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Occupational Safety and Health Promotion as a Strategy to Improve the Knowledge and Practices of Farmers on Pesticide Handling, Safe Machinery use, and Tetanus Prophylaxis in Barangay San Isidro, municipality of Mahayag, Zamboanga Del Sur

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A B S T R A C T

This is a pre and post-interventional study which determined the effect of occupational safety and health promotion as a strategy to improve the knowledge and practices of farmers on pesticide handling, safe machinery use, and on tetanus prophylaxis in Barangay San Isidro, Municipality of Mahayag, Province of Zamboanga del Sur. Simple Random Sampling was utilized to recruit the 35 respondents for this study. The baseline knowledge was evaluated using a self-administered questionnaire before the intervention. Two post-tests were given using the same questionnaire one week and four weeks after the intervention. Actual practices, on the other hand, were evaluated using a checklist before the intervention. Two post-tests were given using the same checklist, for tractor operations right after and one week after the intervention, for thresher four weeks after and a month later, and for pesticide use one week after and four weeks after the intervention. ANOVA for repeated measures was used to determine the improvement in knowledge and retention. The findings showed a significant increase in the mean knowledge score from the pre-intervention score (21.11) to the postintervention one score of (31.69) with a P-value of 0.000. However, a decrease was noted in the mean score at post-intervention 2 (31.46) with a P-value of 1.000. The actual practices were analyzed using McNemar's test. The results revealed significant improvement in the essential practices of the respondents with significant P-values (<0.05). This study concludes that lecture as a form of occupational safety and health promotion is effective in improving the knowledge and practices of respondents on pesticide handling, safe machinery use, and tetanus prophylaxis in Barangay San Isidro, Municipality of Mahayag, Province of Zamboanga del Sur.

Keywords: occupational safety and health, farmers, pesticide handling, tetanus prophylaxis, safe machinery use

1. Background of the Study

Agriculture is one of the essential parts of the Philippine economy, with crops like rice, coconut, and sugar dominating the production of crops and exports. A report from the Department of Agriculture (2022) showed that 52.7% of the total agricultural production consists of crops like rice and corn. Since there is high competition in food production with its decline in crop production due to urbanization, Filipino farmers rely heavily on pesticides, and their equipment use can be unsafe just for them to boost their yields (Lu, 2021).

The agricultural sector employs 874 million workers worldwide, representing 27.4 percent of global employment. According to the latest ILO Global Estimates, at least 210,000 agricultural workers are killed by accidents each year. This means that workers in agriculture run over three times the risk of dying on the job compared with workers in other sectors (ILO, 2022).

Agriculture ranks first among the most hazardous industries. Farmers are at very high risk for fatal and nonfatal injuries, and farming is one of the few industries in which family members who often share the work and live on the premises are also at risk for fatal and nonfatal injuries (National Institute for Occupational Safety and Health, 2022). The Philippines is one of the Southeast Asian countries in which occupational health and safety issues are essential. High-risk occupations exist in both agricultural and industrial sectors. Farmers' risks have increased due to the extensive use of machinery, pesticides, and other agrochemicals. Farm machinery, such as tractors and rice harvesters, have the highest injury and mortality rate (ILO, 2022).

According to the Department of Labor and Employment (2022), superficial injury and open wound accounts for 26.51% of all cases of occupational injuries. Due to soft-tissue injuries and puncture wounds, farmers are also at increased risk of contracting tetanus (Ricco, 2017). This disease affects people worldwide, particularly in developing countries, despite different strategies promoting vaccination.

In Barangay San Isidro in the Municipality of Mahayag, Province of Zamboanga del Sur, Four hundred one (53%) of the total households rely on farming as their source of livelihood. Thus, most residents are farmers, comprising 48% of the total working-age population(Municipal Local Development Office,

2022). Soft tissue injuries secondary to work-related injuries ranked third in the barangay's leading causes of morbidity (Rural Health Unit, 2020). According to Mahayag Municipal Hospital (2022), organophosphate poisoning is common in the municipality. According to the hospital statistics, three patients in 2022 were referred to a higher facility for the further management and treatment of organophosphate poisoning. According to Lu (2021), the rate of occupational acute pesticide poisoning in the Philippines accounted for about 7% of the total injuries recorded in 2021. With this, there is a need to create programs that would address this problem.

According to the Occupational Safety and Health Center (OSHC) and Bureau of Working Conditions (BWC) under the Department of Labor and Employment (DOLE), there is no specific strategy and program for occupational safety and health for farmers. Most agricultural workers work in the informal sector without the protections of regulations, enforcement of labor or health and safety laws, or enrollment in a social security system (International Labor Organization, 2022).

The Safety and Health in Agriculture handbook of the International Labor Organization state that occupational safety and health promotion involves proper storage, handling, and disposal of pesticides. Moreover, the Fertilizer and Pesticide Authority of the Department of Agriculture conducts lectures on the responsible use of agricultural pesticides among farmers. However, these strategies have not reached the farmers of Barangay San Isidro, Municipality of Mahayag, Province of Zamboanga del Sur (Municipal Agricultural Office, 2022).

Thus, due to the inherent hazards present in the working environment, an intervention is needed to solve the existing problem. The research intends to utilize occupational health and safety promotion in improving farmers' knowledge and practices on farm safety in Barangay San Isidro, Mahayag, Zamboanga del Sur.

Nomenclature

Occupational Safety and Health – refers to the hazards identification, risk assessment, and control measures done by the farmers arising in or from the workplace that could impair their health and well-being of farmers such as machinery use, tetanus toxoid immunization, pesticide handling, and basic first aid on work-related injuries.

Occupational safety and health promotion on farm safety - strategies which include promotion of health and safety through health education regarding first aid for common farm emergencies and tetanus infection, prevention of injuries through lecture on proper handling of pesticides and farm machine operation, and prevention of complications from injuries through provision of free two doses of tetanus vaccination.

Tetanus Immunization – involves two doses of tetanus toxoid immunization.

Safe Machinery Use – the practices seen on tractor and thresher operations by the farmers.

Pesticide – the chemical that kill or repel organisms that may pose harm or threat to agricultural crops.

1.1 Review of Related Literature

Files must be in MS Word only and should be formatted for direct printing, using the CRC MS Word provided. Figures and tables should be embedded Agricultural machinery is a significant source of injury on farms. The importance of machinery safety practices as potential determinants of injury still needs to be completed. In a study entitled Operational Safety Practices as Determinants of Machinery-Related Injury on Saskatchewan Farms, researchers examined safety practices as risk factors for injury. The limited presence of safety devices on machinery during farm operations was associated with higher risk of injury. This finding implied that injury prevention programs require continued focus on the use of safety devices on machinery (Narasimhan, Peng, Crowe, Hagel, Dosman, & Pickett, 2010)

A quasi-experimental study conducted in Thailand evaluated the effectiveness of occupational safety and health promotion on the knowledge and behaviors of rice farmers. The study has found that pesticide safety behaviors, ergonomics, and working conditions have improved due to the intervention. Heath education has proven effective in improving workplace safety and health care, including pesticide use, personal protective equipment (PPE), material handling and storage, machine safety/equipment use, and working conditions. (Santaweesuk, Chapman, & Siriwong, 2014). A cross-sectional study in Nepal found that 31% of the farmers practice basic occupational safety and health by using personal protective equipment and wearing gloves and masks during work hours, with an odd ratio of 5.06 even without any intervention. The same study suggests that 69% of the farmers have a high risk for work-related injuries because they do not practice basic occupational safety and health. A quasi-experimental study conducted by Kim et al. (2021) has shown that among the intervention subjects of the study, statistically significant increases were observed in reported safety training, familiarity and availability of MSDSs, and knowledge of OHS legislation after a health education intervention.

Another study conducted by Gelaw et al. (2022) has shown that health education in the form of lectures as an intervention showed a positive increase in knowledge and improved the practices among reproductive age group women in Ethiopia regarding tetanus immunization from a baseline of 26.2% who are vaccinated against tetanus with two doses to 76.3% of the respondents during the post-intervention. Moreover, this was supported by the study of Estrada (2016), that occupational safety and health promotion is indeed an effective form of intervention to improve the knowledge and practices of farmers regarding farm safety. Results of the study revealed a significant increase in the knowledge mean score from both posttest one and posttest two. The study showed the effectiveness of lectures as an intervention towards first aid management for superficial wounds, fractures, eye injury, tetanus infection, and pesticide handling.

There is an increasing reliance on pesticides in Philippine agriculture without considering their deleterious effects on the community, health, and the environment (Reyes, 2018). In addition, there needs to be better policy implementation regarding pesticide use and regulation. With the proper safety precautions, handling pesticides can help the environment and the health of farmers. It is recommended that the government and other associated agencies should offer a training program for the farmers regarding the handling of pesticides considering the rising trend in pesticide exposure in the Philippines from 2000 to 2010. Correct information about the appropriate application, storage, and labeling should be disseminated, especially for small-scale farmers (Lu et al., 2010). A study conducted by Nur in 2016 found that knowledge and practices among farmers in selected barangays in Mahayag have improved after lectures on pesticide handling. The study's results revealed a statistically significant increase in the knowledge after the intervention from a mean score of 23.9±2.64 during the Pre Test to 24.7±2.76 during the Post Test 1 with a p-value of 0.045. The study concludes that health education is effective as an intervention to improve farmers' knowledge and practices on pesticide handling.

A retrospective study was conducted in Southwest Ethiopia about the fatality of adult tetanus admitted in a teaching hospital. Tetanus is endemic and is a pressing health problem among rural farming folks, just like in other developing countries. One hundred seventy-one cases were analyzed, with the predominance of male farmers at 129. Results showed that none of these patients was immunized for tetanus. The case fatality of tetanus was 38% among the cases, which was higher than in developed countries. The authors highly recommend vaccination to help prevent this disease (Derbie, 2016). Another study done by Bajala (2014), who evaluated the effectiveness of lecture in improving the knowledge and immunization rate of tetanus toxoid among adult farmers in the Municipality of Diplahan has shown that initially during the study pre-intervention phase, 0% of the adult farmers were inoculated with tetanus toxoid which supported the claim of the study by Amare & Yami. Moreover, the intervention phase of the same research has shown great improvement in the vaccination rate from 0% to 86% of the total respondents.

According to the updated recommendation of the Advisory Committee on Immunization Practices (ACIP) of the Centers for Disease Control and Prevention (CDC), all previously unvaccinated adults aged 19 years old and above who have not yet received a dose of tetanus vaccine including those aged 65 years of age and above should be vaccinated with a 3-dose primary series of tetanus toxoid. In 2020, there was a slight increase in overall tetanus vaccination of adults; however, coverage persisted to be low for all age groups. CDC recommends education and publicity to promote vaccination and easier access to vaccination services in health centers (Rencken, 2020). Therefore, occupational safety and health, including tetanus inoculation, must be included in the OSH program for farmers.

Hence, occupational safety and health promotion, including safe machinery use, proper pesticide handling, and tetanus prophylaxis, can be utilized in addressing the current problems of the farmers in the Municipality of Mahayag.

2. Methodology

2.1 Research Design

This study used a pre and post interventional research design to determine the effect of occupational health and safety in improving farmers' knowledge and practices on farm safety in Barangay San Isidro, Mahayag, Zamboanga del Sur.

2.2 Respondents

Inclusion Criteria

- Farmers from Barangay San Isidro who were growing crops during the study period.
- Must be 16-65 years of age, male or female.
- Willing to take part in the study.

Drop Out Criteria

- Respondents who failed to answer any of the two-post intervention questionnaire and any of the two observational checklists.

2.3 Sampling Design

Simple random sampling was utilized to recruit respondents in the study. All farmers meeting the criteria were invited to participate in the study. According to OpenEpi, a total of 26 farmers is needed to have an accurate sample size with a power of 80, a confidence level of 95%, and a hypothesized 98% frequency of outcome factor in the population based on the study of Estrada in 2016.

2.4 Research Setting

The study was conducted at Barangay San Isidro, in the South District of Mahayag, Zamboanga del Sur. The barangay is 7.0 kilometers away from the capital of the Municipality, the Poblacion. Barangay San Isidro has a land area of 683.61 hectares where 98.9353 hectares are devoted to upland farming, 578.68 hectares is lowland farming and about 5.98 hectares are built-up areas. The presence of an irrigation system in the barangay enables the majority of the population to make farming their primary source of income.

2.5 Data Gathering Procedure

To prepare the researcher for the educator role in this study, he underwent occupational safety and health training by the Department of Labor and Employment. The researcher also utilized one research assistant. The research assistant was oriented about the content of the checklists and then was trained on how to conduct the actual practice observations. The research assistant is one of the farmers from the same barangay. The research assistant was instructed not to evaluate the respondents too closely or to make his identity known as an evaluator, which may affect the results' validity. The research assistant observed the participants' tractor and thresher operation and pesticide handling practices. This took place before the scheduled pre-intervention assessment.

Upon identification of the probable respondents, informal interviews were conducted to roughly determine existing knowledge and common practices of farmers on farm safety measures utilizing the Hazards Identification, Risk Assessment, and Control Measure Tool from the Department of Labor and Employment. They were asked about injuries from farming activities and other medical problems such as eye injuries, soft-tissue injuries, and pesticide poisoning. Their tetanus immunization status was also asked. The interviewer-assisted knowledge assessment was done. The research assistant assessed the actual practices of tractor and thresher operators and pesticide users actual practices before intervention.

The researcher utilized an occupational and safety health promotion. A representative from the Fertilizer and Pesticide Authority from the Department of Agriculture gave the lecture on safe pesticide handling. For the lecture on safety precautions on farm machinery operation, an agricultural technologist from the Municipal Agricultural Office was invited to conduct the lecture. A registered midwife from the Rural Health Unit was invited to give a lecture about tetanus toxoid immunization. Moreso, the researcher, a trained Safety Officer, talked about common farm medical emergencies, such as first aid management for wounds and eye injuries. The lecture guide on pesticide handling, machine operation, and first aid was adapted from the study of Esturco in 2011 while the lecture on tetanus was from Bajala in 2014. The lectures were conducted in Barangay San Isidro.

At the end of the lecture, a post-intervention assessment of the farmers' knowledge was done utilizing the questionnaire used during the pre-intervention assessment. It was conducted twice: right after the intervention and exactly four weeks or one month after. A post-intervention observation of the farmers' actual practices by the research assistant about their use of pesticides and farm machinery took place. The respondents were not aware that the trained observer was evaluating them. The post-intervention 1 and 2 observation of their thresher use was done on separate occasions four weeks after the intervention. For their actual practices on tractor use, post-intervention observation was immediately after and one week after the intervention. Lastly, their pesticide use was observed one week and four weeks after the lecture. The differences in the schedule of the observations were due to the sequence of their farming activities. Tractor operation occurs during land preparation for planting, usually lasting two to three weeks. Farmers then regularly spray pesticides about four to six times in two to three months. Lastly, during harvest, crop threshing occurs; the number of operations would depend on the volume of crops harvested.

Farmers were given the first dose of tetanus toxoid on the day they preferred to take the shot. Medical students assigned in Barangay San Isidro were supervised by the Rural Health Unit (RHU) staff of Mahayag in administering the vaccines. Respondents were issued a tetanus vaccine card informing them of their received doses and the schedule for their next doses. The second dose was given four weeks after the first dose. The RHU of Mahayag furnished a master list of the names of the participants and the schedule of their third dose. The respondents were then referred to the RHU for their third dose of tetanus toxoid.

2.6 Research Instruments

Questionnaire

The study utilized an interviewer-assisted 36-item knowledge questionnaire which was answerable by true or false. The same questionnaire was used during the pre and post-intervention assessment. The first 20 items assessed knowledge regarding first aid for common farm medical emergencies (soft-tissue injury, eye injury, and fracture) and tetanus, which were adapted from the research of Esturco (2011) and Bajala (2014) and was utilized by Estrada (2016). The second part was a 16-item assessment of the farmers' knowledge on the proper handling of pesticides which was adapted from the study of Estrada (2016). Refer to Appendix A for the English and Bisaya version of the questionnaire.

Checklist

The observational checklists for actual practices regarding the use of farm machineries and pesticide handling utilized in this study were adapted from the study of Esturco (2011). The checklist for tractor operation consisted of eight items, while the thresher operation consisted of nine items. The checklist on pesticide handling consisted of 14 items.

2.7 Statistical Treatment

Data from all the intervention assessments were processed and analyzed using the Statistical Package for Social Sciences (SPSS). Descriptive statistics using means, frequencies, and percentages were used to analyze the respondent's demographic profiles. Pre and post interventions 1 and 2 mean scores were compared using Analysis of Variance (ANOVA) repeated measures with post-hoc tests to determine the retention and improvement in the knowledge. The actual practices were analyzed using McNemars test. Frequency and percentage were used to analyze further and illustrate the improvement in practices.

2.8 Ethical Considerations

The Ateneo de Zamboanga School of Medicine research panel reviewed and approved the study. After a thorough evaluation, permission was granted to proceed. The survey initially prompted participants to read the consent form as they consented to participate in this study. Initial and post-intervention surveys were done on voluntary grounds. All answers were kept confidential. All survey forms and electronic copies of results will be stored for three (3) academic years and will be incinerated or deleted after.

3. Results

Demographic Profile

Table 1 shows the socio-demographic profile of the respondents on knowledge. There were 35 farmers included in the study. Fifteen (43.0%) respondents are male, and twenty (57.0%) are female. Of these, 16 (45.7%) in the 26-35 age group, 9 (25.7%) are aged 36-45, 9 (25.7%) are aged 46-55, and 1 (2.9%) are in the 56-65 age group. Concerning civil status, over half of the total population are married; 26 (74.3%), 7 (20.0%) are widows, and 2 (5.7%) are common law. In terms of the level of education attained by the farmers, most of the respondents are elementary graduates, 22 (62.9%) and 7 (20.0%) reached elementary level, 1 (2.9%) high school level, 1 (2.9%) college graduate, and 2 (5.7%) received no formal education.

Table 1. Socio-demographic profile of respondents on knowledge, n=35.

Demographics		***N (%)***
Gender	Male	15 (43.0%)
	Female	20 (57.0%)
Age	26-35	16 (45.7%)
	36-45	9 (25.7%)
	46-55	9 (25.7%)
	56-65	1 (2.9%)
Civil Status	Common Law	2 (5.7%)
	Married	26 (74.3%)
	Widow/Widower	7 (20.0%)
Educational Attainment	Elementary Level	7 (20.0%)
	Elementary Graduate	22 (62.9%)
	High School level	1 (2.9%)
	College graduate	1 (2.9%)
	Vocational	2 (5.7%)
	None	2 (5.7%)

Table 2 shows the socio-demographic profile of respondents on tractor operations. Out of the total of 35 farmers in the study, only 14 are operating their farm tractors. Out of these 12 farmers, all the respondents who operate their tractors are male. Of these, the majority of the tractor operators belonged to the 26-35 age group comprising 35.7% of the operators, followed by the 36-45 and 46-55 age groups with four (28.6%) operators, respectively, and one (2.9%) operator who ages between the age group of 56-65. Moreover, in their civil status, more than half of the total population are married; 9 (64.3%), 4 (28.6%) are widows, and 1 (7.1%) have common law. In terms of their level of educational attainment by the farmers who are operating tractors, most of the respondents are elementary graduates, 6 (42.9%) and 4 (28.6%) reached the elementary level. Two of the tractor operators were not able to have any formal education. The remaining respondents were able to reach high school and finish vocational school, respectively.

Table 2. Socio-demographic profile of respondents on tractor operations, n=14.

Demographics		***N (%)***
Gender	Male	14 (100.0%)
Age	26-35	5 (35.7%)

	36-45	4 (28.6%)
	46-55	4 (28.6%)
	56-65	1 (2.9%)
Civil Status	Common Law	1 (7.1%)
	Married	9 (64.3%)
	Widow/Widower	4 (28.6%)
Educational Attainment	Elementary Level	4 (28.6%)
	Elementary Graduate	6 (42.9%)
	High School level	1 (7.1%)
	Vocational	1 (7.1%)
	None	2 (14.3%)

Table 3 shows the socio-demographic profile of the respondents on thresher operations. Out of the total of 35 farmers included in the study, only 24 farmers are operating their farm thresher. Out of these 24 farmers, Eleven (45.8%) of the respondents are male and thirteen (54.2%) are female. Of these, 8 (33.3%) in the 26-35 age group, 7 (29.2%) aged 36-45, 8 (33.3%) belongs to the 46-55, and 1 (4.2%) belongs 56-65 age group. About civil status, over half of the total population are married; 17 (70.8%), 5 (20.8%) are widow, 2 (8.3%) common law. Concerning the level of education attained by the farmers, most of the respondents are elementary graduates, 15 (62.5%) and 5 (20.8%) reached elementary level. One respondent or 4.2% reached high school, graduated college, finished vocational school, and has not reached any formal education, respectively.

Table 3. Socio-demographic profile of respondents on thresher operations, n=24.

Demographics		***N (%)***
Gender	Male	11 (45.8%)
	Female	13 (54.2%)
Age	26-35	8 (33.3%)
	36-45	7 (29.2%)
	46-55	8 (33.3%)
	56-65	1 (4.2%)
Civil Status	Common Law	2 (8.3%)
	Married	17 (70.8%)
	Widow/Widower	5 (20.8%)
Educational Attainment	Elementary Level	5 (20.8%)
	Elementary Graduate	15 (62.5%)
	High School level	1 (4.2%)
	College graduate	1 (4.2%)
	Vocational	1 (4.2%)
	None	1 (4.2%)

Knowledge on First Aid for Common Farm Medical Emergencies and Tetanus Prevention

The respondents' knowledge regarding first aid for common medical emergencies and tetanus prevention was assessed using a 20-item interviewer-assisted questionnaire, answerable by true or false. Results revealed an increase in the mean knowledge score of the respondents from 10.86 to 17.06 in post-intervention 1 with a mean difference of 6.200. The increase was statistically significant, with a p-value of 0.000.

Four weeks after the intervention, a post-intervention two assessment was done. There was an increase in the mean knowledge score of 10.86 in the pre-intervention to 16.86 in the post-intervention 2 with a mean difference of 6.000 and a p-value of 0.000 which was statistically significant. However, a decrease in the mean score from 17.06 in post-intervention 1 to 16.86 in post-intervention two was noted with a mean difference of 0.2000.

The decrease was statistically insignificant with at p-value of 1.000. This means that although there was a decrease in the mean score from post-intervention 2 to post-intervention one, the knowledge decay has no significant difference.

Table 5. Comparison of mean knowledge scores on first aid for common farm medical emergencies and tetanus prevention pre-intervention, post-intervention 1, and post-intervention 2 using ANOVA repeated measures, n=35

Test Comparison	*Mean Score*	*Mean Difference*	*Sig.[b]*
Pre-test	10.86	Pretest – Posttest 1: -6.200	Pretest – Posttest 1: .000*
		Pretest-Posttest 2: -6.000	Pretest-Posttest 2: .000*
Posttest 1	17.06	Posttest 1 – Posttest 2: .200	Posttest 1 – Posttest 2: 1.000
		Posttest 1 – Pretest: 6.200	Posttest 1 – Pretest: .000*
Posttest 2	16.86	Posttest 2 – Posttest 1 : -2.000	Posttest 2 – Posttest 1 : 1.000
		Posttest 2 – Pretest: -6.000	Posttest 2 – Pretest: 000*

Knowledge on Pesticide Handling

The respondents' knowledge regarding pesticide handling was assessed using a 16-item interviewer-assisted questionnaire, answerable by true or false. As shown in Table 6, the knowledge of pesticide handling has increased from a mean score of 10.25 to a mean score of 14.63 with a mean difference of 4.38. The increase in score was statistically significant with a p-value of 0.000 which is less than the p-value of 0.05.

After four weeks of intervention, a post-intervention two assessment was done. It was noted that there was an increase in the mean knowledge score from 10.25 in the pre-intervention to 14.60 in the post-intervention 2, with a mean difference of 4.35. This increase was statistically significant, with a p-value of 0.000. It is also noted that there was a slight decrease in the knowledge mean score regarding pesticide handling from 14.63 in post-intervention 1 to 14.60 in post-intervention 2, with a mean difference of 0.03. However, it is noted that despite the slight decrease that the decrease has no significant difference with the p-value of 1.000.

Table 5. Comparison of mean knowledge scores on pesticide handling pre-test, posttest 1, and posttest 2 using ANOVA repeated measures, n=35

Test Comparison	**Mean Score**	**Mean Difference**	**Sig.[b]**
Pre-test	**10.25**	**Pretest – Posttest 1: -4.371**	**Pretest – Posttest 1: .000***
		Pretest-Posttest 2: -4.343	**Pretest-Posttest 2: .000***
Posttest 1	**14.63**	**Posttest 1 – Posttest 2: .029**	**Posttest 1 – Posttest 2: 1.000**
		Posttest 1 – Pretest: 4.371	**Posttest 1 – Pretest: .000***
Posttest 2	**14.60**	**Posttest 2 – Posttest 1 : -0.29**	**Posttest 2 – Posttest 1 : 1.000**
		Posttest 2 – Pretest: 4.343	**Posttest 2 – Pretest: 000***

Actual Practices

Tractor Operation

The actual practices of the respondents for tractor operations were assessed using eight (8) items checklist. Table 6 shows the frequency of respondents demonstrating correct tractor operation practices pre-intervention and post-intervention. Over 50% of the respondents showed correct practices on four items before the intervention. These items were on keeps clear of v-belt, pulleys, and flywheel; keeping children away from the tractor at all times; making sudden turns at low speed; and when the tractor is placed on a trailer, always observing speed limits.

All of the items had shown a positive increase in farmers showing correct practices immediately after the intervention. The majority of the increased number of farmers from all items has a positive significant difference. However, making sudden turns at low speed had shown no statistical difference, with a p-value of 0.063 greater than the p-value of 0.05.

A week after the intervention, post-intervention two was done. Most farmers are still doing the correct practices on tractor operations. However, one respondent decreased during the post-intervention two assessment from 15 (100%) to 14 (93.3%) farmers in keeping children away from the tractor at all times. Moreover, this drop has no significant difference in post-intervention 1 with a p-value of 1.000. All of the practices in post-intervention 1 and 2 showed no significant difference, which means that immediately after and two weeks after the intervention, the respondents were still doing the same correct tractor operations practices.

Table 6. Frequency of respondents with correct practices regarding tractor operation before and after intervention, n=14.

Item	Pre-Intervention	Post-Intervention 1	Post-Intervention 2	P-Value
1. Wears fit clothes when using the tractor	6 (40.0%)	12 (80.0%)	12 (80.0%)	Pre-Post 1: 0.031* Pre-Post 2: 0.031* Post 1 – Post 2: 1.000
2. Takes special care that feet do not slip into the rotavator.	6 (40.0%)	12 (80.0%)	12 (80.0%)	Pre-Post 1: 0.031* Pre-Post 2: 0.031* Post 1 – Post 2: 1.000
3. Keeps clear of V-belt, pulleys, and flywheel.	12 (80.0%)	14 (93.3%)	14 (93.3%)	Pre-Post 1: 0.063 Pre-Post 2: 0.063 Post 1 – Post 2: 1.000
4. Keeps children away at the tractor at all times.	8 (53.3%)	15 (100%)	14 (93.3%)	Pre-Post 1: 0.016* Pre-Post 2: 0.016* Post 1 – Post 2: 1.000
5. Drives the 2-wheel tractor up or down a steep slope at low speed.	7 (46.7%)	14 (93.3%)	14 (93.3%)	Pre-Post 1: 0.016* Pre-Post 2: 0.016* Post 1 – Post 2: 1.000
6. Goes down steep slopes in reverse to avoid tripping.	7 (46.7%)	14 (93.3%)	14 (93.3%)	Pre-Post 1: 0.016* Pre-Post 2: 0.016* Post 1 – Post 2: 1.000
7. Makes sudden turns at low speed.	11 (73.3%)	12 (80.0%)	12 (80.0%)	Pre-Post 1: 0.063 Pre-Post 2: 0.063 Post 1 – Post 2: 1.000
8. When the tractor is placed on a trailer, always observes speed limits.	10 (66.7%)	15 (100.0%)	15 (100.0%)	Pre-Post 1: 0.002* Pre-Post 2: 0.002* Post 1 – Post 2: 1.000

Pesticide Handling

The respondents' actual practices on pesticide handling were assessed using fourteen (14) items checklist. As shown in Table 7, there were five items which are; does not rub eyes or forehead during application; does not eat during application; does not drink during application; does not smoke during application; disposes empty bottles in the garbage; and does not store pesticide under the tree were demonstrated by the majority of the respondents correctly even before the intervention.

A week after the intervention it has shown that all of the items on the pesticide handling had shown a positive increase in the number of farmers demonstrating correct practices. A notable increase was in the use of goggles from 0 (0%) to 35 (100%) farmers since no one was using goggles before the intervention, and immediately a week after the intervention, all of the farmers are now using goggles during pesticide application. There was a provision of goggles given by the Fertilizer Pesticide Authority of the Department of Agriculture. All the increases on all items were statistically significant, with a p-value less than 0.05.

Four weeks after the intervention, post-intervention two was done. It was noted that there was an increased number of respondents who had correct practices in having a separate utensil for mixing pesticides. All of the correct practices of the respondents during post-intervention 1 were still being done by the respondents during post-intervention 2. All of the items on post-intervention 2 have no significant difference on post-intervention 1. Thus, the correct practices on pesticide handling are still being practiced even four weeks after the intervention.

Table 7. Frequency of respondents with correct practices on specific items regarding pesticide handling before the intervention, n=35.

Item	*Pre-Test*	*Post-Test 1*	*Post-Test 2*	*P-Value*
1. Have a separate utensil for mixing pesticide	13 (37.1%)	31 (88.6%)	35 (100.0%)	Pre-Post 1: 0.000* Pre-Post 2: 0.000* Post 1 – Post 2: 1.000*
2. Uses goggles	0 (0.0%)	35 (100.0%)	35 (100.0%)	Pre-Post 1: ----- Pre-Post 2: ----- Post 1 – Post 2: 1.000
3. Uses long sleeves	12 (34.3%)	32 (91.4%)	32 (91.4%)	Pre-Post 1: 0.000* Pre-Post 2: 0.000* Post 1 – Post 2: 1.000
4. Uses long pants	15 (42.9%)	34 (97.1%)	34 (97.1%)	Pre-Post 1: 0.000* Pre-Post 2: 0.000* Post 1 – Post 2: 1.000
5. Wears mask	17 (48.6%)	35 (100.0%)	35 (100.0%)	Pre-Post 1: 0.000* Pre-Post 2: 0.000* Post 1 – Post 2: 1.000
6. Does not rub eyes or forehead during application	24 (68.6%)	35 (100.0%)	35 (100.0%)	Pre-Post 1: 0.001* Pre-Post 2: 0.001* Post 1 – Post 2: 1.000
7. Does not eat during application	22 (62.9%)	35 (100.0%)	35 (100.0%)	Pre-Post 1: 0.000* Pre-Post 2: 0.000* Post 1 – Post 2: 1.000
8. Does not drink during application	22 (62.9%)	34 (97.1%)	34 (97.1%)	Pre-Post 1: 0.000* Pre-Post 2: 0.000* Post 1 – Post 2: 1.000
9. Does not smoke during application	28 (80.0%)	35 (100.0%)	35 (100.0%)	Pre-Post 1: 0.016* Pre-Post 2: 0.016* Post 1 – Post 2: 1.000
10. Removes clothes after pesticide application	12 (34.3%)	35 (100.0%)	35 (100.0%)	Pre-Post 1: 0.000* Pre-Post 2: 0.000* Post 1 – Post 2: 1.000
11. Washes hands after pesticide application	16 (45.7%)	35 (100.0%)	35 (100.0%)	Pre-Post 1: 0.000* Pre-Post 2: 0.000* Post 1 – Post 2: 1.000
12. Stores pesticide away from food and feeds	9 (25.7%)	35 (100.0%)	35 (100.0%)	Pre-Post 1: 0.000* Pre-Post 2: 0.000* Post 1 – Post 2: 1.000
13. Disposes empty bottles in the garbage	10	34	34	Pre-Post 1: 0.000*

		(28.6%)	(97.1%)	(97.1%)	Pre-Post 2: 0.000* Post 1 – Post 2: 1.000
14.	*Does not store pesticide under the tree*	27 (77.1%)	35 (100.0%)	35 (100.0%)	Pre-Post 1: 0.008* Pre-Post 2: 0.008* Post 1 – Post 2: 1.000

Thresher Operation

The actual practices on thresher operation of the respondents were assessed using a nine (9) item checklist. As shown in Table 8, only two (2) items on the checklist were being practice by the majority of the respondents even before the intervention such as checking the belt's alignment and tension; and maintains maximum feeding rate without overloading the engine. Four weeks after the intervention, there was an increase in the number of farmers doing the correct practices for all nine items. All of the items of the post-intervention 1 compared to pre-intervention had a significant difference which means that there was indeed a correction of thresher operations' practices after the intervention. Another four weeks later, the same number of farmers in the post-intervention 2 were practicing the correct practices for the correct use of thresher as compared to the post-intervention 1. Hence, there was no significant difference in terms of practice on the thresher operations in post-intervention 1 and post-intervention 2. Meaning to say, there was a retention of the practices even after 4 weeks from the post-intervention 1.

Table 8. Frequency of respondents with correct practices on thresher operation before and after the intervention, n=24.

Item		***Pre-Intervention***	***Post-Intervention 1***	***Post-Intervention 2***	***P-value***
1.	*Positions the thresher so that the straw is thrown with the direction of the wind*	11 (45.80%)	23 (95.80%)	23 (95.80%)	Pre-Post 1: 0.000* Pre-Post 2: 0.000* Post 1 – Post 2: 1.000
2.	*Checks each belt's alignment and tension.*	17 (70.80%)	24 (100.00%)	24 (100%)	Pre-Post 1: 0.016* Pre-Post 2: 0.016* Post 1 – Post 2: 1.000
3.	*Checks all pegs on the threshing cylinder for tightness.*	7 (29.20%)	22 (91.70%)	22 (91.70%)	Pre-Post 1: 0.000* Pre-Post 2: 0.000* Post 1 – Post 2: 1.000
4.	*Does not wear long sleeves with loose ends when feeding the thresher.*	6 (25.00%)	21 (87.50%)	22 (91.70%)	Pre-Post 1: 0.000* Pre-Post 2: 0.000* Post 1 – Post 2: 1.000
5.	*Maintains maximum feeding rate without overloading the engine.*	15 (62.50%)	23 (95.80%)	24 (100%)	Pre-Post 1: 0.008* Pre-Post 2: 0.004* Post 1 – Post 2: 1.000
6.	*Uses a stick to remove clinging straw from the oscillating screen to protect hands from possible injury.*	6 (29.20%)	23 (95.80%)	24 (100%)	Pre-Post 1: 0.000* Pre-Post 2: 0.000* Post 1 – Post 2: 1.000
7.	*Rotates the threshing cylinder*	11	23	24	Pre-Post 1: 0.000*

	manually at least five revolutions to ensure that there are no obstructions or interferences.	(45.80%)	(95.80%)	(100%)	Pre-Post 2: 0.000* Post 1 – Post 2: 1.000
8.	*Lubricates cylinder and fan bearings with good-quality general purpose grease every 25 hours of operation.*	9 (37.50%)	23 (95.80%)	24 (100%)	Pre-Post 1: 0.000* Pre-Post 2: 0.000* Post 1 – Post 2: 1.000
9.	*Inspect the machine regularly for loose, worn, or damaged peg teeth, concave bars, cylinder, discharge paddles and other parts, and tighten, repair, or replace them immediately.*	5 (20.80%)	23 (95.80%)	24 (100%)	Pre-Post 1: 0.000* Pre-Post 2: 0.000* Post 1 – Post 2: 1.000

Tetanus Immunization Coverage

Being the most at risk of contracting tetanus, lecture on tetanus infections and tetanus toxoid immunization for farmers was also included in the safety and health promotion. During the pre-intervention assessment, it was found out that none of the respondents reported that they were able to receive single dose of tetanus toxoid. None of the respondents was able to complete at least two doses of tetanus toxoid before this study took place. After the health education regarding tetanus infection and the importance of tetanus toxoid immunization among farmers, thirty-five or 100% of the respondents were able to have one shot of tetanus toxoid at 0.5 ml per dose.

Four weeks after the first dose, all of the respondents who have taken the first dose were also given the second dose of tetanus toxoid immunization. Thus, all of the respondents have been completely immunized with second dose of tetanus toxoid.

Table 9. Tetanus Immunization Coverage among respondents before and after intervention, n=35

	Before the Intervention	***TT immunization 1st Dose***	***TT immunization 2nd Dose***
Respondents who completed two doses of tetanus toxoid	0 (0.0%)	35 (100%)	35 (100%)

4. Discussion and Implication

The employed labor force of the agricultural industry in the Philippines comprises the second largest and is composed of 24.3% of the total labor force in the country. Therefore, the impact of work-related injuries and diseases does not only affect the individual but also the country as a whole. The International Labor Organization urges countries to ensure safe and healthy workplaces. That is why there is a need to intervene in such problems. Developing a safety culture in the workplace is an important part of the behavioral approach in improving occupational safety and health. Since human behavior is vital in improving OSH, risk assessment, risk management, and safety audits should be taught among these farmers. This study aimed to determine the effect of occupational safety and health promotion on the knowledge and practices of farmers on pesticide handling, safe machinery use, and tetanus prophylaxis. The occupational safety and health promotion was done through three facets of health education in the form of a lecture which includes: (1) pesticide handling, (2) safe machinery use, and (3) tetanus prophylaxis. The effect of the intervention is based on the respondents' knowledge scores and actual practices.

Initially the study employed two study groups, one (1) experiment and one (1) for control group. However, due to the differences in the timing of the farming activities of the two selected groups the control group was dropped from the study.

Knowledge

The knowledge of the respondents was evaluated in two parts. The first part involved questions on first aid management for simple wounds, fractures, and eye injury; tetanus infection; and the second part was on pesticide handling was determined at the baseline to be compared with the results after the intervention. During the pre-intervention phase, it has shown that the respondents lacked knowledge because they did not receive any formal training or seminar before the lecture. This can be supported by the finding of the study by Kim (2012) that farmers are at a greater risk of developing work-related diseases because they have little knowledge about the use of preventive measures, possibly because they work in small, often family-owned, workplaces that are geographically dispersed and challenging to reach which is similar to the situation of the respondents of this study.

For the first part of the questionnaire, the pre-intervention mean score of the respondents was 10.86. After the intervention, the respondents' mean score on the same questions increased to 17.06. It was statistically significant with a P-value of 0.000. The results indicate that the lecture effectively increased the respondent's knowledge. This increase in the mean knowledge score has validated the results of the previous studies that used lecture as a health education tool to increase their respective respondents' knowledge. Notably, there was a decrease in the mean score four (4) weeks after the intervention. The mean score was decreased to 16.86 with a mean difference of 0.20 and had no significant difference with a P-value of 1.000.

For the second part of the questionnaire, the pre-intervention mean score of the respondents of 10.25, which was increased to 14.63 during post-intervention 1 in which it has a significant difference with the P-value of 0.000, which is less than the P-value of 0.05. However, four (4) weeks after the lecture, it was noted that there was a decrease in the mean knowledge score from 14.63 to 14.60, with a mean difference of 0.03. However, this decrease has no significant difference, with a p-value of 1.000 greater than the p-value of 0.05. This means that the lecture as a health education intervention on pesticide handling effectively increased the respondents' knowledge. This can be supported by the study of Cabelin in 2016, which showed that lecture is an effective tool in increasing the respondents' knowledge on pesticide handling that can be translated into their practices later on.

The finding of this study follows the theory of Brown (1958) on decay, which was pointed out by different contemporary theories such as of Ricker and Cowan (2015), in which they pointed out that the principle of trace decay happens when information is stored as memory traces. The activation of such knowledge decreases with time, unless a recall is initiated or repeated. This explains the decrease in the mean scores in the first part and second part of the questionnaire observed four weeks after the intervention. The lecture was only done once and did not involve any demonstration-return demonstration of first aid and pesticide handling skills. Hence, the farmers could not actively engage in how first aid and proper pesticide handling should be done. Thus, the researcher would recommend employing a demonstration-return demonstration teaching style in future studies. The target of active learning theory, such as this demonstration-return demonstration, should engage actively in the learning process, which could increase retention (Brown, 2022).

Actual Practices

For the actual practices on safe machinery use, such as on tractor and thresher operations, most respondents had correct practices on some items in the observational checklist, even during the pre-intervention phase. However, it was noted that after the intervention, there was a significant increase in the number of farmers with correct practices from pre to post-intervention 1 and 2. During the intervention, it was noted that some farmers agreed with the lecturer on their common incorrect practices when operating the tractor and thresher. This was followed by questions and clarifications about the harm they could get if they continued doing those incorrect practices. The harms explained to the respondents by the lecturer that was being emphasized in the intervention might have increased the risk of perception of the respondents to specific hazards in machine operation and pesticide handling and have caused their change in their practices.

One of the major changes seen in practice during tractor operations is keeping children away from the tractor at all times. From 53.3% of the respondents to 100% in post-intervention 1 and 93.3% in post-intervention 2, it clearly showed that the harm explained when children are near the tractor could lead to tragic accidents such as death. The incorrect practice of these farmers during tractor operations is that they usually allow their children to ride on the tractor to help them in farming activities because it serves as a training ground for their family's business. This was supported by Fargo (2013) that 41% of farm deaths of children under 15 happen when these children regularly ride on tractors with their family members. These children are thought to be born and raised on the farm, and it was believed that they are needed to help in farming activities as soon as possible. Thus, these children are allowed by their parents to ride on the tractor.

Another major change in practice was more of their clothing and personal protective equipment use during farming activities, both on safe machinery use and pesticide handling. Before the intervention, it was noted that all of the observed respondents did not use goggles during pesticide handling. This finding was similar to the study of Esturco (2011) and of Estrada in 2016, in which farmers do not use goggles as protection. Thus, to bring a change in the farmers' perception, the lecturer during the study initiated giving away goggles, material safety data sheet, and how to read the label exercises to the farmers, which encouraged the farmers and their employers to provide goggles and gloves as part of the promotion on safe pesticide handling. According to the ILO Code of Practice on personal protective equipment, employers must assess and ensure the need to protect their employees against harmful substances, such as fertilizers and pesticides (ILO, Safety and Health in Agriculture: ILO Code of Practice, 2011).

Aside from the use of goggles, their clothing was also noted. Most of the respondents, during tractor operations, wear loose clothing. They also wear short sleeves and does not use a mask when handling pesticide. Most of the respondents during thresher operations wear long sleeves with long ends when feeding the thresher. Thus, the above-said practices are all incorrect. According to the study of Palis (2020), due to the farmers' beliefs and how

they perceive illness, the more knowledgeable they are, the more they are willing to invest in personal protective equipment. It was held true that during post-intervention 1 and 2, most of the respondents now wore gloves, long sleeves, pants, and masks during pesticide handling; they wore fit clothing when using the tractor and short sleeves when feeding the thresher. In the study of Palis (2020) that health education promoting greater awareness among farmers and laborers about pesticides and safe machinery use is highly effective. Thus, the health education intervention done in this study was an effective tool.

Tetanus Prophylaxis

For tetanus immunization coverage, all of the respondents were able to complete two doses of tetanus toxoid. It was found out during the pre-intervention that none of the respondents were able to have themselves vaccinated for tetanus. It is because it was too costly, and they have poor knowledge on tetanus vaccination and tetanus itself. It was noted that during the post-intervention 1 and post-intervention 2 all of the respondents had their immunization doses. The immunization schedule was done at the Barangay Health Station on the day based on the farmers' discretion. According to the record, 16 farmers took their first dose a day after the intervention, 12 farmers took their first dose 3-5 days after the intervention, and seven farmers took their first dose 5-7 days after the intervention. All respondents returned on the respective scheduled date of their second doses. Thus, Providing health education through lectures regarding work-related diseases and free immunization to such should be integrated as part of occupational safety and health.

Hence, in summary, lobbying for health policies on the informal sector of workforce must be strengthened. The Department of Agriculture in collaboration with the Department of Labor and Employment must enact programs that would benefit the farmers, and other workers that do not belonged to formal working sector. Aside from that, the Department of Health must make Tetanus Toxoid Immunization be part of the free health services available at the Barangay Health Station. The lack of supplies has clearly shown the zero immunization rate among farmers. Thus, there is an encompassing challenge to create an occupational safety and health program that would address the needs of the informal sector of the human workforce such as the farmers.

5. Recommendation and Conclusion

Conclusion

There were significant improvements in the mean knowledge scores of the respondents during post-intervention one compared to the pre-intervention. The results of post-intervention two after one month suggest minimal knowledge decay with a decrease in the mean knowledge. However, the knowledge mean score decrease in post-intervention 2 was statistically insignificant compared to the mean score in post-intervention 2.

The actual practices on tractor and thresher operations and pesticide handling improved significantly after post-intervention one and were still evident during post-intervention 2. The strategies taken effectively covered tetanus toxoid immunization, increasing the number of respondents who completed at least doses of tetanus toxoid immunization from 0% to 100%.

After the results were analyzed, the study concludes that there is a need for health information campaigns such as health education programs on famers on occupational safety and health. Since, these programs could actually put ideal practices into a reality. This study furthermore concludes that occupational safety and health promotion by a safety practitioner is an effective form of intervention in enhancing the knowledge and practices of farmers on safe machinery use, pesticide handling, and tetanus prophylaxis.

Recommendations

The study recommends that future studies on occupational safety and health must utilize the Hazards Identification, Risk Assessment, and Control Measures tool used by the Department of Labor and Employment in assessing health hazards present in the workplace. The study also recommends that the research assistants must be trained as Safety Health Officer for the sustainability of the study's outcomes. The study also suggests that there must be a control group to have a comparison versus the interventional group. The study suggests that it is better first to determine factors that attribute to the outcome of the wrong practices of the farmers or assess the risk of organophosphate poisoning through identification of signs and symptoms present in the farmers. The study further recommends that a cross-sectional study to be done on factors affecting compliance to ergonomic working conditions at the work must be done before intervening.

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