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Health Issues among Women Cotton Pickers from Pesticide Exposure and Use of Protective Measures

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Abstract

The current study investigated the social problems and health issues faced by women cotton pickers in selected districts of Punjab, Pakistan. Cotton picking is an intensive activity performed mainly by women and is considered the most important source of livelihood and income generation in rural areas. The paper used cross-sectional data collected via face-to-face interviews with female cotton pickers in 2023 from Vehari and Multan districts. The study employed a probit model and other statistical techniques to estimate the factors affecting women cotton pickers' adoption of protective measures and their exposure to health hazards. Results indicated that more than half of the respondents (56%) among young cotton pickers did not use any protective measures at the cotton-picking stage. Health issues reported by young and elderly cotton pickers, in descending order, included eye irritation, skin infections or rashes, headache, flu &fever, cough, abdominal pain, and sleeplessness. The Probit estimation revealed that older age, prior experience in cotton picking, access to formal education, and knowledge of pesticide use were positively associated with the adoption of protective measures. On the other hand, variables such as age, access to transportation, adverse effects of pesticides, picking experience, long working hours, illiteracy, frequent illness, reliance on traditional remedies, and seeking medical treatment were found to be negatively associated with the use of such protective measures. The study recommends strengthening occupational health training, improving access to protective equipment, and enhancing rural healthcare outreach for women cotton pickers.

Keywords: Health Issues, Cotton Picker, Preventive Measure, Pesticide, Pakistan

Introduction

Females work alongside men, contributing their essential labor in agriculture, and their share increases over time; they make up almost 43% of the total farming labor force worldwide. Similarly, in Pakistan, women play a vital role in agriculture, livestock, and forestry, accounting for nearly 67% of the country's workforce (Jamali, 2009; Romero-Paris, 2000). Women are engaged in cotton farming from sowing to harvesting, as evidenced by their significant involvement in manual picking (Bakhsh et al., 2016). Cotton picking is carried out using mechanical and manual methods worldwide, but in developing countries, it is only done manually, e.g., in Pakistan (Abbas et al., 2015).

In Pakistani rural communities, women are reliant on men economically and experience discriminatory behavior in health, education, financial independence, and decision-making. The health problems of rural women are the most critical issue due to low income and cultural barriers (Bakhsh et al., 2017). A significant proportion of the marginal livelihood is spent on feeding the Family daily, paying utility bills, and educating children. Health problems of women involved in farm activities and due to pesticide exposure are not taken seriously (Yousaf et al., 2023). They are

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suppressed by taking primary painkillers or using "totkas"(a word used in the mother language), which results in aggravation of the problem. If the problem persists, village quacks are consulted, and medicine is taken daily. Poor nutritional status and unbalanced/insufficient diet also worsen health status (Yasmeen et al., 2017). Due to poor health status, the productivity and active participation of female farm workers are reduced, which ultimately leads to further poverty. Due to pesticide genotoxicity and chromosomal aberrations, chances of mentally retarded and handicapped offspring increased in female farm workers. The presence of such a child in a family reduces the working hours that females spend in the field due to the child's unique care needs and also reduces income and poverty (Ali et al., 2018).

For agricultural production, pesticide application has become a prominent part of agricultural production worldwide (Damalas and Eleftherohorinos, 2011). There is a dire need to use pesticides on cotton crops for pest management (Sinzogan et al., 2004), and, in addition to poor use of protective measures by farm workers (Damalas and Hashemi, 2010). Cotton growers mainly apply ten to fifteen times the amount of pesticides on the cotton crop during the cotton season to save the crop from insect/pest attacks. Spraying continues during cotton picking as farmers generally do three to four pickings (Okoffo et al., 2016). Pesticides have different time window during which picking is dangerous to human health, but farmers do not follow the recommended periods. Due to the intensive use of insect killers and improper time of picking for cotton in sprayed fields, women cotton pickers face some severe health-related problems like skin and internal organs diseases (Ali et al., 2017). Due to the lack of protective equipment, direct pesticide exposure during picking can result in serious health issues (WHO, 2009). Females usually work in a defenseless environment of pesticides throughout the cotton-picking season in Pakistan (Tahir and Anwar, 2012; Bakhsh et al., 2016).

Poor people's health has become a matter of utmost importance for a country's progress, and it is now higher on the international agenda. The world's nations have decided that achieving the highest possible level of health is an elementary right of every person, without discrimination based on religion, social, economic, or political situation (Khan et al., 2013). Health also plays a vital role in overall human progress and in poverty decline (Azmi et al., 2009). Healthy and energetic individuals can combat depression, certain cancers, diabetes, and different infections more efficiently than people with poor health status. Although many studies have evaluated the physical, internal, and external issues of farm workers in Pakistan, some research has examined protective equipment for women and the health dilemma (Bakhsh et al., 2016, 2017).

The major problems faced by developing countries are malnutrition and hunger. The rural female is also involved in various farming activities for income generation, and the types of activities depend on the geographical zone (Zahoor et al., 2013). Cotton is cultivated over 2.79 million hectares in Pakistan (Shuli et al., 2018). Upland cotton is grown mainly in Punjab and Sindh. Major cotton-growing cities of Punjab include Jhang, Faisalabad, Bahawalpur, Vehari, Multan, Khanewal, Raheem Yaar, Bahawalnagar, Rajanpur, Muzaffargarh, and Lodhran. Women have been participating in cotton spraying and picking in rural areas of Punjab since childhood. Undoubtedly, pesticide applications have become essential to agricultural commodities worldwide (Damalas, 2009). Cotton crops receive many pesticide applications for pest management. Due to the intensive use of pesticides on cotton and improper time of picking in sprayed fields, women cotton pickers face some severe health-related problems like skin and internal organ diseases. Due to the non-use of protective measures, direct pesticide exposure during picking results in serious health issues (Bakhsh et al., 2017).

Cotton growers spray different chemicals on cotton, either alone or in combination. All these chemicals have harmful effects on non-target crops and on farm workers. They cause severe skin and eye allergies, headache, nausea & vomiting, flu & fever, shortness of breathing, and sleeplessness. Prolonged exposure can cause different types of cancers (Yasmeen et al., 2017). According to the WHO (2009), about 0.3 million farmers in developing countries die each year from serious health hazards caused by pesticide exposure. Female farm workers in Pakistan are affected by pesticide exposure due to the non-use of protective measures during cotton picking (Tahir and Anwar, 2012). Women workers typically work in cotton fields without protective measures and guidance; this negligence is a serious problem. Current studies have demonstrated increased genotoxicity, low levels of antioxidant enzymes, differentiated esterase responses, and increased lipid peroxidation in female

cotton pickers (Manyilizu et al., 2016; et al., 2017). Thus, the objective was to evaluate cotton picker women's health issues and socio-economic status and estimate the use of protective measures.

Materials and Methods

The study was conducted in the Multan Division (Multan and Vehari Districts). Primary data was gathered from these two districts. Vehari is situated in the southern part of the Punjab province of Pakistan. Among all districts of the Multan division, Vehari is the most flourishing district, accounting for 30% of the division's cultivated area (GoP, 2014). The data was collected during the 2022 cotton season. Eight cotton-growing villages were selected to collect data and information from agriculture officers from Vehari and Multan. The villages were selected at random, and 160 female cotton pickers were chosen from them. A pre-tested, well-structured questionnaire was used to collect data from cotton pickers on the health impacts of pesticide exposure, and SPSS was used for data analysis.

Percentage and Mean:

Percentage and mean values were computed to make comparisons of various categories of the female women cotton pickers. The formula was used to compute the percentage is as follows:

P=F/N*100

P=Percentage

F=Frequency

N=Total number of frequencies/Total number of observations mean was calculated as

Mean =$\sum X/n$, where

X= Total no of variables,

N= Total no of observations

The health costs of female cotton pickers are approximated using the method used by Atreya (2007). Female pickers are responsible for covering their own medical expenses related to sickness. Due to illness, they incur a loss of earnings, resulting in a decrease in revenue. Illnesses caused by pesticides had a negative impact on cotton pickers' work capacity (Tahir and Anwar, 2012). Labor is frequently engaged in cotton picking during the harvest season in rural areas. This study utilized the actual wages paid to individuals employed in this work. The second section is the costs of protective measures adopted for cotton picking. Cotton picker females may use protective measures, such as masks, shoes, long-sleeved shirts, handkerchiefs, and sunglasses, to reduce pesticide exposure.

Some cotton pickers wear personal protective equipment, while others do not. So, the result can be represented as a binary variable. A logit model was used to identify factors influencing PPE use. The equation applied in this study is provided below.

$\ln Y_i = \ln (P_i/1-P_i) = Z_i = \beta 0 + \beta_i \Sigma x_i + \mu i$

The dependent variable is binary, i.e., taking the value 1 for individuals who use PPE and 0 for those who do not. As noted, β0 represents the intercept, while βi represents the coefficients to be estimated. The explanatory variables included a dummy for the age group, dummy variables for education level, a dummy for reporting headaches and skin issues, A dummy indicating the perception of temporary health effects, and the Logarithm of health cost. The logarithmic form of health costs was used to get a more stable estimation. The age group variable categorizes respondents as either older or younger, as described previously. If female cotton pickers reported headaches during picking, the variable is assigned a value of 1; otherwise, it is assigned a value of 0. Similarly, if respondents believed that the health effects of pesticide exposure during cotton picking are temporary and would not have long-term consequences, the variable takes a value of 1; otherwise, it is 0. It is hypothesized that higher health costs may increase the likelihood of PPE usage among cotton pickers.

Results and Discussion

Socio-economic characteristics

Results presented in Table 1 compare the health impacts of cotton picking between younger and older cotton pickers. Since only women were involved in cotton picking in the study areas, we focused primarily on gender. Regarding demographic characteristics and education, it was observed that younger pickers were relatively more educated than older ones, with 19.1% of the younger group having completed 8 years of education, compared to 4.9% of the older group. Out of 99 young pickers, (28.2%) are married, while 44% among the elder pickers. Among the total number of women cotton pickers, 26.2% had 14 years of picking experience. Additionally, 45.4% of the younger women began cotton picking ten years ago. In comparison, 59.0% of the elder women and 22.2% of the

younger women reported involvement in cotton harvesting over the past 15 years. The study also examined how often women cotton pickers experienced illness during and after the cotton-picking season. It was found that 14% of the young pickers reported no illness during the season, compared to 52.4% of the elder pickers. In contrast, 48.4% of the younger cotton pickers reported falling ill once during the season, while only 24.5% of the elder pickers did. Similarly, 29.3% of the young cotton pickers experienced illness twice during the season compared to 14.7% of the elder pickers. Furthermore, 8.08% of the younger cotton pickers reported being ill three or more times during the cotton-picking season.

Table 1. Socio-economic characteristics and sickness among cotton Pickers

Characteristics	**Number of cotton pickers (%)**	
	Young pickers	**Elder pickers**
Illiterate	32.3 (13)	59.0 (36)
Primary	67.6 (68)	34.4 (21)
Middle & above	19.1 (19)	4.9 (03)
Marital status		
Single	72.7 (72)	27.8 (17)
Married	28.2 (28)	72.1 (44)
Cotton picking experience		
Upto 5 years	29.2 (29)	3.2 (02)
6 - 10 years	45.4 (45)	26.2 (16)
11 – 15 years	22.2 (22)	59.0 (36)
16 & above	3.0 (04)	11.4 (07)
Sickness during cotton picking		
No effect	14.1 (14)	52.4 (32)
One time	48.4 (48)	24.5 (15)
Two time	29.3 (29)	14.7 (09)
Three-time and above	9.08 (09)	8.19 (05)

Figures in parentheses are actual numbers. Authors own calculation

The results presented in table 2 regarding use of protective measures adopters according to socio-demographic variables depicted that adoption of mask for covering face and gloves was higher in unmarried women. Similarly, the adoption of protective measures like mask and gloves was observed higher in educated women who indicated educated women know the harm effects of pesticide in cotton fields. Furthermore, high experienced cotton picker women observed adopters of face covering and gloves to covering skin to prevent their skin by diseases.

Table 2.Use of personal protective measures according to socio-demographic variables

Categories	**Mask Adopters**		**Gloves Adopters**	
	Mean	**Std. Deviation**	**Mean**	**Std. Deviation**
Unmarried	1.27	1.03	1.96	1.92
Married	1.25	0.44	1.94	0.23
Joint Family	1.23	0.42	1.95	0.21
Single-family	1.31	1.21	1.97	0.22
Illiterate	1.22	0.42	1.94	0.19
Educated	1.32	1.17	1.96	0.22
Low experience	1.30	0.46	1.84	0.15
High experience	1.42	0.50	1.97	0.37
No effect	1.26	1.35	1.98	0.13
Sickness	1.23	0.42	1.93	0.25
Young women	1.33	1.05	1.94	0.23
Old women	1.16	0.37	1.98	0.13

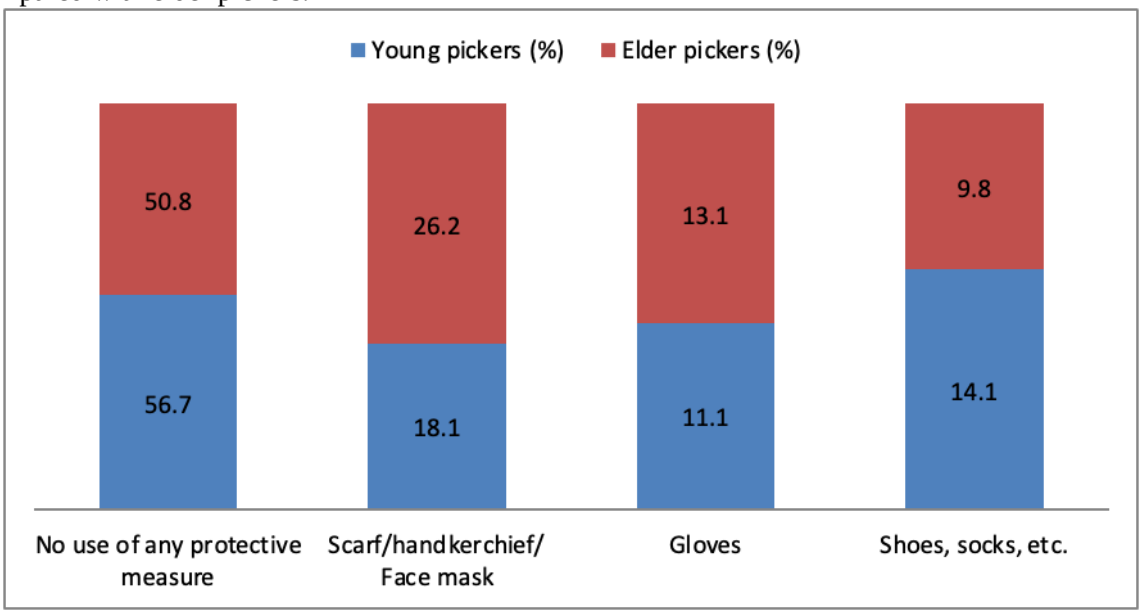
Results regarding Cotton pickers' observation showed that they felt the difference in family decisions when they were not earning was highly significant. Among cotton pickers, it was easily observed that whether the cotton field was sprayed, the duration of the symptoms, and the health impact due to cotton activity were significant (table 3).

Table 3.Perceptions regarding cotton picker's allied factors

Variables	**Young Pickers**		**Elder Pickers**		**(sig.)**
	Yes	No	Yes	No	
Have the right to decide to spend time	88	2	69	1	.594
Feel the difference in family decisions when you	20	70	2	68	.000***

were not earning					
Cotton field was sprayed	39	51	16	54	.000***
Feel any discomfort after cotton picking	78	12	59	11	.419
Access to Doctor's facility	41	49	31	39	.500
Access to hospital facility	38	52	30	40	.532
Duration of the symptoms	46	44	57	13	.000***
Access to transport	67	23	57	13	.196
The health impact due to cotton activity is temporary	59	31	30	40	.003***

The results regarding the use of protective measures by cotton pickers during the cotton-picking season were observed and explained in Graph 1. The young respondents (56.7%) and almost 50% the elder cotton pickers did not use any defensive measures during cotton picking. Some cotton pickers (26.2%) reported using a Scarf/handkerchief/face mask to cover their faces, compared to young pickers (18.1%); among elder pickers, 13.1% reported using gloves to cover their hands, compared to young pickers (11.1%). Similarly, among young cotton pickers, 14.1% wore socks and shoes during cotton picking, whereas among elder pickers, 9.8% did so. Primary education and middle or above education showed a strong positive correlation with personal protective measures, compared with elder pickers.



Graph.1Use of personal protective equipment by cotton pickers

Health issues of cotton picking

Women cotton pickers in the study area reported experiencing a range of health problems. The study specifically focused on the immediate or short-term effects associated with cotton picking**.** Information about these impacts was collected through a structured questionnaire, which included symptoms such as eye irritation, skin infections or rashes, headaches, flu or fever, coughing, abdominal pain, sleeplessness, and nausea or vomiting**.** Some respondents reported the health impacts of pesticides during cotton picking season more than once. Young cotton pickers reported health impacts in descending order, i.e., eye irritation, skin rashes, headache, fever, cough, abdominal pain, and sleeplessness. Considering the health impact on older women, the most common symptoms were eye and skin irritation, headache, fever, and cough, in descending order (Table 4). Furthermore, headaches, coughs, itching, and sleeplessness are statistically more common among younger respondents than among older cotton pickers.

The health challenges cotton pickers used to face during the harvest season have been broadly categorized into chronic and acute (short-term) effects**.** This study emphasized the short-term health consequences**,** based on the workers' recollections of past experiences. Symptoms frequently mentioned by respondents included headaches, eye irritation, flu-like symptoms, coughing, vomiting, skin allergies, and abdominal discomfort. Though younger female workers appeared to suffer more frequently from these ailments than their older counterparts, this highlights a need for greater awareness. This underscores the importance of educating cotton pickers about the potential health

risks associated with pesticide exposure and other environmental hazards and providing them with basic occupational safety training**.** Previous research supports these findings; for instance, studies by Rizwan et al. (2005), Devi (2007), and Khan (2012) have also documented similar health outcomes associated with pesticide exposure in agricultural settings. London et al. (2013) noted that women may be particularly vulnerable to such exposures. Additionally, Bakhsh et al. (2016) identified comparable health issues among cotton pickers in Pakistan.

Table.4 Health problems during cotton harvesting reported by the cotton pickers.

Variables	Young pickers	Elder pickers
Eye irritation	82.8 (82)	40.6 (39)
Sleeplessness	46.4 (46)	8.1 (05)
Fever	48.4 (48)	95.0 (23)
Vomiting	23.3 (23)	3.27 (02)
Cramps	35.3 (35)	4.9 (03)
Itching	82.8 (82)	22.9 (14)
Skin irritation	82.8 (82)	88.5 (54)
Headache	77.7 (77)	13.1 (08)
Cough	15.1 (15)	11.4 (07)
Flue	71.7 (71)	9.8 (06)
Abdominal pain	42.4 (42)	4.9 (03)

Figures in parentheses are actual figures.

Some respondents reported more than one health issue impact, so the percentages would not add up to 100.

The study focused exclusively on the short-term health impacts experienced by women cotton pickers. The questionnaire collected data on immediate health effects, including eye irritation, skin infections or rashes, headaches, fever, cough, abdominal pain, sleeplessness, and nausea or vomiting**.** Some respondents reported experiencing these issues repeatedly, particularly related to pesticide exposure during the cotton-picking season. Younger workers reported health problems in descending order: eye irritation, skin rashes, headaches, fever, cough, abdominal pain, and sleeplessness. In contrast, older women reported eye and skin irritation, headaches, fever, and cough in that order (see Table 4). Notably, headaches, coughs, itching, and sleeplessness were statistically more prevalent among younger pickers compared to older ones.

In contrast, older women reported eye and skin irritation, headaches, fever, and cough in that order (see Table 4). Notably, headaches, coughs, itching, and sleeplessness were statistically more prevalent among younger pickers compared to older ones. Research by Athukorala et al. (2012) found that preventive expenses for farm workers were an important determinant. Travel costs have increased due to the lack of medical facilities in rural areas.

Cotton pickers often incurred various costs due to health problems, including medication, transportation, and productivity losses. Older workers who had been in the field for many years faced more severe health complications owing to long-term exposure to agricultural chemicals, which also led to higher healthcare costs, as highlighted by Pérès et al. (2012). However, younger pickers incurred higher expenses for personal protective gear and dietary needs, suggesting they were more health-conscious and invested in preventive measures.

On the other hand, older workers had to spend more on medication, lost workdays, and travel likely because of limited access to healthcare in rural areas, which also contributed to the overall burden of healthcare costs. In Pakistan, female cotton pickers typically earn around Rs. 450 per day for picking 40 kg of cotton. While personal protective equipment (PPE) can reduce exposure to pesticide residues and dust, improperly maintained or unclean PPE may pose its own health risks. Unfortunately, this study lacked detailed data on the condition and maintenance of workers' PPE.

Moreover, many cotton pickers did not use any protective gear during harvesting. The findings show that 50.8% of younger workers and 56.7% of older workers did not utilize PPE. However, younger pickers showed greater concern for their health, possibly due to higher educational levels**,** as indicated by Table 1. This becomes particularly worrying when considering that workers are directly exposed to harmful pesticides**.** Saeed et al. (2017) reported that 63% of farm workers adopted protective measures during pesticide application**,** and Abbas et al. (2015) also observed that only a

limited number of cotton pickers used PPE during the harvest**.** Similarly, Damalas and Abdollahzadeh (2016) noted that just 24% of Greek farm workers wore protective clothing**.**

Although this study did not specifically measure risk reduction associated with PPE, it was found that many cotton pickers regularly practiced protective behaviors. The logit model was employed to determine the determinants of cotton pickers' adoption of personal protective equipment. Our results revealed that the young women pickers were more likely to use PPE than the elders. This was found because young pickers had greater awareness and information about the unpleasant consequences of cotton harvesting without protective measures. This trend is attributed to their greater awareness of the health risks involved in cotton picking. Previous studies (Damalas and Hashemi, 2010; Damalas and Abdollahzadeh, 2016) have shown that older farmers are less inclined to use PPE**.** Additionally, farmers who had already experienced negative health effects from pesticides often felt that PPE provided limited benefit, leading **to** low adoption rates among older workers (Remoundou et al., 2015).

Table 5: Estimates of the Logit model

Variables	Unit	Coefficients (SEE.)
Age group	1 = younger pickers (<30 years)	0.45 (0.27)*
Education above middle	1 = education is above middle	0.12 (0.56)
Education below middle	1 = education is below middle	0.81 (0.38)***
Headache,	1 = headache, reported	0.34 (0.21)*
Breathing dummy	1 = breathing problem	0.27 (0.15)**
Temporary health impact	1 = health impact is temporary	−0.41 (0.17)***
Health cost Log of health cost		0.30 (0.05)***
Constant		−2.70 (0.50)
Log-likelihood		−157.75
LR Chi2		35.37***
Number of observations:		160

Standard deviations and standard errors are in parentheses.
*p < 0.10.
** p < 0.05.
*** p< 0.01.

The Probit regression analysis revealed that older age, prior experience in cotton picking, access to formal education, and knowledge of pesticide use were positively associated with the adoption of personal protective measures. On the other hand, variables such as age, access to transportation, adverse effects of pesticides, picking experience, long working hours, illiteracy, frequent illness, reliance on traditional remedies, and seeking medical treatment were found to be negatively associated with the use of such protective equipment. In relation to age and marital status, individuals who were more involved in cotton picking and worked longer hours tended to use more protective measures, possibly due to lower levels of education and limited awareness among younger pickers. This observation suggests that younger cotton pickers may not prioritize personal safety as much during the cotton-picking season, contradicting the findings of Bakhsh et al. (2017), who observed a higher use of protective measures among the youth.

Regarding illiteracy, it was noted that a large proportion of female cotton workers are uneducated and come from economically disadvantaged rural areas. These women often lack connections to broader networks of other cotton workers and have minimal awareness of their healthcare rights or of their ability to access advocacy in cases of workplace violations. In many rural communities, education is often overlooked in favor of immediate livelihood needs, contributing to low literacy rates.

To address this issue, national-level government intervention is necessary to prioritize and expand educational access, especially for rural populations. Additionally, training and awareness programs focused on agricultural safety and pesticide use should be implemented for farm workers. As highlighted by Damalas and Koutroubas (2017), training farmers in safe pesticide application practices significantly improves their safety behaviors.

Table 6. Estimates of the Probit model

Variables	**Coef.**	**P-Value**	**Z-value**
Age	-.29***	0.021	-2.32
Family Type	1.224	0.39	0.86

Marital Status	8.300***	0.04	1.98
Involvement in picking	7.692***	0.022	2.30
Access to School	.372	0.705	0.38
Access to Transport	-1.114	0.26	-1.12
Impact of Pesticide	-1.279	0.357	-0.92
Experience in cotton picking	-.137	0.268	-0.99
Adult male in Family	-.341	0.416	-1.11
Adult female in the Family	-.306	0.542	-0.81
Working hours	-1.978***	0.010	-2.59
Education	4.329***	0.029	2.19
Information about pesticide name	.404	0.902	0.12
LR chi2(13)	190.38		
Prob> chi2	0.0000		
Log likelihood	-13.70660		
Pseudo R2	0.8741		

*p < 0.10., ** p < 0.05., *** p< 0.01.

Conclusion and Recommendation

Conclusion

In southern Pakistan, women cotton pickers faced a few health problems due to pesticide exposure. Health problems incur treatment costs that exceed the costs of protective measures. Our findings revealed that our activity plays a significant role in guiding cotton pickers on safety protective measures in cotton-growing areas. Moreover, this study provides a baseline for researchers who may wish to analyze additional aspects of women cotton pickers and categorize the compelling circumstances. Improving proper learning and effective training on protective measures is imperative to reduce health threats and costs among women workers. All media schemes should raise awareness of the risks posed by pesticides. The present study has certain restrictions. First, this study relies on self-reported health indicators and security behaviors, which may be subjectively assessed. Second, the respondent's health status before the survey was not considered; prior health problems might have led to health issues during picking. Third, the time between cotton pickings was evenly distributed among respondents, but differences in the length of the cotton-picking period might have affected the self-reported health symptoms. Future research can take these parameters into account.

Recommendations

In rural areas, most of the population is unqualified because they pursue their livelihoods rather than getting an education in schools. Therefore, the national establishment needs to take steps to address illiteracy and prioritize education. Furthermore, the government should implement educational and agricultural training for women cotton pickers and farmers. Farmers' training in pesticide use was associated with high levels of protection. Most of the women respondents are unaware of the health risks posed by pesticides. A comprehension extension network is needed to create awareness among women cotton pickers. Wages should increase with the number of working hours for women. There is also a need to educate women cotton pickers through television, FM radio, and print media. It may prove an effective tool to educate cotton pickers. The government should also ensure that laws and regulations regarding protective measures for cotton pickers are in place to minimize health impacts.

Data Availability: The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethical Conduct: We confirm that this material is original research, has not been previously published, and is not under consideration for publication, either in whole or in part. This article does not involve any experiments with human participants or animals conducted by any of the writers.

Conflict of Interest: The authors declare no conflict of interest.

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