Our farmers at risk: behaviour and belief system in pesticide safety

Florencia G. Palis, Rica Joy Flor, Hilary Warburton and Mahabub Hossain

Abstract

Background The study was done in three villages in Nueva Ecija, Philippines. It surveys farmers' belief system and pesticide practices relative to health and safety.

Methods Initially it used a simulated market study on willingness to pay for personal protective equipment in the form of gloves and masks. Then a combination of semi-structured, formal, informal, and key-informant interviews, as well as focus groups, and field observations was done intermittently in a span of approximately 12 years.

Results The farmers perceive illness in terms of inability to function. Pesticide to them may not be a threat because (i) they are immune, (ii) it is regarded as a medicine that is needed by the plants rather than poison, and (iii) exposure is only through inhalation and ingestion not through dermal contact. Added to that, they put value on pasma, and try to prevent it at the cost of exposure to pesticides. These perceptions lead to their practices showing inadequate protection.

Conclusion There is the need for more health education programs that tap farmers' belief system and cognitive categories to stress the need for precautions.

Keywords: illness, pasma, personal protective equipment, pesticides

Introduction

Since the green revolution in the early 1970s, pesticides have been a major component in food production. Although the green revolution has doubled rice production in Asia, the use of pesticides had adverse effects on the environment and human health, making it an important concern in public health. An estimated 1.3 billion workers are active in agricultural production worldwide, 80 per cent of these are found in Asia. In the Philippines, 41 per cent of the total labour force is in agriculture. The ILO estimates that as much as 14 per cent of all occupational injuries are due to exposure to pesticides and other agrochemical constituents, and 10 per cent of these – around 17 000 per year – are fatal.

The World Health Organization (WHO) and the United Nations Environmental Programme estimated that one to five million cases of pesticide poisoning occur among agricultural workers each year with about 20 000 fatalities. In Philippines, of the 4031 acute pesticide poisonings reported by government hospitals from 1980 to 1987, 603 resulted in death. The number of poisonings is likely underestimated, because most cases do not reach the hospital, and health officers may not always correctly diagnose pesticide poisoning.

Reasons for poisoning cases include lack of protective equipment and use of defective equipment. Poisoning episodes among farm workers occur during spraying, mixing and diluting of pesticides. The use of malfunctioning or defective equipment is also an important contributor. Pesticides enter the human body through skin absorption, inhalation or ingestion. In tropical countries where temperature and humidity are high, pesticide uptake is likely higher because the individual is hot and sweating.

This article aims to explore farmers' perceptions and beliefs on illness and pesticides and relate them with their safety behaviour and willingness to pay for personal protective equipment (PPE). We hypothesize that farmers' perceptions and beliefs about pesticides and associated health risks differ from public health views causing them to undervalue the effects of pesticide exposure. In this article, we utilize both cognitive and symbolic anthropology through the interpretations of farmers, which ultimately reflect the belief system which is apparent in their pesticide perceptions and safety practices. According to the health belief model, these perceptions relate to the importance of health to the individual, his perceived susceptibility and perception of the severity of the illness that may result. This then translates to certain behaviour towards maintaining good health or using adequate precautions.
Methods

This article came from a study in 1991 which was followed up intermittently through the years until 2002. It initially aimed to explore farmers’ precautionary measures and willingness to pay for PPE by introducing the use of masks and gloves to a random sample of 162 farmers and labourers from the three study villages of Cabanatuan City, Nueva Ecija, Philippines: Lagare, Caalibangbangan and Santa Arcadia. Labourers here referred to hired agricultural farm workers.

In this study, black neoprene (chemical resistant) gloves and dual-cartridge respirators designed for agricultural spray were regarded as PPE in safeguarding farmers’ health. The masks were recommended by pesticide applicators at International Rice Research Institute (IRRI) as being the most important piece of protective clothing while gloves were chosen being one device that gives the most protection, as the hands are particularly subject to pesticide exposure.

Data were gathered using a combination of quantitative and qualitative methods such as semi-structured formal interviews, informal interviews, focus groups, key informant interviews, field observations and simulated market survey.

Results

Farmers’ pesticide practices and precautionary measures

Most common pesticides used by farmers were highly hazardous chemicals according to the WHO classification. The liquid pesticides or soluble powder formulations were often applied by mixing the concentrated pesticide with water. During mixing, the concentrated chemical was poured into the lid of the sprayer or pesticide bottle top and then poured into the sprayer increasing the risk of spilling. This was normally done 8–12 times to spray a 1-hectare field. During spraying, the farmer sprayed in the direction where he was going and he therefore walked in a cloud of spray. This worsened if the farmer sprayed against the wind. Farmers also mentioned leaks and chemical dripping directly onto their backs or from the hose of the sprayer, which they held with their hands, making them vulnerable to high levels of dermal exposure.

The most common precautions taken were avoiding spraying under strong sunlight, wearing ‘protective clothes’ such as long pants and long-sleeved shirts, avoiding spraying against the wind and avoiding smoking while spraying. An extreme precautionary response was getting someone else to spray.

Protective clothes, however, are not adequate protection. Around 35 per cent of the respondents wore some kind of mask, normally a T-shirt or handkerchief tied around their nose and mouth. The clothes used by sprayers, although giving some protection, also absorb pesticide spray that likely cause secondary dermal exposure. Cloth masks gradually become saturated with chemicals and can do more harm than good.

Health and safety intervention: use of gloves and masks

Only around a third of the farmers and labourers bought the gloves and masks. Most of the farmers and labourers, however, are not willing to pay for the PPE. Actual use of masks (100 per cent), however, was higher than the use of gloves. For those who bought gloves, only about 70 per cent used these for mixing and spraying pesticides while the remaining 30 per cent used them instead for weeding, doing laundry, cleaning dikes or playing baseball. The common reasons given for not using gloves were too stifling to be used, uncomfortable and can cause an illness called pastma.

Health beliefs on illness

In local definitions, health or kalusugan is primarily defined as ‘the state of being able bodied’, with the implicit assertion that one is able to work or to function. This connotes that if one has an illness or sakti, there is the inability to function. Sakti may also mean ‘pain’ but it is used as a context and with varying

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Most common harm reduction measures taken by Central Luzon farmers and labourers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method</td>
<td>Farmer [frequency (%)]</td>
</tr>
<tr>
<td>Avoids spraying when very hot (sprays as early as possible)</td>
<td>72</td>
</tr>
<tr>
<td>Wears a shirt or jacket with long sleeves</td>
<td>71</td>
</tr>
<tr>
<td>Avoids spraying against the wind</td>
<td>66</td>
</tr>
<tr>
<td>Avoids smoking while spraying</td>
<td>61</td>
</tr>
<tr>
<td>Wears long pants</td>
<td>52</td>
</tr>
<tr>
<td>Wears a hat</td>
<td>40</td>
</tr>
<tr>
<td>Wears a cloth or mask over the nose and mouth</td>
<td>35</td>
</tr>
<tr>
<td>Gets someone else to spray</td>
<td>20</td>
</tr>
<tr>
<td>Eats or drinks something sweet before spraying</td>
<td>9</td>
</tr>
<tr>
<td>Washes immediately afterwards (before taking a rest)</td>
<td>6</td>
</tr>
</tbody>
</table>

No one reported wearing gloves, goggles and boots while spraying pesticides.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Purchase of personal protective equipment (PPE) by farmers and labourers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category</td>
<td>Farmer [frequency (%)]</td>
</tr>
<tr>
<td>Gloves</td>
<td></td>
</tr>
<tr>
<td>Bought the gloves</td>
<td>30 (31)</td>
</tr>
<tr>
<td>Did not buy the gloves</td>
<td>66 (69)</td>
</tr>
<tr>
<td>Mask</td>
<td></td>
</tr>
<tr>
<td>Bought the masks</td>
<td>27 (28)</td>
</tr>
<tr>
<td>Did not buy the masks</td>
<td>69 (72)</td>
</tr>
</tbody>
</table>
degrees or qualities. People may at first seem unconcerned about health maintenance, or in the case of illness, they wait for symptoms to worsen, depending on the level of activity they are still able to do.28

Illness is attributed to natural phenomena and susceptibility. Natural phenomena are outer conditions categorized with diet, supernatural entities or even ‘germs’. The inner conditions are those that are innate in the individual such as ‘strength of life’ or susceptibility, which is perceived to be affected by fatigue, hunger, overheating, thin or weak blood, old age or pre-existing illness. Hence, for one to become sick, a combination of these two conditions must be satisfied.28

Health is closely associated with the notion of balance and equilibrium. Avoiding sudden extreme temperature conditions and keeping the body heat-balanced are considered important to health maintenance.29 Many Filipinos generally believe this hot/cold syndrome which forms the basis for the concept of pasma literally, ‘spasm’ or ‘exposure illness’28,30 and is characterized by weakness or trembling muscles or in symptoms like arthritis, numbness and paralysis.31 Thus this belief in pasma, like the effects of overheating when wearing gloves or taking a cold shower right after spraying are thought to be worse than the effects of pesticides.

**Pesticide practices: mirrors perceptions and beliefs**

*Pesticides are not health threats as long as the person is immune*

Most respondents did make some attempts to protect themselves against pesticides but around a quarter of the respondents took no special precautions. The foremost reason given was that they were immune or not susceptible to pesticides because malakas ang kanilang dugo or kaya ng kanilang dugo ang mga gamot ng halaman (their blood is strong or their blood can take pesticides). Others who suffered ill effects of pesticides described the reactions as ‘allergy’ to pesticides.

Immunity or non-susceptibility is seen as inherent to the person and not the result of precautions taken. It is associated with ‘strong blood’, good health and youth explaining farmers’ notion that pesticides only harm certain types of people (i.e., the old, the weak) and not those who are immune and that pesticides are harmful only under certain conditions (Table 3).

The concept of immunity has led to farmers’ employing their sons or hiring young people as pesticide applicators, as soon as they are old enough to spray, in the belief that young men are less susceptible to pesticide poisoning because they are younger and stronger. In the same 1991 survey, 47 per cent did the spraying themselves (farmers), whereas 41 per cent used family labour, often their sons. The average age of hired pesticide applicators was 25, ranging from 17 to 35. This may explain findings on young males in farming communities facing an abnormally higher risk of cardiac problems than older males because they are generally the pesticide applicators.19,32,33

### Table 3 Perceptions about pesticides and pesticide use among Central Luzon farmers

<table>
<thead>
<tr>
<th>Perception/Use of Pesticides</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pesticides are harmless</td>
<td>Farmers suffer from ill effects, but they attribute these to causes other than pesticides.</td>
</tr>
<tr>
<td>Pesticides are harmful only under certain conditions or harm is done through certain entry points into the body</td>
<td>Farmers think they are already taking sufficient precautions.</td>
</tr>
<tr>
<td>Pesticides harm only certain types of people – e.g. the old, the weak, but not those who are ‘immune’</td>
<td>Pesticides are harmful, but precautions do not help; they cause more harm than good.</td>
</tr>
</tbody>
</table>

Hence, this immunity belief increases the risk of young people to cardiovascular-related problems, supposedly uncommon among young people, through recurrent pesticide exposure from an early age.

**Analogy of human and plant care calls for pesticide use**

Pesticides may also be seen as necessitated by belief in the analogy of human and plant health care. Farmers often suggest a parallel in managing or caring for the health of plants and humans, resulting in many overlaps in the linguistic terminologies employed for both humans and plants. To Filipino farmers, rice plants at the early stage are more vulnerable to pest infestations than at the ripening stage like a baby is more susceptible to illnesses and diseases than an adult. Thus, farmers usually applied pesticides in the first 40 days after transplanting, mostly against leaf feeding insects like the leaffolder. Scientific evidence, however, had shown that leaffolder damage at the vegetative stage could not affect crop yield because plants could still recover.34 Farmers often commented that ‘If the plants are still young, they have to be taken care of’ to prevent pest infestation, ensure good health and eventually good yield. In the same way that a sick baby is given medicines, a young rice crop needs pesticides for its sickness.

**Dichotomy in pesticide perception: poison and medicine**

The concept of pesticides configures into a dichotomy – a poison to pests and a medicine to plants. In one category, pesticides are referred to as gamot (medicine), because they heal the illness or disease of the plant.35 The other category labels them as pestisidyo, or even lason (poison) because pesticides kill the pests that damage their crops.

The dual concept of pesticides leads to divergent views on their health effects to humans, that pesticides are either harmless or harmful (Table 4). According to farmers, pesticides are harmful because they not only kill the pests but also people and animals. As one farmer told us

My neighbor died 20 years ago. He sprayed during noon time. He was about to finish his work, but he vomited, felt weak, fell down, fainted, and died before reaching the hospital.
Table 4 Farmers’ reinterpretations of the pesticide dichotomy

<table>
<thead>
<tr>
<th>Description</th>
<th>Positive characteristics</th>
<th>Negative characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selfish person</td>
<td>Gives effort</td>
<td>Killer</td>
</tr>
<tr>
<td>Insincere</td>
<td>Shows good</td>
<td>Has bad intentions</td>
</tr>
<tr>
<td>Politician</td>
<td>Externally good</td>
<td>Hiding his true identity</td>
</tr>
<tr>
<td>Friend</td>
<td>Good</td>
<td>Bad when taken too seriously</td>
</tr>
<tr>
<td>Usurer</td>
<td>Gives money</td>
<td>Charges high interest</td>
</tr>
<tr>
<td>Albularyo/healer</td>
<td>Finds a cure</td>
<td>May do more harm than good</td>
</tr>
</tbody>
</table>

Most farmers reported that they had felt some ill effects of pesticide application such as headache, dizziness, and vomiting that normally occur during or after spraying. Despite these, people treat pesticides as something useful and ordinary in that they are using it in their everyday normal dealings, with less safety precautions including storage and disposal, concurring to earlier findings. Pesticide mistaken for flour caused the food poisoning of more than 100 children resulting to 27 deaths last 9 March 2005 in Bohol, Philippines, a case of unsafe pesticide storage. Whatever the cost of people’s health, pesticides may still be viewed as harmless when perceived as medicines that heal crop diseases in the same way that medicine heals people.

Farmers also reinterpret the binary concept in different ways which ascertains the duality of the perceptions about pesticides (Table 4). For example, some see pesticides as a politician, hiding behind the shadow of his true identity, doing something else from what he says. Pesticides to farmers come in both the good and the bad in one package. There is the belief that pesticides help in killing insects but other lives are sacrificed in return. This blurred perception about their helpful effects is reinforced when chemical salespersons stress the ‘medicinal’ effects of pesticides on plants.

Pesticide exposure through inhalation and not through dermal absorption

Most of the respondents perceived that pesticides might only be dangerous through inhalation and oral ingestion. Contact or exposure of pesticides on the skin may only cause a kirot (discomfort) and is not considered detrimental to health. Thus, the hazards of pesticide absorption through the skin, especially the hands, are underrated compared with precautions against inhalation and ingestion.

Consequently, none of the respondents reported wearing gloves or boots while spraying pesticides (Table 1). Only few of those who bought the gloves were seen using them in 1992 and none afterwards. Almost all respondents bathed and changed their clothes after spraying, but not necessarily straight away. The majority took a rest of at least 30 minutes before washing their hands. Others washed hands and feet after spraying, but did not change completely until they had finished all work for the day allowing dermal exposure. All these behaviours reflected farmers’ unawareness of the dermal routes of pesticide poisoning and giving more concern on pasma.

Table 5 Contributing factors on the willingness to pay for personal protective equipment (PPE)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Gloves Farmers</th>
<th>Gloves Labourers</th>
<th>Mask Farmers</th>
<th>Mask Labourers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>−1.92</td>
<td>−2.04</td>
<td>5.43</td>
<td>−26.3*</td>
</tr>
<tr>
<td>Age (log)</td>
<td>−0.5</td>
<td>0.01</td>
<td>−3.07†</td>
<td>−0.87</td>
</tr>
<tr>
<td>Education (log)</td>
<td>2.01*</td>
<td>0.21</td>
<td>0.61</td>
<td>1.50</td>
</tr>
<tr>
<td>Farm size (log)</td>
<td>1.75</td>
<td>0.21</td>
<td>0.85†</td>
<td>0.54</td>
</tr>
<tr>
<td>Income (log)</td>
<td>−0.03</td>
<td>−0.05 E(+4)</td>
<td>0.36</td>
<td>2.93†</td>
</tr>
<tr>
<td>Belief in pasma</td>
<td>−2.90†</td>
<td>−2.72†</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant at α = 0.05.
† Significant at α = 0.10.
‡ Significant at α = 0.01.

Willfulness to pay for PPE

Education and the belief that gloves would cause pasma significantly affected farmers’ willingness to pay for the gloves (Table 5). The more educated the farmer, the more he was inclined to pay for the gloves; while a farmer who believed that wearing gloves would cause pasma, the more he was less inclined to pay for the gloves. Forty-one per cent of the respondents acknowledged that using gloves might cause more harm than protection specifically pasma, because the hands would be muggy, which is in agreement with their perceptions about pesticides (Table 3).

On the other hand, age and farm size significantly affected farmers’ willingness to pay for the masks. Farmers who were more willing to pay for the mask were young, and working on a larger area. Notably, younger farmers did the spraying, which is strongly associated with the concept of pesticide immunity or kaya ng dugo. Also, the larger the farming area, the greater the exposure to pesticide sprays.

Among the labourers, income and belief in pasma were significant factors contributing to the willingness to pay for the gloves. Income significantly contributed to the labourers’ willingness to pay for the masks but not for farmers. This indicates the profound disadvantage of a farm labourer in protecting himself from the hazards caused by pesticides to his health. The wage rate for agricultural farm workers in Central Luzon was US$7 and US$4 in 1991 and 2002, respectively. Aside from the low pay for farm work, the availability of work itself was uncertain for a hired farm worker on a daily basis. Thus, income or the absence of it, presents a dilemma for the labourer and his family: the uncertainty of having something to eat today or the probability of his being sick in the future.

Conclusion

Filipino farmers and labourers do not take adequate protection from pesticides. Their beliefs on how illness is brought about, perceptions and beliefs on pesticides, as well as their functional definition of health and its maintenance, have inevitably led to
certain actions that hampered their taking preventive measures to protect themselves from the ill-health effects of pesticides.

The belief of immunity, that some (particularly the young) are not susceptible to the adverse health effects of pesticides, has contributed to farmers’ thinking that they are not at risk. There is a need therefore to stress that everyone is at risk to acute or chronic pesticide poisoning, especially when one is exposed to pesticides on a regular basis. Thus, the need to promote the importance of PPE and safety practices when using pesticides.

The dichotomy in the belief of pesticides as both medicine and poison has put the medicine concept above the poison concept. Health education programs should then stress the poison side of pesticides. The proper choice of words is critical in educational campaigns for safety practices in using pesticides. Health educators should promote and emphasize the use of the word lason (poison) and not gamot (medicines) to refer to pesticides. This is particularly important to counter information disseminated by chemical companies that stress the ‘medicinal’ effects of pesticides on plants when they promote their products.

All these beliefs and perceptions relate to how farmers and labourers are willing to pay for PPE. Many of them see no point in spending on things that just might cause other illnesses such as pasma as in the case of using gloves to protect the hands from pesticides spill over and sprinkles.

A health education program promoting greater awareness among farmers and labourers about pesticides is highly needed. This awareness should tap the belief system. It should include relevant information that explicitly takes into account farmers’ beliefs and perceptions about pesticides and specific details of how pesticides can enter the body, who are those at risk and how they can reduce their exposure.

The promotion of integrated pest management and the introduction of new, less toxic chemicals may help reduce the risks to farm families. However, many farmers and labourers are exposed to pesticide hazards, which they could reduce if they had more information about health hazards and appropriate safety measures. In addition, the use of protective equipment suitable for tropical farm workers should be promoted. Governments, particularly in developing countries, should take the lead in spearheading well-targeted and culturally appropriate health education programs. Non-governmental organizations (NGOs) and even the pesticide industries should also provide information on pesticide hazards and precautionary measures.

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