The technique of stratified random sampling was used to obtain cross-sectional data. As a sampling strategy, at least two villages were selected purposively from every tehsil in each district to get the pesticide-related information from pesticide applicators.

Section VI. Survey findings

I. ***Background information:*** Overall 163 respondents were interviewed in both districts (97 in district Vehari and 66 in district Lodhran). The 163 surveyed farmers were all male. The majority of farmers 75.5% owned their land. Age ranges from 18 to 60 years, with an average age of 35 years. The age and education breakdowns of the respondents were as follows:

Table1. Age of the Respondents

Age	No	%
11-20	09	5.5
21-30	51	31
31-40	57	35
41-50	37	23
51-60	09	5.5
Total	163	100

Table II. Education Level of Respondents

Education Level	No	%
None	47	29
Primary	04	02
Middle	39	24
Metric/Lower secondary	47	29
Higher secondary	15	09
Graduates	11	07

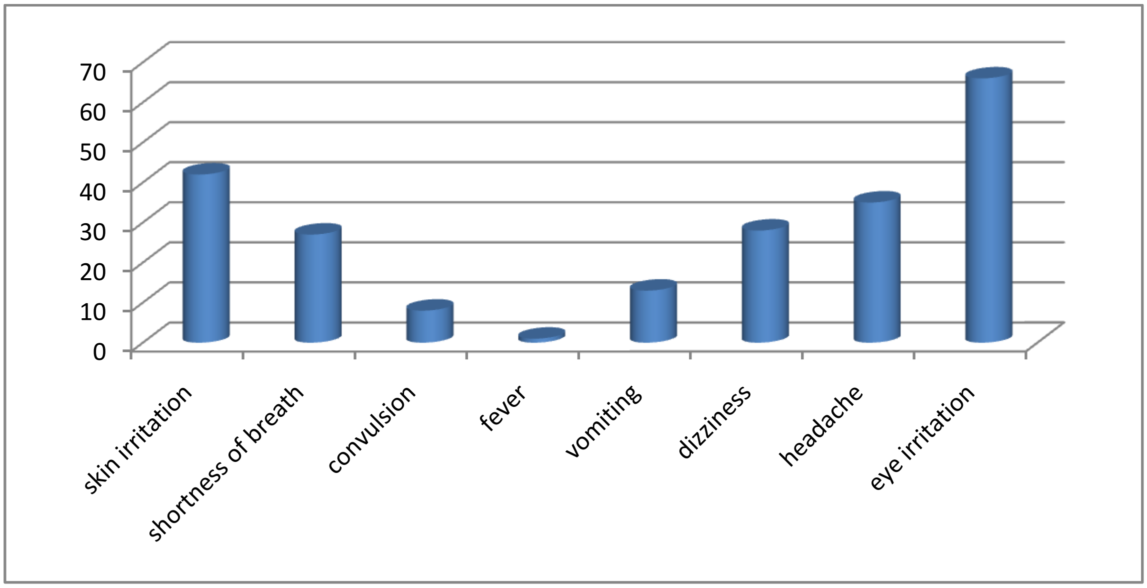
Over 71% of respondents had received education of different levels, 7% of the farmers had also attended university whereas 29% of respondents had never in the school and could not read or write. The average land area was 3.8 acre in district Vehari, and 10 acre in Lodhran district.

II Risk Perception: The majority (86%) of farmers believed that they are at risk while using pesticides, 53% some small risk, 20% a medium amount of risk, 10% a large and significant amount of risk, 3%very toxic risk, however 14% believed that there is no risk at all. It is important to note that pesticides are regarded as very important for successful production. They also added that they cannot grow crops without pesticides. Although many of them believed that spraying pesticide is dangerous but, they said they have "no other option" at all.

III Health effects: Almost all the farmers interviewed (96%) believed that pesticides could have some affect on their health. 34% farmers rated that pesticides had little health effect, 17% of them said that effects were medium, compared to 11% and 2% believing it was large and fatal (respectively). Few 4(2%) of them said that they don't know, whereas 6(3.6%) also believe that pesticides had no influence on their health.

More than 77% experienced one or more health effects while spraying, few of them experienced multiple symptom. However 22% of them never had any health problem during or after spray or they don't know about it.

Figure 1. *Type of poisonings experienced by respondents during last year*

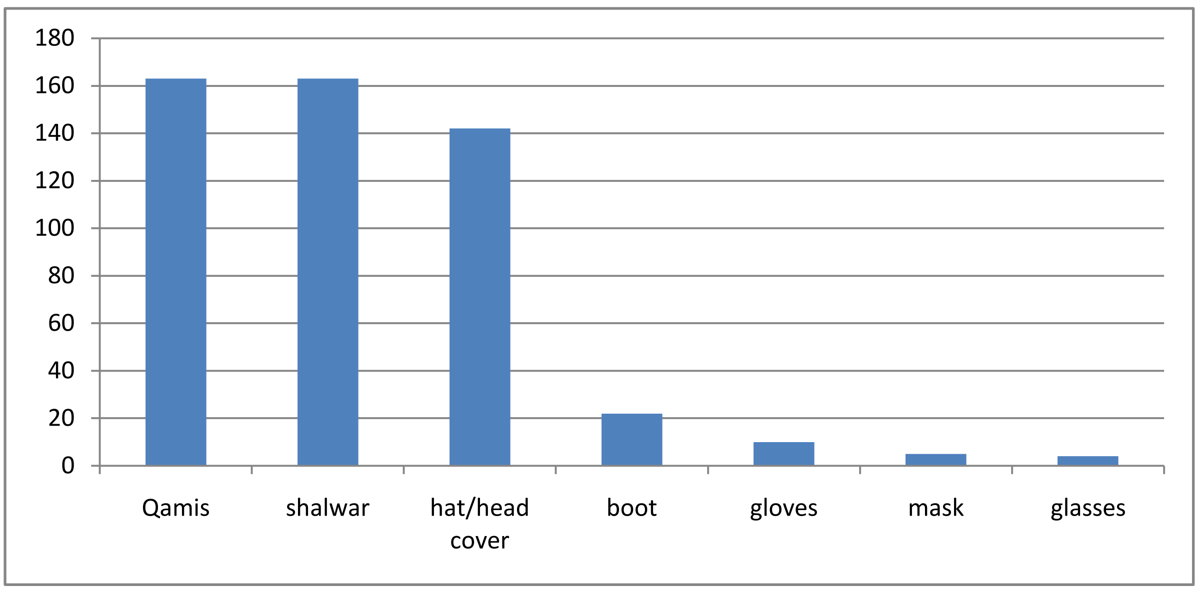


Majority of the farmers reported the following symptoms during or after short period of applying pesticides; headaches, dizziness, skin irritation, shortness of breath, irritation of eyes, vomiting and convulsion.

Iv. Pesticide application: The survey also found that farmers often apply pesticides very frequently. It was quite common for farmers (78%) to use pesticides more than 10 times on one crop particularly on cotton in a season. The spray frequency is as high as 16 on cotton crop in one season. Almost all the farmers found mixing several different brands together and the common reason of the practice was better control over different type of insects at a time. However they also believed that mixers are getting less and less effective which ultimately leads to frequent applications and more than recommended dose.

V. **Protective clothing's and behavior:** All the respondents said they wore protective clothing when they were spraying which was consisted of qamis (long sleeved shirt), shalwar (long pants), head cover and boot. Figure 2 shows the types of protective clothing respondents said they usually used while spraying.

Figure2. Different types of protection farmers used while spraying:



However, not all farmers used these materials when they sprayed. The use of masks and glasses was almost nonexistent. Also the use of gloves was limited, only 6% of them used gloves. The common reasons for not using these materials were carelessness, uncomfortable and non availability of these materials. Majority of the farmers said they changed their clothes shortly after spraying; only few of them did not change their clothes. They also did not think it necessary to change their clothes. Approximately all the respondents usually take bath after spray, but again most of them do not consider it necessary.

VI. Analytical Model

1. Health experience and risk perception

Seriousness of health risk is important factor in shaping individual's behavior. Previous literature and theoretical background help to identify factors determining individual's risk perception. Following Lichtenberg and Zilberman (1999), this study analyzed pesticide related risk perception using ordered probit framework. Ordered probit regression relating farmers risk perception (dependent variable) of health problems associated with the use of pesticides to a number of independent variables such as health experience, age, education, training, income and geographical area. Regression results are reported in table III.

Table III. Estimated Coefficients of Ordered Probit Regressions Explaining risk perception as a Function of Farmer's Characteristics

Variable	Dependent variable: **Risk perception**
Health effect	.2561867 (0.046)
Age	.0002307 (0.977)
Education	.0281032 (0.048)
Training	1.683223 (.0000)
Income	.0000061 (0.005)
District dummy	.1406782 (0.431)
Farm size	.0035921 (0.032)

The values in parenthesis are P values.

The findings support the hypothesis that there is a strong linkage between adverse health effects and heightened perception. The adverse health experiences were positively related with the seriousness with which farmers view health problems associated with pesticides. The farmers who got training of safe pesticide handling were found perceiving more risk than the farmers who did not have such like training. It is widely accepted that education enhances awareness regarding health. The Results also showed strong association between education and heightened risk perception. Similarly higher income farmers reported heightened perception of pesticide risk compared to low income farmers, explaining their access to information and extension. District controls reveal that perceived risk from pesticides are more or less same in both districts.

2. Health Experience and protective Behavior

The behavioral factor studied here in relation to health experience was the extent to which farmers used protections to avoid pesticide exposure. Result shows that farmers who experienced health symptoms during mixing or spraying pesticides are more likely to adopt protective measures, *ceteris paribus.* The result is consistent with theory and priory expectations. Similarly more educated farmers reported statistically significantly taking more protective clothing than farmers with less education. The result implies that education exerts a significant effect on the decision to adopt protective measures. Also trained farmers reported significantly higher concern about protection. This could be interpreted as indicating that the more learned farmers in terms of safety are more likely to select higher level of protection than non-trained farmers. Similar findings were noted by Lichtenberg and Zilberman (1999).

Table IV. Estimated Coefficients of Ordered Probit Regression

Variable	Dependent variable: **Protective Behavior**
Health effect	.7691605 (0.001)
Risk perception	.3063673 (0.002)
Age	-.0009447 (0.913)
Education	.0325256 (0.070)
Training	1.612334 (0.000)
Income	.0000579 (0.000)
District dummy	.2153523 (0.267)
Farm size	.0042906 (0.032)

The values in parenthesis are P values.

There are a few well-defined coefficients associated with the farmer's socio-economic background. For instance, farmers with higher income and farm size category are more likely to choose higher level of protection than their counterpart. The farmer's perception of health risk also exerts significant effects on the probability of choosing more protection. District dummy shows no variability in taking protective measures.

3. Health effects and environmentally sound behavior of pesticide use

A probit model was used to study more thoroughly the relationship between health experience and environmentally safe pest management practices. The probability that any alternative pest management Practice used by the farmers which is assumed environmentally safe was assumed to be a function of farm and farmers attributes, in addition to health experience. "The incorporation of the additional variables controls for factors that may be associated with health experience as well as decisions about using alternative pest management practices and thus allows isolation of the effects of health experience" (Lichtenberg and Zilberman 1999). The probit results are reported in table V.

Table V. Estimated Coefficients of Probit Regression

Variable	**Dependent variable:** **Alternative pesticide use**
Health effect	.1626112 (0.701)
Risk perception	.0525527 (0.050)
Age	.0302561 (0.043)
Education	.0724647 (0.110)
Training	.0677845 (0.040)
Income	.0000516 (0.015)
District dummy	-.7011234 (0.046)
Farm size	-.0002776 (0.925)

The values in parenthesis are P values.

The probit result did not confirm the hypothesis that farmers who have had adverse health experiences related to pesticides are more likely to adopt alternate pest management practices that reduce reliance on pesticides than farmers who have not had such experiences. In the probit analysis, we found number of other variables that affect the decision to use alternate pest management that have implications. The alternative pest management practices are positively related to risk perception, age, training and income. District dummy reveals that alternative pesticide use is more in district Lodhran than in District Vehari.

VII. Conclusion and Policy Implication

The specific focus of this paper was to systematically examine the factors that influence a farmer's decision making behavior of pesticide use at farm level. In our survey, 86% farmers perceived pesticides a health risk and more than 77% experienced at least one health effect when mixing or applying pesticides. However, practically all the farmers were found, using pesticides extensively and covering their body partially. About 78% farmers were reported spraying 10 or more times in a season on cotton crop.

The econometric analysis presented provides evidence that there is an association between the farmers' experience of health problems from pesticides use and their risk perception. The health experiences farmers reported having positively influenced their perception. Association also existed between the experience of health problems and the use of protective measures. Finally, we found no association between the experience of health problems and the use of alternative pest management practices. This however does not mean that farmers who have had such experiences do not care about the effects of pesticides. The lack of proper know-how about alternative pest management practices and inaccessible or non-existent extension are probably the contributing factor for this comportment.

Finally, we consider that our research findings have some important implications, for example, the empirical relation that appears to exist between training of safe handling and alternative pest management would suggest trained farmers significantly and effectively substitute for pesticide. Hence, to improve more informed choices of pesticide use, specific and relevant information through training programs should be provided to farmers regarding the health and environmental risks of using pesticides. Increased effort by Government and NGOs to educate farmers on the externalities of pesticides through training on IPM techniques can help reduce dependency on pesticides while at the same time maintaining or improving production.

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