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Pest management services and pesticide handling practices of smallscale pesticide dealers: the case of Kwaebibirim District, Ghana

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ABSTRACT

Public outcry on the exposure of pesticides has been associated with the inappropriate use of pesticides by farmers. Little is known on the contribution of small-scale pesticide dealers in exposing the public to pesticides. Fifteen small scale pesticide dealers were interviewed in order to ascertain how their activities can expose the public to pesticides. Results reveal that small scale pesticide dealers are involved in many activities that expose the public to pesticides contaminations. The use of protective equipment in the handling of the pesticides is almost zero. Many do not wash their hands after handling pesticides and they also sell food and 'purewater' alongside pesticides. Pesticides are also transported in passenger cars and often are stored in kitchens in their houses. Dealer's children and other family members who are not trained in handling such hazardous substances also assist in selling the shops.

Some dealers use and sell empty pesticide containers to the public. However, dealers who are members of Ghana Agri-Input Dealers Association (GAIDA) show restraint to some activities that can potentially expose the public to pesticides contaminations. Regular checks and education of smallscale pesticide dealers may create awareness and improve the standards of their operations.

Keywords: contamination, exposure, food, hazardous substances, protective equipment

1. INTRODUCTION

Pesticides are substances used to control/manage, repel or kill pests and diseases pathogens and may be naturally occurring or synthetically derived (Lengai et al., 2020; Kumar et al., 2021; Sarkar et al., 2021). They are specially designed to be toxic to target pests and can be dangerous if they are misused or mishandled. The importance of pesticides has been well documented (Cooper and Hans, 2007). Just to mention a few, pesticides have been shown to increase yield, increase aesthetic and cosmetic value of crops and control pest; given the crops room to attract premium prices (Blay et al., 2006). However, the maximum benefits of pesticides can only be achieved if only they are used with meticulous care and respect for regulations given their toxic nature.

This is even grave in the case of insecticides, which in many cases target the insect nervous systems which are similar to nerve cells and function to that of humans (Bernardes et al., 2015; Harita, 2016). In events where pesticides are mismanaged, mild to alarming consequences to humans and other animals often results from exposure and in some cases can be fatal.

Mismanagement can also lead to pest resistance and resurgence, environmental pollution and marked levels of pesticide residue in food beyond accepted levels (Kotey et al., 2008). In recent times there has been public outcry on the negative immediate and long-term effects of pesticides due to the hazards associated with these pollutants and their persistence in the environment, the bioaccumulation potentials in tissues of animals and humans through the food chain, and their toxic properties for humans and wildlife (Fu et al., 2003).

Many reports in Ghana lay emphasis on the inappropriate use of pesticides by farmers that can lead to public and environmental exposure and contamination (Diham, 2003; Ntow., et al., 200; Ntow et al., 2008; Kotey et al., 2008; Essummameng et al., 2008) with little emphasis on the attitudes and behavior of pesticide dealers, especially the small-scale dealers (retailers), who in many cases are interested only in profit making and pay little or no attention to safety standards.

There are reports of pesticide dealers participating in unscrupulous activities like adulterating or changing expiry date, or in most case switch labels. There are also extreme cases of preparation of concoctions especially those that are decanted, sometimes into unlabelled bottles meant to contain drinks and other household liquids; this in particular is the primary source oral contamination.

The registration of pesticide and pesticide dealers, as well as pesticide imports, distribution, marketing and safety have been regulated. However, due to problems with implementation, the legal instruments have been largely inefficient in controlling and mitigating risk to human health and the environment in Ghana (Gerken et al, 2001).

Despite the criticisms of pesticides use, farmers will continue to need to apply them, because chemical control remains the most cost effective and rapid way of combating the effects of weeds competition and crop loss due to pathogens and insect pests (Afreh-Nuamah, 1984; Mathews, 2000). Thus, the lucrative trade of pesticide has come to stay with charlatans in the sector particularly in developing countries. Thus, this was designed to evaluate small scale pesticide dealers (retailers) attitude and behaviour that endangers the public and the environment in areas of handling, storage, transportation and marketing.

2. MATERIALS AND METHODS

2. 1. Study site

Kwaebibirim District is a district in the Eastern Region of Ghana. It lies between latitudes 6° and 7° North and between longitudes 1°30' West and 0°30' East. 60 – 70% Of the inhabitants are solely employed by Agriculture. Crops like oil palm, cocoa, plantain, rubber and vegetables are predominantly grown in this district. Farmers obtain the pesticides from buyers of their crops and from small scale pesticide dealers (retailers) with their shops dotted all over the district who in some cases are farmers.

2. 2. Subjects and Survey

Fifteen small scale pesticide dealers were randomly interviewed in the shop with the use of semi-structured questionnaires. Information on demographics, sources of pesticides, and safety precautions employed in the shop were obtained. Recommendations given to farmers, shop location and construction, transportation and storage of pesticides were also sought from them. Study was conducted between September and October 2012.

2. 3. Data analysis

Descriptive statistic was conducted using Microsoft Excel® (2007). Some of the respondents gave multiple responses for some questions, so percentages may not sum up to 100. Statistical Package for Social Sciences (SPSS for Windows® version 16.0) was used for further analysis. We wanted to find out if there exists a strong relationship between social background (age, education, gender, longevity) and some dealers behaviour of handling pesticides. Such relationships could be indication of the casual influence of these social backgrounds on behaviour. 20 variables of pesticides handling and precautionary measures employed by farmers was scored '0' of '1' representing 'no' or 'yes'. However, some of the categorical data was ordinal and received codes depicting the various levels of variables as such. Pearson's correlation coefficient was computed between pairs of variables in order to highlight patterns in the data and to show their similarities and differences.

3. RESULTS

3. 1. Demographic parameters of pesticide dealers

Six pesticide dealers (40%) are members of Ghana Agri-Input Dealers Association (GAIDA) and have frequently attended workshops organized by MoFA (Table 1). The pesticide dealers have been in business on an average of 5 years (range of 1 – 26 years).

Table 1. Sociodemographic data of pesticide dealers.

Variable	Number and percentage respondents	
	Number	(%)
Age		
20 – 29	1	6.67
30 – 39	3	20.00
40 – 49	5	33.33
50 – 59	4	26.67
≥ 60	2	13.3
Sex		
Male	10	66.66
Female	5	33.34
Education		
None	3	20.00
Primary	2	13.3
JSS	5	33.33
SSS/GCE	2	13.3
Tertiary	3	20.00
Member of GAIDA		
Yes	6	40.00
No	9	60.00

3. 2. Pesticide management services

The pesticide dealers were asked if they give some pesticide management services to farmers and all said yes (Fig. 1). All pesticide dealers give advice on topics like method of application of pesticides, mixture of pesticides, frequency of application and equipment to use and alternative pesticides in events where that demanded by farmers is not available. No dealer admitted exchanging labels.

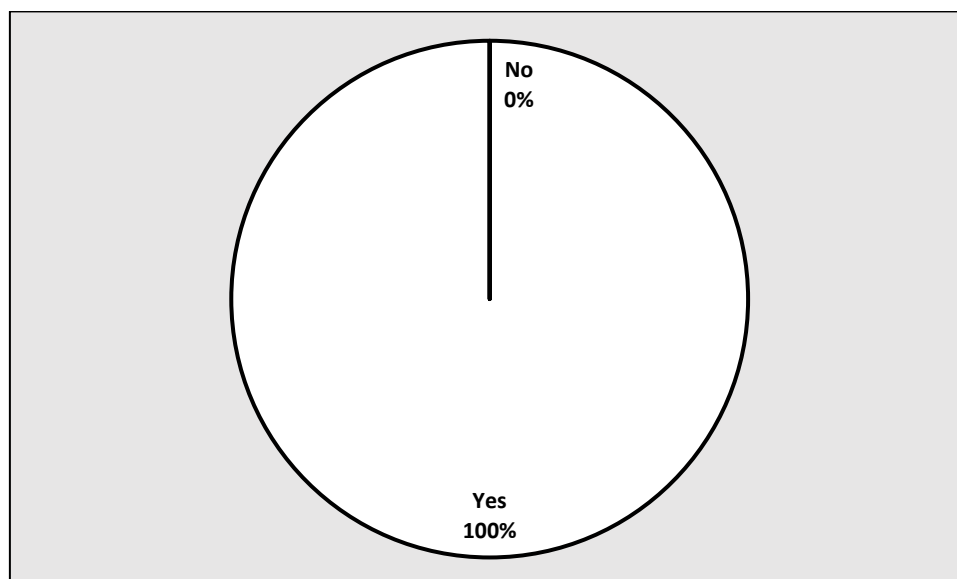


Figure 1. Percentage of pesticide dealers who give pesticide management services to farmers.

3. 3. Small scale pesticide dealer source of assistance

Thirty-three percent (5) of the pesticide dealers sell alone in their shops and 26.6% (4) of them sell with someone they hire (Fig. 2). However, 40% (6) of the dealers are assisted by members of the family like husband, wife, children and relatives who take turns in the shop in events when the others are busy or in the case of some of the children who are school pupils/students, after school they immediately move to the shops till evening hours. Some of the children stay in the shop with their uniforms which they will eventually use the next day in school.

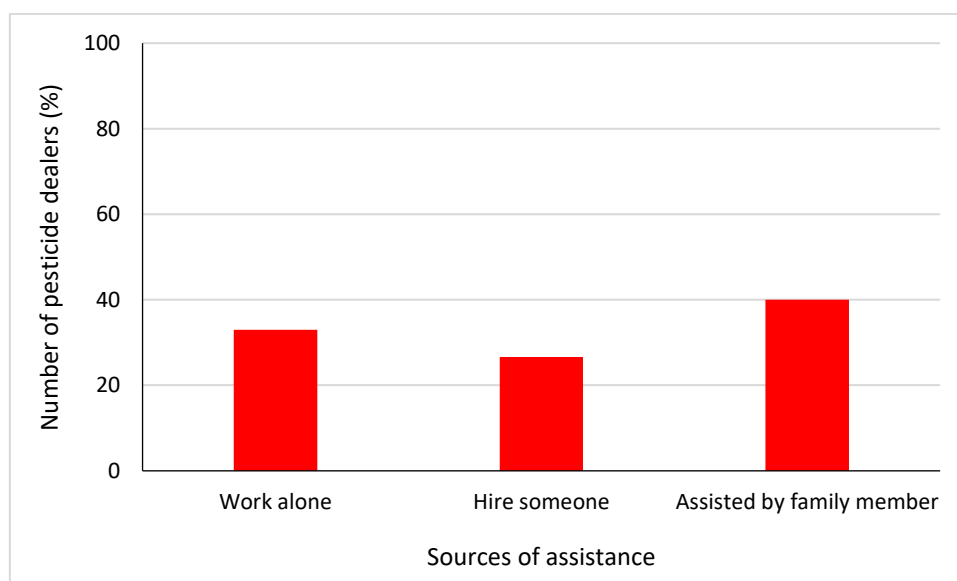


Figure 2. Source of assistance for the small scale pesticide dealers.

3. 4. Source of pesticides and means of transportation

All pesticide dealers travel periodically to cities like Accra, Tamale, Kumasi and Takoradi to buy these pesticides from importers and other bigger shops. Five (33.33%) of the pesticide dealers say, the big dealers and importers from the city usually send their agents to come around and supply them with the pesticides (Fig. 3). Some small-scale pesticide dealers (66.67%) also say that some middle men usually come around to supply the pesticides (Fig. 3). These middlemen do not represent any importer or dealers in the city, they are private business men.

The small-scale pesticide dealers have varied means of conveying their pesticides to their shops. All dealers use passenger vehicle in events of small consignment (Table, 2).

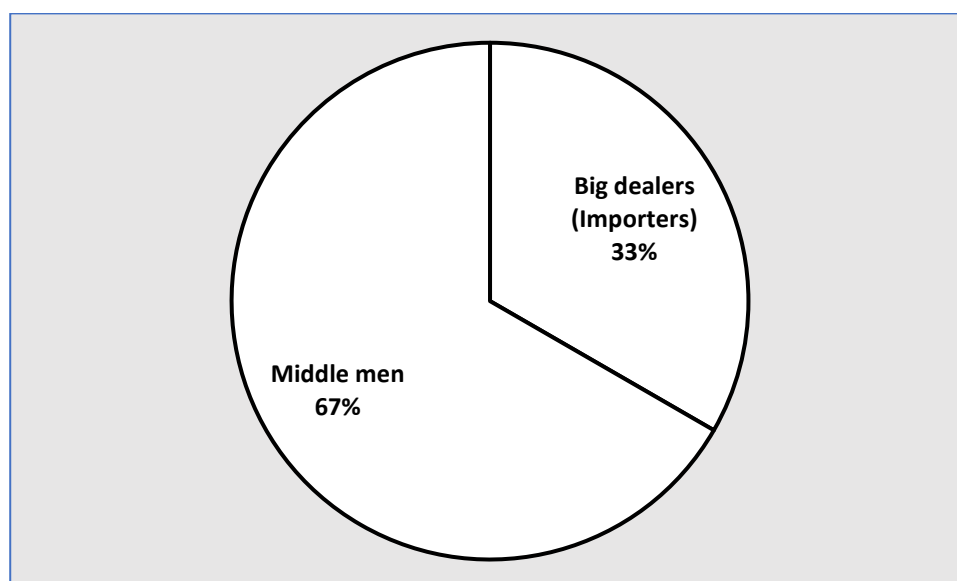


Figure 3. Source of pesticides for small scale pesticide dealers.

Table 2. Transport means used by small scale pesticide dealers.

Means of transport	Number of farmers (%)
Use passenger vehicle	15 (100.0)
Use my personal car	2 (13.33)
Hire a particular truck	1 (6.67)
Use any truck available	10 (66.66)

3. 5. Use of expired pesticides and empty containers

Four (26.67%) of the pesticide dealers still sell expired pesticides. Two (13.33%) of the retailers returned the expired pesticides to the importers and big dealers in the big cities. Six

(40.00%) of the dealers dump or bury the expired pesticides. Three (20.00%) of the small-scale pesticide dealers have never had any experience with expired pesticides (Fig. 4).

No dealer decants or retail pesticides from their original containers, so there is no occasion of empty pesticide containers. However, empty cartoons from which the pesticides are removed have varied uses. Some use it to store fertilizers, farm inputs like seeds and people from other shops collect them to store goods. In one of my visit to a shop, a lady collected one of the cartoons with some herbicide powder spillage in it and packed some yam tubers. These cartoons are also used to pack some of the items bought by farmers who carry them to their homes. Some of the dealers do burn the cartoons after the pesticides have been shelved.

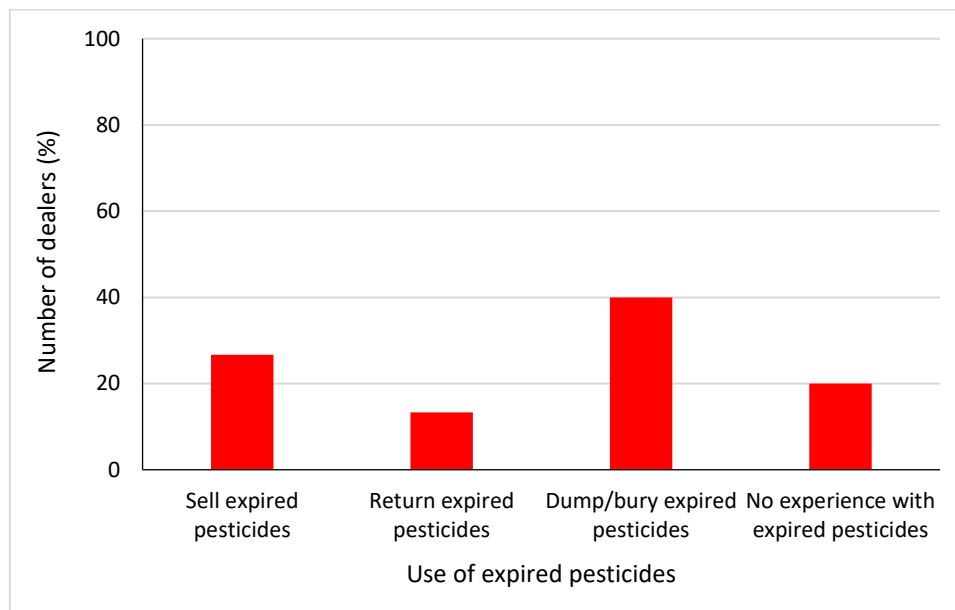


Figure 4. Use of expired pesticides by small scale pesticide dealers.

3. 6. Use of Personal Protective Equipment (PPE)

Rarely did any retailer have any particular protective clothing during the operations in their shops. However, 6 (40.00%) of the dealers wear aprons during operations like sales, loading and off loading of pesticides and fertilizer and retail of inorganic fertilizers (NPK). Use of aprons was significantly different between males and females ($X^2 = 10.37$, $df = 1$, $p = 0.001$) with more women using aprons than men (Table 3).

Table 3. Use of personal protective equipment (PPE) by small scale pesticide dealers.

	Male	Female	Total (%)
Use of PPE	1	5	6 (40.0)
No use of PPE	9	0	9 (60.0)

3. 7. Pesticide shop, Building and location

Pesticides shops are scattered all over the communities: along major commercial highways, markets and among residential areas. Twenty percent (3) of the pesticide retailers display the pesticides on open tables in the market and along major highways (Fig. 5).

Such tables are often shaded with thatch materials, broad umbrellas, or old used aluminum roof sheets to prevent the sun's rays above from reaching the pesticides. Such pesticides were still severely exposed to the sun rays from the sides given that there were no walls. Eighty percent (12) of the pesticide retailers own shops in which they sell the pesticides, among these, only two (2) of these shops were isolated from other buildings (Fig. 5).

Ten of the shops were sandwiched among other shops selling varied articles like food items, electronics, construction materials and residencies. Four of the pesticide shops still suffered severe exposure to the sun's rays because they were facing the West. In an attempt to prevent the sun's rays from entering the shops, the dealers have attached a mat made of thatch material vertically from the front roof of the shops.

No pesticide shop contained any signed post indicating danger, inflammable or any of the warning signs associated with pesticides. Only one dealer possessed a fire extinguisher and one possessed a sand bucket in events of fire out breaks.

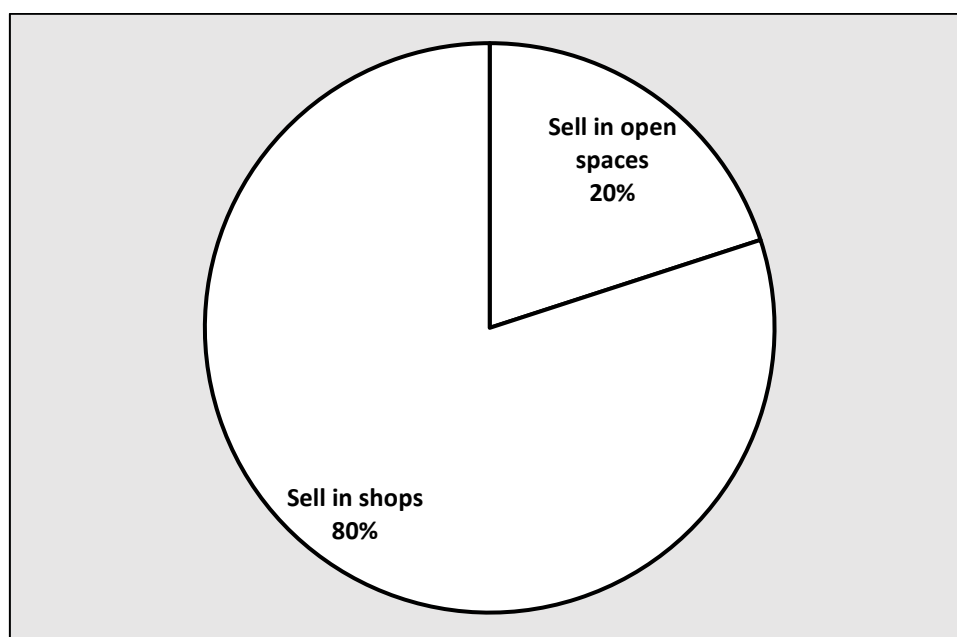


Figure 5. Point of sale of pesticide by small scale pesticide dealers.

3. 8. Pesticide storage

All pesticide retailers who had shops stored their pesticides and fertilizers in their shops (Table 4). However, some of the pesticides are often stored in their houses in places like kitchen behind doors and under beds (Table 4). Two of the retailers who use tables to sell, carry their pesticides home after everyday's sale while one has hired a corner in a nearby multipurpose shop to store the pesticides at the close of everyday.

Table 4. Place of storage of pesticides by small scale pesticide dealers.

	Number	Total (%)
Store pesticide in shop	15	100.0
Store pesticide at home	7	46.67

3. 9. Other commodities sold alongside pesticide retailers

Apart from the traditional farm inputs like fertilizer, seeds, hoes, machetes and sprayer equipments, pesticide retailers also sell other commodities that are not related to farming activities. One retailer also sells baby toys which she displayed closely associated with the pesticides exposed to the sun's rays (Table 5).

Table 5. Other commodities sold alongside pesticides by small scale pesticide dealers.

	Number	Total (%)
Farm inputs (e.g seeds, fertilizers, equipment)	15	100.0
'Purewater'	7	40.00
Toy	1	6.67

3. 10. Correlation analysis

There is a significant correlation between level of education with dealers who buy from big dealers in the city ($r = 0.677$, $p = 0.006$), dealers who sell in their shops ($r = 0.519$, $p < 0.05$). There is a significant correlation between users of expired pesticides and sale of empty pesticide containers.

There is a significant negative correlation between age and dealers who use passenger car to transport the pesticides ($r = -0.55$, $p < 0.05$).

There is a significant correlation between longevity with membership to GAIDA ($r = 0.64$, $p = 0.009$), membership with GAIDA and workshop attendance ($r = 0.645$, $p = 0.009$), membership with GAIDA and possession of washbasin ($r = 0.794$, $p < 0.001$) and a significant negative correlation in workshop attendance with dealers who always sit in their shops ($r = -0.693$, $p = 0.004$).

There was a strong correlation between those who sell toys, dresses and those whose pesticides are exposed to the sun's rays ($r = 0.612$, $p = 0.05$). 8 (53.3%) of the pesticide dealers sell 'Purewater'. There is a strong correlation between dealers who sell in open space and those who sell pure water ($r = 0.564$, $p = 0.029$).

Table 6. Correlation matrix of association between social background of retailers and the handling of pesticides.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1																			
2	.119	1																		
3	.105	-.134	1																	
4	.074	-.094	.445	1																
5	-.76**	-.107	-.211	.040	1															
6	.138	-.86**	.044	-.055	-.123	1														
7	-.552*	.139	-.486	-.367	.650**	-.080	1													
8	.575*	-.378	.355	.250	-.443	.327	-.68**	1												
9	.188	.354	.344	.200	-.302	-.272	-.196	.134	1											
10	.154	-.533*	-.111	-.040	.023	.431	-.207	.443	-.82**	1										
11	.339	.213	.245	.040	-.364	-.123	-.237	.161	.829**	-.65**	1									
12	.060	-.354	.101	-.200	-.075	.612*	.196	-.134	.250	-.302	.302	1								
13	-.138	.107	-.111	-.64**	.023	-.185	.237	-.161	-.452	.318	-.318	-.302	1	*						
14	-.423	-.094	-.387	-.339	.342	-.055	.419	-.286	-.468	.262	-.262	-.200	.564*	1						
15	-.119	-.100	-.319	-.189	.107	.000	-.139	-.189	-.70**	.533*	-.533*	-.354	.213	.094	1					
16	.036	-.577*	-.029	-.055	.185	.444	-.080	.327	-.612*	.739**	-.431	-.068	.123	-.055	.577*	1				
17	.057	.289	.649**	.491	-.123	-.389	-.480	.327	.408	-.185	.185	-.408	-.185	-.327	-.289	-.389	1			
18	.572*	.102	.518*	.221	-.69**	.059	-.66**	.595*	.503	-.119	.444	.036	-.281	-.355	-.406	-.381	.645**	1		
19	.486	.160	.330	.211	-.374	.046	-.243	.392	.677**	-.391	.519*	.310	-.264	-.354	-.75**	-.415	.276	.502	1	
20	.097	-.289	-.199	-.055	.185	.444	.320	-.218	.068	-.185	.185	.612*	-.185	-.055	-.289	-.111	-.389	-.234	.276	1

*Significant at $p = 0.05$ (green); **Significant at $p = 0.01$ (yellow): The bold numbers represent variables. **1** -age of respondents; **2** - gender of respondents; **3** - longevity of respondents in pesticide retailing; **4** - respondents who possess washbasin; **5** - respondents who always sit in their shops; **6** - respondents who use aprons; **7** - respondents who carry pesticides in passenger car; **8** - respondents who use a particular truck to carry pesticides; **9** - respondents who occasionally buy from agents from the big dealers in the cities; **10** - respondents who sell pesticides in open spaces; **11** - respondents who own a shop; **12** - respondents who sell clothing or toys alongside pesticides; **13** - respondents who sell food items alongside pesticides; **14** - respondents who sell 'purewater' alongside pesticides; **15** - respondents who use or sell empty pesticide containers; **16** – respondents who sell expired pesticides; **17** - respondents who are members of GAIDA; **18** - respondents who attend workshops on pesticide handling; **19** - level of education of the respondents; **20** - sun's rays reaches the pesticides in the shop open

4. DISCUSSION

Small scale pesticide dealers (retailers) engage into many activities that can serve as route of exposure of pesticide to the general public. Such activities span from purchase, transportation, retail, storage and others not directly associated with pesticide use.

Children and other family members who assist their parents to sell pesticides are often not aware of the potential danger and hazards associated with the products they sell, given the anxious nature of the children; they can eventually contaminate themselves with these chemicals in the events of eating and drinking in the shops. It is expected that small pesticide dealers should sit more often out of the shops rather than inside. The reason is because the atmosphere in the pesticide shops is often stuffy with a pungent smell of the pesticides. However, not all the dealers heed to this call, particularly the young dealers who have televisions in their shops for entertainment. The constant exposure to this pungent smell is exacerbated in dealer whose shop does not possess a working ceiling fan.

Handshake is a traditional way of salutation in Ghana and many other African countries. Many of these dealers who do not own wash hand basin are not exempted from the usual handshakes greetings after touching the pesticides; as such they expose the general public to pesticides. Even with the strict regulations instituted by Environmental Protection Agency about the sources of pesticides small scale dealers still buy from sources that cannot be traced. The suppliers of pesticides who do not represent any company from the cities often may be those who deal in illegal products. Such products could be coming from neighbouring countries, and may have not gone through the rigorous quality checks. The more educated retailers may be aware of this and this explains why they prefer to buy from the big dealers in the cities who are traceable in events of doubts.

There are potential dangers associated with the transportation of pesticides in passenger car with passengers. This is the case of some of the dealers who buy small consignment. These products are often loaded under the seats in or in the boots just behind the passengers. Given the high temperatures in the tropics, some of the chemicals evaporate and concentrate the atmosphere of the car. As such, the passengers constantly inhale the stuffy air in the cars. Older dealers who have been in business longer have the potential to buy in bulk and load them in large trucks rather than passenger cars.

However, using trucks do not necessarily exclude the potential for exposure. This is because such trucks often also carry other none pesticide commodities like foodstuff, electronics and building materials. In events spillage, these chemicals can still spill off and contaminate these other products. The picture of pesticide shops depicted by this article is similar that reported by Oudegens et al., (1999) who reported most pesticide retail shops in the tropics range from open spaced tables to small shops attached to residences and other shops involved in different commercial activities.

The sale of used insecticide containers is risky since none knows where they eventually end up and what they may be used for. Also associated with this is the use of empty insecticide containers for storage purposes. According to Williamson (2003), the re-use and resale of empty pesticide containers is a hazardous practice especially when they are used to store food and drinking water. Over 75% of poisoning cases recorded by PAN Africa partners in the cotton zones of Benin and Senegal have been the result of food and drink contamination (Williamson, 2003). The sale and use of expired pesticides is another potential source of exposure to some dangerous chemicals. Expired chemicals could show an increase in toxicity, loss of potency or a total alteration to some very poisonous substance (Oudegans et al., 1999).

Hence farmers are either buying a product with little or no effect on the pests or some very toxic product that can even endanger their live more than the original pesticides. This may also be the case with pesticides that are constantly exposed to sun's ray.

The pesticide dealers are expected to wear some basic protective equipment especially in the events of loading and offloading like gloves and aprons. However, no dealer uses a glove during any operations in the shops. Females wear aprons more than males supporting the view of Nordin et al (2001) who said in such situations women are more careful than men.

The position of pesticides shops is very important in limiting the exposure to the general public. Oudegan et al (1999) that pesticides shops should be isolated from all other shops that do not sell likewise commodities. The reasons are many, first, most pesticides are flammable. Secondly they are toxic and easily evaporates, hence should not in close association with other none related products. This is often not the case with pesticide shops in this area; closeness of pesticide shops to other shops increases the chances of neighbours who are none pesticide dealers having access to the pesticide shops and often touch pesticides and other contaminated surfaces of the shops. Open spaced pesticides dealers in the markets exposed the public especially children who by the nature and inquisitive and playful with just anything.

Storing pesticides in kitchens and other household corners are equally sources of exposure of pesticides to the public. Ideally, pesticides especially organochlorines should not be stored with inorganic fertilizers like NPK. This is because the Nitrogenous components of the fertilizer can react with the chloride components of the organochlorines to produce toxic fumes.

'Purewater' refers to 500 ml of drinking water packed in polytene sachets, often sold from ice cold boxes along roadsides. Pesticide dealers who engage in this activity are equally exposing the public to the pesticides considering that many do not wash their hands immediately after the sale of pesticides.

5. CONCLUSION

In 2003, Ghana Agri-Input Dealer (GAIDA) was born: to provide training, business, development, services and safe use of Crop Protection Products (CPP) for small scale pesticide

dealers. Dealers who are members of GAIDA seem to show some basic precautions in order to prevent themselves and the general public from hazardous pesticides.

Small scale pesticide dealers should be encouraged to join GAIDA and attend workshops from where they can learn the good and the ugly sides of the chemicals there are handling.

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