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Pesticide use among farmers in Mindanao, Southern Philippines

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Abstract. The hazards of pesticide exposure have been a growing concern all around the globe. Increase of susceptibility of farmers to pesticide intoxication is due to lack of knowledge regarding safe and proper pesticide handling. This study aims to assess the pesticide use and handling, perceptions on the pesticide effects to health and environment and the self-reported symptoms of potential pesticide poisoning among farmers in Mindanao, Southern Philippines. This study used a combination of an open-ended and a close-ended structured questionnaire where a total of 701 farmers were interviewed. Majority of the farmers believed that pesticide has negative effects to health and environment. Despite this notion, their unsafe handling of pesticides and non-compliance to proper utilization of personal protective devices may increase their risks to the potential danger brought about by exposure to pesticides. The most prevalent pesticides were those that belong to chemical families pyrethroid and organophosphate which are classified by WHO as Class II toxicity level. The most common complaints among farmers after the spraying sessions were skin irritation (32.95%), headache (29.55%), cough (23.30%), dry throat (15.34%), shortness of breath (14.96%), dizziness (14.20%), nausea (12.69%) and eye irritation (11.36%) which were manifestations of mild pyrethroid and organophosphate poisonings. These findings suggest that improving habits towards safe use and handling of pesticides among farmers by extensive trainings will significantly decrease pesticide poisoning incidences.
Key Words: knowledge, pyrethroids, personal protective devices, self-reported symptoms.

Introduction. The spreading concern about global food security has led to various approaches to improve food production systems and increase productivity. Toxic chemicals are purposely introduced to the environment to reduce the agricultural loss incurred due to the presence of pests (Singh & Kaur 2012). Despite their substantial contribution, the use of pesticides posts serious concerns about occupational hazard arising from the exposure of farmers, pesticide sprayers and residents living adjacent to heavily treated agricultural land. Indirect exposure occurs when the least degradable substances from pesticides remain in the soil penetrates into the ground water consequently contaminating the environment. These chemicals in turn enters the food chain by contaminating organisms thereby leading to possible adverse effects to human health (Dey et al 2013). On the other hand, people directly exposed to pesticides, such as production workers, formulators, sprayers, mixers, loaders and agricultural farm workers (Aktar et al 2009), are particularly at risk and frequently suffer acute as well as chronic poisoning symptoms. Several factors determine the safety of farmers from the potential risks of pesticide exposure namely, attention to details and safety precaution provided by the pesticide label, use of personal protective devices during the administration of pesticides, and proper storage and disposal of pesticides. Most often farmers had little knowledge of pest management as well as the consequences of pesticide use (Mahantesh & Singh 2009) and even if they are aware of the negative health effects of pesticides, many still use personal protective devices (PPDs)

inappropriately, or none at all, while handling pesticides (Pasiani et al 2012). Discomfort, carelessness, cost, or unavailability of protective devices are some of the reasons that attributes to the non-use and misuse of PPDs among farmers (Yassin et al 2002). In fact, despite high literacy level, most farmers do not care to read the instructions on pesticide containers and follow them (Devi 2009). Further, even training does little change regarding the proper use of pesticides (Mancini et al 2005).

It has been a growing concern in Malaysia, Thailand, as well as the Philippines regarding the impact of increased use of agropesticides on public health and safety, especially in farming communities. However, due to the growing populations, agriculture will always be an essential component of developing the economy of Malaysia, Thailand and Philippines. Thus, the introduction of modern farming technologies in these countries has meant increased use of fertilizers and pesticides to achieve higher agricultural productivity (Lum et al 1993). In the Philippines, agriculture is considered to be the most common form of employment where it comprises 41% of the total labor force (Palis et al 2006) in which its current industrial agriculture regime promotes the use of agrochemicals without considering their negative effects on the human health and the environment (Tirado et al 2008). Economically, the agriculture sector supply about 20% of its Gross Domestic Product (GDP) where crop production alone contributes about 510 Billion Pesos (P510B) to its national income (Lu 2009a). Specifically, rice production has tripled to more than 16 million tons in 2008 from 5 million tons in 1970 which was caused by the development of new agricultural technologies (Bordey 2010). Inspite of the presence of alternative methods for organic farming such as pest control and integrated pest management, these are not strongly sustained due to the extensive reliance of farmers on pesticide use neglecting its detrimental effects on community, health and environment (Lu 2009a). Due to improvements in agricultural industry, there is therefore a need to provide information on pesticide management practices and establish the impacts of the use of pesticide to the health of farmers and the environment. In order to address this issue, this study was carried out to decribe the types of pesticides used, pesticide handling practices, perceptions on the pesticide effects to health and environment and the self-reported symptoms of potential pesticide poisoning among farmers in Mindanao, Southern Philippines. It is hoped that the data generated from this study will raise farmers' awareness of the hazardous effects of pesticides to the community and environment. This research also aims to serve as a benchmark which will be an eye opener to the immediate agencies for their future intervention programs.

Material and Method. The study was carried out in several selected areas in Southern Mindanao popular for its agricultural yields of crops such as rice (*Oryza sativa*), corn (*Zea mays*) and cassava (*Manihot melanobasis*). These areas include the Municipality of Baungon and City of Valencia in Bukidnon Province; Municipalities of Alubijid and El Salvador in Misamis Oriental; Municipality of Panaon and City of Oroquieta in Misamis Occidental; Municipalities of Tukuran and Molave in Zamboanga del Sur (Figure 1).

Interviews were conducted within the months of August and September 2014. The data were obtained from farmers using a combination of an open-ended and a close-ended structured questionnaire (Annex A). Permission was obtained from both the barangay chairmen and farmer's association leaders on each areas before the study took place. A total of 701 farmers were interviewed of mixed gender, age range and socio-economic status. Farmworkers were visited from morning to afternoon at their farms or at their homes using a convenience sampling technique. The questionnaire included questions related to: respondent and household characteristics, property and crop characterization, names of pesticides used and its application, knowlegde and training in the use of pesticides, utilization of personal protective devices, symptoms of poisoning experienced from exposure to pesticides and knowledge on the effects of pesticide exposure to health and environment. Accomplished questionnaires were then electronically processed and summarized with the essential means and percentages computed.

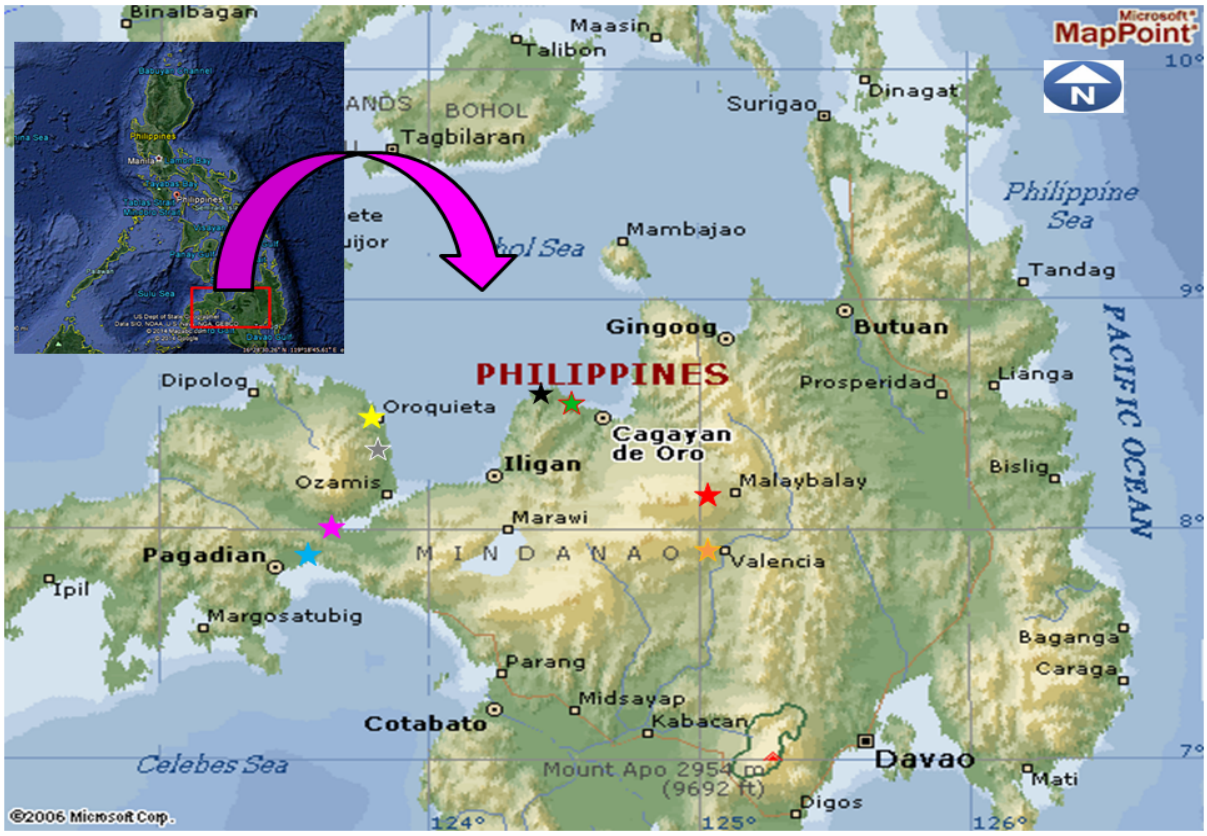

Figure 1. Geographical locations of the sampling areas where data were collected. Inset is the map of the Philippines with Mindanao enclosed in a red rectangle. Legend: ★ Municipality of Baungon; ★ Valencia City; ★ Municipality of Alubijid; ★ Municipality of El Salvador; ★ Municipality of Panaon; ★ Oroquieta City; ★ Municipality of Tukuran; ★ Municipality of Molave (Source: https://www.dipolognon.com)

Results and Discussion

Socio-demographic profile. A total of 701 farmers, who were engaged in rice, corn and cassava farming, participated in this study. Among these populations (Table 1), 528 were recorded as pesticide sprayers, while the remaining 173 (mostly women: 111) were non-sprayers and were involved in other agricultural activities such as seed and land preparations, weed control, fertilizer application and post harvest management.

Majority of the pesticide applicators were men (97.8%), while only a small proportion were women (2.2%). Most female respondents, who were not engaged in applying pesticides due to the heaviness of the knapsack sprayer, actively participated in other farming activities as mentioned above. Mancini et al (2005) reported that women in developing countries play a supportive role such as refilling tanks among others, which was proved to be as dangerous as direct pesticide application itself. Moreover, these farmers had large family sizes but owned or worked on small farm sizes (< 1 ha) such that they tend to maximize all family labors. Most often, female members were tasked to assist in farming activities in order to minimize expenses by not hiring additional workers. According to Pasiani et al (2012) family agriculture settings are quite common in small-scale farmers and often utilize manpower within their immediate family members to lessen farming operating expenditures (Jamala et al 2011).

The average age of farmers was 47.96 years (±12.97) most of whom (73.86%) were between 31 and 60 years of age thereby showing a relatively adult population. The same was also reported in most countries in Asia (Jensen et al 2011; Devi 2009; Lu 2009b; Van Mele et al 2001), Africa (Lekei et al 2014; Kolawole et al 2012; Mokhele 2011) and middle east (Issa et al 2010; Yassin et al 2002). It was not surprising to

observe few farmers with ages younger than 30 years old (9.7%) suggesting that agricultural employment may be undesirable for young generations probably because of the hard labor often associated with farming.

Majority of the respondents attended school, with almost half of them completed or reached elementary (42.23%) and secondary (40.1%) educations and some even attended tertiary level (13.45%) of which 3.1% obtained a degree. This would indicate that most of the farmers were educated which might lead to their ability to properly read and understand the instructions related to pesticide usage.

In terms of land ownership, one-third (38.64%) of the pesticide sprayers cultivated their own lands, while 38.45% of them have landlords and are caretakers or maintainees of parcels of farmlands.

Table 1

Social and demographic characteristics of farmer sprayers (N = 528) in Mindanao, Southern Philippines

Characteristics		*N*	*(%)*
Age	18–20	5	0.95
	21-30	51	9.66
	31-40	93	17.61
	41-50	125	23.67
	51-60	172	32.58
	61-70	61	11.55
	>70	21	3.98
Education	Illiterate/No schooling	17	3.22
	Elementary	226	42.80
	Secondary	210	39.77
	College	71	13.45
	Masteral	1	0.19
	Vocational course	3	0.57
Land tenure	Own	204	38.64
	Rent	72	13.63
	Caretaker	203	38.45
	Sharecropper	42	7.95
	Casual	7	1.33

Lifestyle habits of farmer sprayers. Majority of them (60.98%) reported history of smoking where most used cigarettes with filter (Table 2). Of these smokers, almost half (41.74%) admitted consuming 1-2 packs or boxes daily, while 21.07% and 35.95% consumed 1-5 pieces and 6-10 pieces per day, respectively. Most of the farmers (83.05%) started smoking while they were in their teens, while some (1.24%) even commenced as early < 10 years of age. On the other hand, most of the sprayers (67.80%) claimed they drink alcoholic beverages once (41.06%) or twice/thrice (35.47%) in a week.

Table 2

Lifestyle habits of farmer sprayers (N = 528) in Mindanao, Southern Philippines

Habits		*N*	*%*
Smoker		242	45.83
Non-smoker		206	39.02
Ex-smoker[1]		80	15.15
Type of cigarette (N = 242)	Cigarette with filter	218	90.08
	Tobacco	18	7.44
	Pipe	6	2.48
Number of cigarettes consumed daily (N = 242)	1-5 pcs	51	21.07
	6-10 pcs	87	35.95
	1-2 boxes[2]	101	41.74
	3-4 boxes	3	1.24
Age started smoking (N = 242; average = 21.46, SD = 3.99)	≤10	3	1.24
	11-15	71	29.34
	16-20	130	53.71
	21-25	31	12.81
	26-30	5	2.07
	>30	2	0.83
Drink alcoholic beverages (N = 528)		358	67.80
Frequency of engaging into drinking alcoholic beverages per week (N = 358)	Once	147	41.06
	2-3	127	35.47
	4-5	68	19.00
	6-7	16	4.47

[1]Ex-smoker – had quit smoking for at least 1 year (Mekonnen & Agonafir 2002); [2]One box of cigarette contains approximately 10-20 cigarette sticks depending on the brand.

Pesticide used. The adverse effects of pesticides to health are attributed to its active ingredient as categorized by the World Health Organization (2009). The active ingredients and classification of the chemicals used in the present study is shown in Table 3. The most commonly used pesticides are the moderately hazardous insecticide pyrethroids (cypermethrin and lambda-cyhalothrin, class II), the moderately hazardous herbicide Phenoxyacetic acid derivative (2,4 D IBE, class II) and the moderately-slightly hazardous insecticide organophosphates (Butachlore + propanil: class III, Chlorpyrifos: class II, Malathion: class IV and Diazinon: class II). The same trend was also reported among farmers in other countries where pyrethroids and organophosphates were one of the most commonly utilized pesticides (Lekei et al 2014; Dey et al 2013; Leungo et al 2012; Jensen et al 2011; Lu 2009b; Polidoro et al 2008; Chitra et al 2006; Jors et al 2006; Mancini et al 2005; Yassin et al 2002; Ngowi et al 2001; Van Mele et al 2001). Pyrethroids, which are ion channel toxins, act on the nervous system and could be considered harmful. These impacts may consist of extensive range of signs and symptoms from mild cases namely, nausea, headache, vomiting, dizziness, fatigue, anorexia and paresthesia (numbness/tingling sensation), to moderate conditions such as increased salivation, fever, blurred vision, diaphoresis (excessive sweating), fasciculations and central nervous system depression, to severe cases like seizures, coma, pulmonary edema and respiratory failure (Beasley & Temple 2013). In addition, pyrethroids can cause irritation to the skin, mucous membranes, respiratory tract and eyes. Conversely, organophosphates work by hindering the enzyme acetylcholinesterase so that nerve transmission will continue to function although nerve impulses have already reached their target muscles, organs or glands (Murphy et al 1999). As a result, excessive levels of acetylcholine will intensify in the muscles triggering the muscles to malfunction (Hayes & Laws 1991). Signs and symptoms will occur in response to excessive acetylcholine and may consist of mild cases which may be mistaken for those of flu, heat stroke or heat exhaustion, or upset stomach includes headache, fatigue, dizziness, loss of appetite with nausea, stomach cramps and diarrhea, blurred vision associated with excessive tearing, contracted pupils of the eye, excessive sweating and salivation, slowed heartbeat, rippling of surface muscles just under the skin, to moderate

cases comprised of all the signs and symptoms found in mild poisonings, plus unable to walk, chest discomfort and tightness, exhibits marked constriction of the pupils (pinpoint pupils), exhibits muscle twitching, has involuntary urination and bowel movement, and to severe cases like incontinence, unconsciousness and seizures (Schulze et al 2001). The use of strong and hazardous pesticides was prevalent because it was cheaper and is readily available. The farmers also believed that the application of stronger pesticides will provide better protection to their crops. Since 1987, the utilization of Class I pesticides in the Philippines had been increasing because they are cheaper (Rola & Pingali 1993) and were claimed to be more effective. According to Wesseling et al (1997), pesticides that are strongly banned or restricted due to its deadly effect tend to have the lowest cost in the market. Moreover, negligence in the enforcement of laws against utilization of dangerous pesticides in the Philippines is another reason why farmers can easily use hazardous chemicals despite knowledge on its potential risks to health (Rola & Pingali 1993).

Table 3

Pesticides used by farmer sprayers (N = 528) and its classification in Mindanao, Southern Philippines

Active ingredient	*WHO classification*	*Chemical family*	*N*	*(%)*
Cypermethrin	II	Pyrethroid	336	63.64
Lambda-cyhalothrin	II	Pyrethroid	246	46.59
2,4 D IBE	II	Phenoxyacetic acid derivative	226	42.80
Butachlore + propanil	III	Organophosphate	177	33.52
Niclosamide	U	Salicyanilide	107	20.27
Niclosamide ethanolamine salt	U	Nitro compound	93	17.61
Cartap hydrochloride	III	Nereistoxin	91	17.23
Chlorpyrifos	II	Organophosphate	84	15.90
Beta-cypermethrin	II	Pyrethroid	64	12.12
Malathion	U	Organophosphate	56	10.61
Metaldehyde	II	Aldehyde	41	7.77
Diazinon	II	Organophosphate	33	6.25
Carbofuran	IB	Carbamate	29	5.49
Phenthoate + BPMC	II	Organophosphate+Carbamate	23	4.36
Methomyl	IB	Carbamate	17	3.22
Glyphosate IPA	U	Phosphonoglycine	17	3.22
Coumatetralyl	IB	Coumatrin derivative	14	2.65
Thiobencarb	II	Thiocarbamate	13	2.46
Imidacloprid	II	Pyrethroid	13	2.46
Pyribenzoxim	U	-	12	2.27
Beta-cyfluthrin	II	Pyrethroid	12	2.27
Metsulfuron Methyl+Chlorimurone	U	Sulfonylurea	12	2.27
Endosulfan	II	Organochlorine	9	1.70
Fipronyl	II	Pyrazole	8	1.52
Fenoxaprop p-ethyl	III	Aryloxyphenoxypro-pionate	6	1.14
Difenoconazole+Propiconaloze	II	Azole	5	0.95
Zinc phosphide	IB	Inorganic zinc	5	0.95
Monochrotophos	IB	Organophosphate	2	0.38
Deltamethrin	II	Pyrethroid	2	0.38
Chlorantraniliprole	III	Oxadiazine	2	0.38
Copper hydroxide	III	Copper hydroxide	2	0.38
Tebuconazole	II	Triazole	1	0.19
MIPC (Isoprocarb)	II	Carbamate	1	0.19
Diuron	U	-	1	0.19
Thiophanate Methyl	U	-	1	0.19

IB – highly hazardous; II - moderately hazardous; III – slightly hazardous; U - unlikely to present acute serious hazard in normal use (WHO 2009).

Factors related to pesticide exposure. Knowledge, attitudes and practices are important factors that may enhance the exposure of pesticide applicators to hazardous chemicals. The present data revealed that most of the sprayers (77%) have been using pesticide for more than a year, with 28.78% stated working with pesticides for almost 2 decades (Table 4). Nearly all of them (72.88%) reportedly applied pesticides 2-3 times per planting season, with majority (72.35%) of the farmer sprayers working 3-8 hours in the farm per day during the growing season. Almost one-third of the farmers (29.17%) waited a week or more before re-entering the sprayed field, with 27.27% of the population waited only a day while a few (9.28%) returned immediately (in the afternoon) after the pesticide application (which was early in the morning). These results show that the farmers have been exposed to pesticides for longer period hence making them highly susceptible to the negative health effects of pesticides. Prolonged and frequent pesticide exposure could degrade the health of farmers and thus their productivity (Rola & Pingali 1993). All of the farmers obtained information about pesticide and its uses by consulting other farmers (40.15%) and from their local association (38.07%). Kolawole et al (2012) pointed out that membership to associations is very important since there could be pooling of resources among farmers enabling them to buy farm machines like land tillers as well as exchange ideas and tackle problems common to them. Regarding pesticide storage practices, almost all (94.89%) of the farmers stored the pesticide bottles/containers outside their homes such as farm huts, special storage together with wastes materials or in places that are not easily accessible to children, while a few (5.11%) reported they kept these in the kitchen along with other utensils, a practice which might expose children and adults to hazardous risks. Unsafe storage of pesticides is common among households in many developing countries where significant associations of poisoning incidence and pesticide storage with households has been found (Lekei et al 2014). Such were true in Phnom Penh, Cambodia (Jensen et al 2011) and Ethiopia (Mekonnen & Agonafir 2002), where some farmers reported storing the pesticides near to food commodities thus resulting to greater potential of daily unintensional exposure. Issa et al (2010) further emphasized the increased risk of pesticide exposure among family members within farm homes that were detected with higher frequency of pesticide residues.

Concerning farmer's belief of pesticide effect to health and environment, most of them perceived the hazardous impact that pesticide may have to their health (88.45%) and environment (89.16%) by killing the natural enemies of the pests and other non-target organisms such as birds, frogs, fishes, spiders, dragonflies and other insects. Despite this notion, most of the farmers still washed and cleaned their knapsack sprayer after the spraying sessions either directly on the field (29.16%) or along nearby canals (57.01%) and even a few washed it in nearby well (7.01%) or in the faucet/pump-well at home (6.82%). Half of them (47.79%) even admitted that after spraying they observed dead frogs, insects, rats, birds and fishes on the field. Other ecological impacts of pesticides to the environment can also be assessed by the disposal habits of empty containers. Almost half of the farmers bury these underground (43.94%), or kept these together with other waste materials (41.48%), and some dumped these containers anywhere within the proximity of their household (6.19%), while a few either sold it to junkyards (2.84%) or just throw these into the river (2.65%). According to Sawalha et al (2010), improper dumping of empty pesticide containers such as discarding these into immediate surroundings, into local waste bins, or even burying and reusing it at home can render danger to the environment and the general public. Other hazardous habits also consisted of improper washing of gears in water supplies utilized by the general public, inappropriate dumping of empty pesticide bottles, recurrent application of chemicals, eating and drinking during the duration of chemical spraying (Del Prado-Lu 2007; Shrestha et al 2010; Hurtig et al 2003). Unfortunately, such unsafe practices are still carried out in many developing countries (Lekei et al 2014; Shrestha et al 2010; Mahantesh & Singh 2009; Del Prado-Lu 2007; Recena et al 2006; Yassin et al 2002) and are considered as one of the problems often associated with pesticide use (Wesseling et al 1997). There is now overwhelming evidence that extensive use of pesticides do pose a potential risk to human health and other life forms and has adverse effects to the

environment. For one, certain pesticides at long-term but low-dose exposure can disrupt natural hormone properties leading to human health effects such as immune suppression, hormone disruption, diminished intelligence, reproductive abnormalities and cancer (Brouwer et al 1999; Crisp et al 1998; Hurley et al 1998). Other findings had also associated occupational exposure to pesticides with increased prostate cancer risk (Koutros et al 2013; Band et al 2011; Meyer et al 2007; Van Maele-Fabry & Willems 2004), sarcomas, multiple myelomas, cancer of the pancreas, lungs, ovaries, breasts, testicles, liver, kidneys, and intestines as well as brain tumors (WHO IARC 2008) and abnormal sperm quality and counts (Hossain et al 2010). Unwanted side effects to the environment include surface and ground water contaminations through runoff and leaching from treated soil, and air contamination from pesticide sprays which can spread over a distance and eventually killing or injuring non-target plant, fish, birds and other wildlife species (US EPA 2000).

Table 4

Knowledge, attitudes and practices of farmer sprayers (N = 528) regarding the use of pesticides in Mindanao, Southern Philippines

Practices		*N*	*%*
Years of pesticide use	2-10	140	26.52
	11-20	152	28.78
	21-30	117	22.16
	31-40	80	15.15
	> 40	39	7.39
Frequency of pesticide application per cropping/planting season	1	67	12.69
	2	187	35.42
	3	145	27.46
	4	81	15.34
	> 4	48	9.09
Hours spent in the farm by sprayers	1-2	86	16.29
	3-5	177	33.52
	6-8	205	38.83
	9-10	45	8.52
	> 10	15	2.84
Days passed before sprayers revisited the field	In the afternoon of the same day	49	9.28
	1 Day	144	27.27
	2-3 Days	130	24.62
	4-6 Days	51	9.66
	$\geq$ 1 Week	154	29.17
Information source regarding pesticide use	Reading from label	115	21.78
	Other farmers	212	40.15
	Farmer's Association in the area	201	38.07
Believe pesticides are harmful to the health (N = 701)		620	88.45
Believe pesticides are detrimental to the environment (N = 701)		625	89.16
Observe death of fish, frogs, birds (N=701)		335	47.79
Storage of pesticide products	In a special storage location (outside the house)	501	94.89
	In the house	27	5.11
Empty containers are	Buried/thrown in a hole	232	43.94
	Kept with other waste materials	296	56.06
	Dumped anywhere	36	6.82
	Sold to junkyard	15	2.84
	Dumped into the river	14	2.65
Wash sprayer tanks	In the field	154	29.16
	In river/irrigation canal	301	57.01
	In the faucet/pump-well at home	36	6.82
	In the well	37	7.01

The present findings may suggest that the farmers lacked the seriousness to observe proper disposal of chemicals despite their perception on its effects to the environment. Considering the hazardous nature these practices imposed to man and environment, government authorities must therefore embrace appropriate measures that may lead to safe disposal management.

Majority of the sprayers, all of whom do the mixing and spraying of pesticides, had read (84.85%) and followed the instructions and safety precautions (72.16%) stated on the pesticide label (Table 5). This is expected since most of these farmers were educated and even lived above the national poverty level. Moreover, significant details provided by the pesticide brands are also incorporated to guide farmers on the correct handling and usage of pesticides. The present results are in agreement with other studies (Leungo et al 2012; Isin & Yildirim 2007) where all farmers that were interviewed read the pesticide labels. During mixing and refilling of tanks, only 15.53% wore rubber gloves and almost half (49.05%) used masks however, these are either disposables or improvised masks (i.e. clothes that were wrapped around their faces which act as the only means of protection). The same trend was also reported in La Trinidad, Philippines stating cloth face masks to be unfit as personal protective device for some chemical contaminants (Del Prado-Lu 2007). Some studies reported that cloth masks, especially those made of cotton, increase the absorption rate of pesticides (Kishi et al 1995; Dey et al 2013). In addition, making use of disposable dust masks are inappropriate devices that may allow the passage of unwanted and hazardous pesticide fumes (Lekei et al 2014). In the present study, the farmers admitted that the reason why they seldom wore these protective gears is because they find these items inconvenient and unnecessary since they believed that their short exposure to pesticide during the mixing process will not pose any harm to them. During spraying, not all farmers complied with the full use of personal protective devices and clothing needed to ensure protection against pesticide exposures (Table 5). Although majority of the farmers wore hat/head cover (91.10%), full sleeve shirt (93.94%), full length trousers (94.51%) and mask (69.51%), most of these items are made of permeable cotton which are not suitable for pesticide spraying. Barely one-third of the farmer population put on protective goggles (29.9%) and gloves (23.1%), with only a few of them wore rubber boots (12.12%). Most of the sprayers did not wear shoes or rubber boots while spraying because it makes it harder for them to move around the rice field. Further, they seldom utilized protective goggles and gloves in handling pesticides since several farmers admitted that these items are costly, while others complained of inconvenience that they felt during the hot weather, and some thought that the only route of pesticides in entering the body was through inhalation.

According to reports, discomfort, extreme hot climate and high cost are the major factors for the partial utilization of personal protective equipment (Jensen et al 2011; Dey 2010; Devi 2009; Mahantesh & Singh 2009; Ohayo-Mitoko et al 1999). Generally, the common entry of pesticide into the human body are: 1) dermal, where pesticide can be absorbed through the skin of the body, hands and eyes; 2) ingestion through the mouth; and 3) inhalation of powders, airborne droplets or vapors by breathing via the nose into the lungs (Schulze et al 2001). Some studies have shown that farmers were at risk to effects of pesticides simply because they were not aware of inhalation and dermal absorption as entry points into the body (Sawalha et al 2010; Iorizzo et al 1996). It has been suggested that dermal exposure is the most important route of absorption that leads to acute pyrethroid poisoning (Zhang et al 1991). Hence, the present findings may indicate that most of the farmers do not follow the appropriate precautionary measures by not wearing adequate protective devices required in order to fully protect themselves from pesticide poisoning. Further, their misconception that pesticide can enter only via inhalation may put them at risk to pesticide poisoning. Inadequate use of protective gears have also been a common practice in other countries like India (Devi 2009; Mahantesh & Singh 2009; Chitra et al 2006; Mancini et al 2005), Cambodia (Jensen et al 2011), Bangladesh (Dey 2010), Indonesia (Kishi et al 1995), China (Chen et al 1991), middle east (Issa et al 2010; Salameh et al 2004; Yassin et al 2002) in most African countries (Lekei et al 2014; Mokhele 2011; Akhabuhaya 2005; Mekonnen & Agonafir

2002; Clarke et al 1997) and even in Latin America (Pasiani et al 2012; Feola & Binder 2010; Recena et al 2006).

Table 5

Personal protective measures among sprayers (N = 528) in relation to pesticide application in Mindanao, Southern Philippines

Protective measures		*N*	*(%)*
Read label		448	84.85
Follow label		381	72.16
Wear gloves while mixing		82	15.53
Wear mask while mixing		259	49.05
While spraying	Wear boots	64	12.12
	Wear gloves	122	23.11
	Wear goggles	158	29.92
	Wear hat	481	91.10
	Wear mask	367	69.51
	Wear long-sleeved clothes	496	93.94
	Wear long pants	499	94.51
	Observe wind direction	487	92.23
	Smoking while spraying	11	2.08
	Eating/drinking while spraying	6	1.14
	Change clothes/take a bath after spraying	464	87.88

Most of the farmers (92.23%) observed wind speed and direction before commencing to a spraying session, and all did not spray when strong winds were observed. Almost all of them even refrained from smoking (97.92%) and eating/drinking (98.86%) while spraying. The present findings are in accordance with those reports from other countries where majority of the farmers observed wind direction at the time of application (Pasiani et al 2012; Shrestha et al 2010). These procedures are important in reducing pesticide exposure especially in warmer countries where increase atmospheric temperatures tend to enhance the volatility of the chemicals, resulting in greater chances of inhalation and skin absorption (Silva et al 2005). After the spraying sessions, sanitary practices like changing of clothes and taking a bath were followed. Almost all of the farmers (87.88%) took a shower and changed their clothes after spraying. Similar findings were observed in other studies where many farmers perceived that removal of pesticide that came in contact to the body could be eliminated through washing and changing clothes (Sapbamrer & Nata 2014; Jensen et al 2011; Shrestha et al 2010; Mekonnen & Agonafir 2002) so that the hazardous effects of pesticides to health can be reduced (Mokhele 2011).

Pesticide exposure. The most common self-reported signs and symptoms among sprayers are presented in Table 6. The most prevalent complaints felt by farmers right after applying pesticides were skin irritation (32.95%), headache (29.55%), cough (23.30%), dry throat (15.34%), shortness of breath (14.96%), dizziness (14.20%), nausea (12.69%) and eye irritation (11.36%). The respondents who felt the said symptoms did not go to a doctor or the nearest health center because the symptoms were mild and tolerable. They reported drinking coffee or milk, drinking water and taking a sleep after feeling the symptoms as remedies. There were also a few who attributed the symptoms they felt to the nature of their work, that is hard labor associated with farming. The self-reported vision irritation may be due to direct contact of pesticide droplets with the eyes since most farmers in the present study did not utilize eye protective measures such as goggles during spraying. Respiratory problems such as cough and shortness of breath reported by pesticide sprayers might be attributed to their use of inappropriate masks since they had been employing disposable cotton masks and improvised cloth masks allowing chemical fumes to be inhaled and thereby irritating the

lungs. Common skin irritation manifested by farmers may be related to their infrequent use of gloves during handling, the repeated leaks of the backpack sprayer, working barefooted and the use of cotton clothing (i.e. long-sleeved and long-legged work clothes) that can increase dermal absorption during spraying of pesticides. Chen et al (1991) reported acute pyrethroid poisoning among sprayers in China due to careless usage of pesticides resulting to serious skin contamination with pyrethroids. Exposure of pesticides such as pyrethroids and organophosphates among agricultural farmers documented by other studies also demonstrated respiratory and vision problems, itchy eyes and dry/sore throat, nausea, dizziness and headache (Dey et al 2013; Singh & Kaur 2012; Jensen et al 2011; Lu 2009b; Del Prado-Lu 2007; Chitra et al 2006; Mancini et al 2005; Yassin et al 2002). The results of the present study may indicate that the short-term spraying activities done by the farmers may have exposed them to mild pyrethroid and organophosphate poisonings as reflected in their self-reported signs and symptoms. Further, their unsafe handling of pesticides and non-compliance to proper utilization of personal protective devices may increase their risks to the potential danger brought about by the exposure to pesticides.

Table 6

Reported self-percieved symptoms among the sprayers (N = 528) in Mindanao, Southern Philippines

Symptoms	*N*	*(%)*
Skin irritation*•	174	32.95
Headache*•	156	29.55
Cough	123	23.30
Dry throat*	81	15.34
Shortness of breath*	79	14.96
Dizziness*•	75	14.20
Nausea*•	67	12.69
Eye irritation	60	11.36
Excessive sweating*•	21	3.98
Loose bowel movement	11	2.08
Excessive salivation*•	4	0.76
Convulsion*•	3	0.57
Fatigue*•	3	0.57

*manifestations of pyrethroid poisoning; • manifestations of organophosphate poisoning.

Conclusions. Generally, the result of the present study indicates that symptoms of occupational and non-occupational pesticide poisonings are prevalent among Filipino farmers and may have been attributed to their longevity to pesticide exposure, unsafe practices in the storage of pesticides, improper disposals of empty pesticide containers, washing of backpack sprayers along the irrigation canals and near water supplies utilized by the general public and non-compliance in the use of personal protective devices in handling pesticides. Despite the farmers' knowledge regarding the impacts of pesticide use towards health and environment, they still lacked the seriousness to put it into practice so that their chances for possible pesticide poisoning enhances. It was also found that there were lapses in the regulation of pesticides due to the presence of the use of some of the banned and restricted pesticides such as endosulfan and monochrotophos. The probability of reducing risk associated with pesticide use is very low because the farmers think that the reduction of use in pesticides would also decrease the output of their farms. There is therefore a need of extensive trainings that would educate farmers to the possible hazards posed by pesticide use, proper handling and application, and possible alternative pest management methods, as well as extensive monitoring on the pesticide sold.

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ANNEX A

Survey Questionnaire on the Knowledge, Attitudes and Practices of farmers in Mindandao, Southern Philippines Regarding Pesticide use

Part I: Respondent and Household Characteristics

1. Name: _____

2. Gender: ☐ Male ☐ Female

3. Age:_____ Height: _____ Weight:_____

4. Educational attainment

☐ No schooling ☐ Elementary

☐ High School ☐ College

1st year ___ 2nd year ___ 1st year ___ 2nd year ___
3rd year ___ 4th year ___ 3rd year ___ 4th year ___

5. How many years have you lived in this locality?_____

6. Is your house near the rice field? ☐ Yes ☐ No

7. How many years have you worked as a rice farmer?_____
If less than 2 years, what was your work before? _____

8. Are you the main person responsible for the farming activities? (Planting, harvesting, spraying, etc.)

☐ Yes ☐ No

9. How many hours do you visit the rice field in a day?_____
How many days do you visit the rice field in a week?_____

10. How many are you in your home?_____

11. Do you have any helper in doing the farming activities:

Labor situation in your household	*How many*
Main labor	
Supplement labor	
Dependent	

12. Are there any family members working aside from farming?
☐ Yes ☐ No
If yes, what kind of work?
1:_____
2:_____
3:_____

Part II: Respondent Property and Crop characterization

13. How large is your farm?_____

14. Do you own the farm? Yes ☐ No ☐

15. If not, what is your agreement with the farm owner?

☐ Caretaker ☐ Rent the land
☐ Sharecropper ☐ Casual

16. How many times do you plant in a year?_____

17. Do you use pesticide in your farm? Yes ☐ No ☐

18. How many years have you been using pesticides? _____

19. Do you use any alternative pest control methods aside from applying pesticide?
Yes ☐ No ☐

If yes, what kind of method?_____

20. Why have you stopped using this alternative method?
☐ Pesticides are cheaper
☐ Lesser harvest
☐ Following others
☐ Time consuming
☐ Ineffective
☐ Others (Please specify)

21. Who decides about what pesticides will be used?
☐ Me ☐ The land owner ☐ Other family members

22. Upon purchase of pesticides, does it have any label?
☐ Yes ☐ Sometimes ☐ No

23. How often do you change the brands of pesticides?
☐ I only use one/typebrand ☐ Sometimes ☐ Always

If you change brands, why? _____

24. Who is responsible in applying the pesticides? ☐ Me ☐ Other Family members

25. Pesticides used

Name/Brand	*Purpose/Target pest*	*Number of times applied per cropping cycle*

26. Do you change the dose of the pesticides? ☐ yes ☐ No
If yes, why? ☐ Others changed doses ☐ Recommended by the distributor ☐ Increase in pest infestation ☐ Pests are resistant to pesticides ☐ For better effectivity ☐ Others (Please specify)_____

27. Do you mix pesticides with water? ☐ yes ☐ No

If yes, how much water do you mix?

Volume of water	*Name/brand of pesticides*	*Amount of pesticide per spraying container*

28. Do you mix different kinds/brands of pesticides?? ☐ Yes ☐ No
If yes, why?_____

29. How much was you harvest/yield last year? _____

30. Do you use different pesticide dosage in dry and wet season?
If yes, how much? Dry season:_____
Wet season:_____

Part III: Knowledge/Training

31.Where did you learn on how to apply pesticides?
☐ Reading From the label
☐ Other farmers
☐ Training from farmer's association
☐ Training provided by the local government

32. Did you observe any effects on your health in using pesticides?
☐ None ☐ Little effect ☐ Large effects ☐ Fatal Effects

33. Have you received any basic training on safe handling and applying pesticides?

☐ Yes ☐ No

If Yes, what kind of training?_____

If No, do you have any access with someone to provide such training? _____

Part IV: Protection habits

34. Kindly answer the following questions by checking either yes or no.

Habits Before Application	*Yes*	*No*
Do you read the label?		
If you cannot read, do let others read it for you?		
Do you follow the label?		
Do you use gloves while mixing the pesticides?		
Do you use goggles while mixing the pesticides?		
Do blow the nozzle when clogged?		
Personal protective Equipment while spraying		
Gloves		
Hat (Other head gears)		
Masks		
Long-sleeved clothes		
Long pants		
Do you observe wind direction before spraying?		
Do you spray even when it is windy?		
Do you smoke while spraying?		
Do you eat or drink while spraying?		
Do you change clothes after spraying?		
Did you bury you empty pesticide bottles?		
Do you store pesticides along with your food and medicines?		

35. Where do you wash your spray containers?

☐ In the field ☐ In the river/irrigation canal ☐ Faucet at home ☐ In the well

36. How many days do you let to pass before re-entering the rice fields after spraying? _____

37. Are there any social actions against pesticide use in your area?

☐ Yes ☐ No

If yes, how often? ☐ Sometimes ☐ Often ☐ Always

38. Where do you store the pesticides when not in use? _____

Part V: Health

39. Do you smoke? ☐ Yes ☐ No ☐ Ex-smoker

What type of cigarette do you smoke? ☐ Pipe ☐ Cigarette with filter ☐ Dried Tobacco leaves

How many sticks do consume in a day?

☐ 1-5 pcs ☐ 6-10 pcs1- ☐ 2 boxes ☐ 2-4 boxes ☐ 4-6 boxes

Age started smoking?

☐ 11-15 ☐ 16-20 ☐ 21-25 ☐ 26-30 ☐ >30

If you are an ex-smoker, how many years have you stopped smoking?

☐ Less than a year ☐ 1-3 years ☐ 4-5 Years

☐ 6-10 years ☐ >10 Years

40. Do drink any alcoholic beverages? ☐ Yes ☐ No

If yes, please specify?_____

How frequent in a week?_____

41. Do you have any perceived symptoms of possible pesticide poisoning while spraying?

☐ None ☐ Yes

If yes, what symptoms?

☐ Dry throat ☐ Difficulty in breathing ☐ Cough
☐ Excessive sweating ☐ Salivating ☐ Headache
☐ Eye irritation ☐ Skin irritation ☐ Nausea
☐ Diarrhea ☐ others (please specify_____

42. Do you think it was caused by the use of pesticides?

☐ Yes ☐ No

43. Did you consult a doctor? ☐ Yes ☐ No

If yes, what was the diagnosis?_____

If no, why?_____

44. Are there any sick members of your family? ☐ Yes ☐ None

If yes, what was the sickness?_____

Is there any history of this sickness in your family? ☐ Yes ☐ No

45.Do you know any farmer who died within the last 3 years?

☐ Yes ☐ No

If yes, do you think it was caused by pesticide use?_____

46. Do you think pesticide use has negative short term impacts on your health?

☐ No effect ☐ Little effect ☐ Large effects ☐ Fatal affects

47. Do you think pesticide use has negative long term impacts on your health?

☐ No effects ☐ Little effect ☐ Large effect ☐ Fatal affects

Part VI: Environment

48. Do you think that pesticide use have negative effects in our environment?

☐ No effects ☐ Little effect ☐ Large effect ☐ Fatal affects

49. Have you experienced any water contamination due to pesticide use?

☐ Yes ☐ No

50. Have you experienced any water contamination due to pesticide use?

☐ Yes ☐ No

51. Have witnessed any death of non-target organisms (fishes, frogs, birds) due to pesticide use?

☐ Yes ☐ No

Thank you so much for participating in this survey. Your answer will be of great use to our research. Once again I assure you with the confidentiality of your identity and your answers. Rest assured that the data will not be relayed to other groups or persons and will only be used for research and academic purposes.

Part II: Interviewer Debriefing Questions
(For the interviewer only)

52. Do you think the respondent answered truthfully?

☐ Very uncertain ☐ Moderately uncertain ☐ Neutral

☐ Moderately Certain ☐ Very Certain

Data entry operator (name): _____

-END-