

Patterns of Use, Knowledge, and Perception of Household Pesticides Among Residents of Oakland's Fruitvale District

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Abstract Recent studies estimate that in 1995 homeowners spent nearly \$2 billion on the purchase of 74 million pounds of the pesticides used in the United States. Pesticides have been shown to cause severe health and neurodevelopment problems, especially in children. Pesticide use is correlated with low income and poorly maintained housing. Furthermore, pesticides purchased and applied by consumers pose a problem in that they are the same chemicals used by trained professionals, yet there is no way to monitor that consumers are using them properly. This study examined patterns of use, knowledge, and perception of pesticides among residents of Oakland's Fruitvale District, a low income, largely Latino community. Results indicate that the majority of homes in Fruitvale use pesticides primarily to control for ants and cockroaches. Frequency of use is strongly correlated with immigrant status. Results also indicate that immigrant status is related to education level and awareness of pesticides. These results indicate that there is a serious need for better community-based education regarding proper handling of and alternatives to pesticides, and their potential health hazards.

Introduction

Studies estimate that in 1995 homeowners spent nearly \$2 billion on the purchase of 74 million pounds of the pesticides used in the United States (Landrigan *et al.* 1999). These pesticides can then accumulate in carpet, on hard surfaces, and on children's toys.

Pesticides used residentially pose a problem in that they are the same pesticides used by trained professionals. Consumers, however, have no training in proper pesticide use or handling and therefore greatly increase their risk of exposure by improper handling (Gurunathan *et al.* 1998). O'Malley (1997) cites the three most common exposure situations of consumers to be accidents, spills, and ingestion by small children at floor level. Van Veen *et al.* (2001) observe that consumers use pesticides in ways never intended or anticipated, often using products without regard to the label (van Veen *et al.* 2001). Since residential exposure assessment is at such an early stage in its development, there is a serious need for data on residential usage of pesticides (Powell 2001).

The most commonly used residential pesticides found in over-the-counter ant and roach killers are chlorpyrifos and pyrethroids (Heudorf *et al.* 2001). Chlorpyrifos is a broad-spectrum organophosphate insecticide and is moderately toxic to humans. Organophosphates have been shown to inhibit enzyme-catalyzed breakdown of the neurotransmitter acetylcholine, which results in overstimulation of certain parts of the nervous system. Chlorpyrifos also has been shown to cause irritation of the skin and upper-respiratory tract, higher rates of antibiotic sensitivity, and autoimmune system disorders (Voccia *et al.* 1999).

Pyrethroids are a semisynthetic derivative of the natural insecticides found in certain species of the chrysanthemum plant. They have been shown to be of low chronic toxicity, however, acute poisonings in humans do occur. Exposure can cause asthmatic breathing, sneezing, headaches, nausea, incoordination, convulsions, burning, and stinging (Extension Toxicology Network 1996).

Mammals can avoid pyrethroid poisoning by ester hydrolysis; however, the enzymes responsible for the hydrolysis are inhibited by organophosphates. Hence, the use of chlorpyrifos actually enhances the toxicity of pyrethroids (Ray *et al.* 2000). This is an important point since most toxicity studies only analyze one chemical at a time. In reality, consumers are exposed to both chemicals because both pyrethroids and chlorpyrifos are active ingredients in the typical ant and roach killer.

This study focuses on the use, knowledge, and perception of pesticides in Fruitvale, a primarily Latino, low income community in the East Bay. Studies indicate that inner-city children tend to be at a higher risk of pesticide exposure than children living in higher income housing, possibly as a result of living in substandard housing with more pests (Landrigan *et al.* 1999).

What consumers know and how they perceive pesticides is also an important area of study because knowledge and perception can motivate how pesticides are used. However, there is limited previous research regarding consumers' knowledge and perception of pesticides. This information is important to future studies and education programs regarding household pesticide exposure.

Studies indicate that race and class are important determinants of environmental exposure and health effects (Brown 1994). Recent studies indicate that increases in pediatric asthma and other illnesses are most evident in urban communities, and rates are highest among Black and Latino children (Landrigan *et al.* 1998).

According to the report prepared by the council of economic advisors for former President Clinton's initiative on race, Black and Latino households tend to report more problems in their neighborhoods, including house deterioration and litter. The report also states that there are serious gaps in quality of life and health among racial groups which can be accounted for by differences in educational opportunities (Council of Economic Advisors 1998).

Detailed information regarding inner-city children's exposure to pesticides is extremely limited. Landrigan and colleagues stress the need for "our society to adopt new approaches that complement and build on risk assessment," as well as programs for reduction of pesticide use (Landrigan *et al.* 1999). Cohen Hubal and colleagues (2000) reiterate the need for identification of pesticides primarily used in the home and patterns of pesticide use (Cohen Hubal *et al.* 2000).

Landrigan and colleagues (1998) and the Children's Environmental Health Network describe the seven specific issues regarding children's environmental health that need to be researched further in order to understand and eliminate pediatric diseases. Of these issues, they stress the need to assess the role of indoor air pollutants such as pesticides in exacerbating respiratory disease. They also stress the need for population-based studies of children living in the inner-cities and in affluent environments in order to assess the interactions among disease and environmental exposures. The Children's Environmental Health Network also urges

development of more child-centered research involving risk assessment, education, and community empowerment with the ultimate aim of informing environmental health policy in the United States (Landrigan *et al.* 1998).

The goal of this study was to better understand health risks to socioeconomically disadvantaged families in Fruitvale, a neighborhood in Oakland, CA, as a result of residential pesticide use. I gathered information regarding the pesticides most commonly used inside the home. Information on specific pesticides used residentially can then aid further studies regarding children's pesticide exposure.

I also gathered data on how these pesticides are perceived by residents of Fruitvale regarding potential health hazards. This information will be helpful to future studies because it will provide a base for educational programs regarding household pesticides. Are people using these pesticides in order to create a safer environment for their children, because poor housing conditions force them to use pesticides, or because they are unaware that the pesticides could pose health risks to their children? I hypothesize that higher education level correlates with both a better understanding of the dangers of pesticides and less frequent pesticide use.

Fruitvale provides an interesting population because there is a high percentage of primarily Spanish-speaking immigrants living in the community. I hypothesize that immigrant status will correlate with lower education level since Latinos nation-wide are more likely than Whites to have less than a ninth-grade education (U.S. Census Bureau 2000). Furthermore, I hypothesize that higher education level will correlate with increased awareness of pesticide safety and with a decrease in the use of pesticides. I also hypothesize that the immigrant population will report more signs of pests in their homes, as pests correlate with house deterioration and Latino communities nation-wide report more house deterioration (Council of Economic Advisors 1998)

I hypothesize, based on previous research, that the most commonly controlled pests will be ants and cockroaches (Landrigan *et al.* 1999). Problems with these insects could be indicators of deteriorated housing conditions. Furthermore, I hypothesize that most people are unaware of the potential health effects of residential pesticides, so they use these chemicals without concern.

Methods

In order to enroll participants, self-administered questionnaires were distributed outside three different locations in Fruitvale: Safeway Grocery Store, Longs Drugs Store, and Mi Tierra

Grocery Store. In Figure 1, “1” represents Safeway, “2” represents Longs Drug Store, and “3” represents Mi Tierra.



Figure 1: Fruitvale Avenue and locations of survey sites

Respondents were all customers at one of these three stores, residents of Fruitvale, and over 18 years old. The questionnaire was available in English and in Spanish. In order to obtain a representative sample of the population, I surveyed at each location on different days of the week and at different times. I spent one hour at each location per day.

The questionnaire (Appendix 1) asked what specific pests participants find in their homes and if they use pesticides to control them. Participants were asked to report whether or not they use any protective clothing, such as masks or gloves, when applying pesticides, how often they apply them, and which rooms they primarily apply them in.

I also asked questions regarding how residents perceive pesticides in terms of their health effects and safety.

With regard to the demographic information I collected, I compared responses to the questions on pesticide use and perception specifically with education level and immigrant status.

I also analyzed how responses differ among households with young children and households without young children.

Results

After distributing the questionnaire, the total number of respondents was 83 (n=83). Figures 2 and 3 below compare the demographics of the sample population with the demographics of Fruitvale.

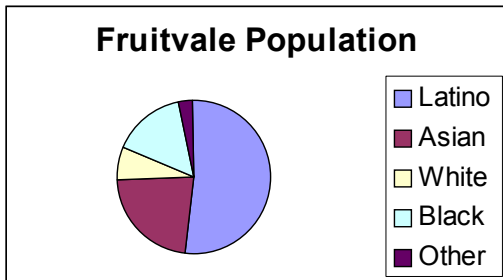


Figure 2: Fruitvale Population (Unity Council, 2002)

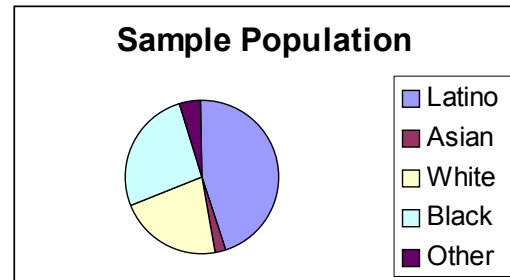


Figure 3: Sample Population

The primary differences between the sample population and the actual population of Fruitvale are the low percentage of Asian respondents (2.4% versus 23%) and the high percentage of White respondents (21.7% versus 7%).

Seventy-one percent of respondents reported seeing signs of one or more types of pest in or around their home. Twenty one percent of respondents reported seeing signs of two or more pests in or around their home. Seventy-seven percent of respondents use some kind of pesticide in or around their home. The pests most commonly controlled for were cockroaches and ants, followed by rodents, fleas, and termites. Figure 4 displays the pests most commonly controlled for.

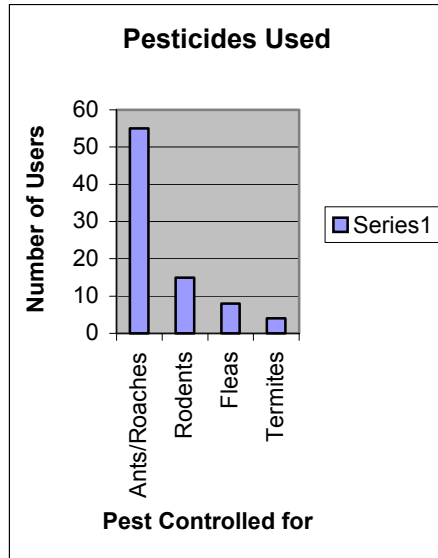


Figure 4: Pests most frequently seen and controlled with pesticides

Among pesticide users, the most common location of pesticide use is in the kitchen, as seen in Figure 5.

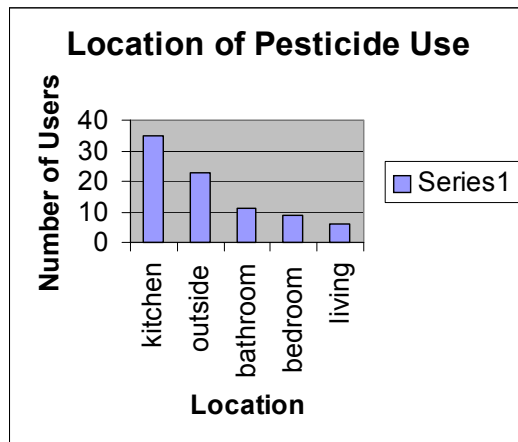


Figure 5: Most common locations of pesticide use

Seventeen percent of all respondents believed that using pesticides could create a safer home for children. Forty-two percent of respondents believed that using pesticides could prevent health problems.

Chi-square tests were done to analyze the difference between various demographic characteristics and knowledge or perception of pesticides. Immigrant status was determined by the respondent's answer to the question regarding country of birth. Frequency of use, concern, and education level were all based directly on responses to the questionnaire. Awareness level

was determined by adding up the number of questions answered correctly regarding the toxicity of pesticides. One point was given for each correct answer, zero points were given for an incorrect answer. There were a maximum of five points possible. Figure 6 displays the tests performed, the respective p-value, and the significance of the results.

Chi-square test (dependent v. independent variable)	p-value	Statistically Significant
Awareness v. Education Level	0.021	Yes
User status v. Education Level	0.072	No
User status v. Awareness	0.067	No
Education Level v. Immigrant Status	<<0.001	Yes
Awareness v. Immigrant Status	0.005	Yes
Pest Sightings v. Immigrant Status	0.079	No
Frequency of Pesticide Use v. Immigrant Status	0.034	Yes
Increased Concern About Pesticides v. Pest Sightings	0.025	Yes

Figure 6: Chi-Square tests

Frequency of pesticide use is plotted in Figure 7 to depict differences in immigrant and non-immigrant frequency of use. Sixty seven percent of immigrants use pesticides daily or weekly, whereas only thirty percent of the non-immigrant population uses pesticides as frequently.

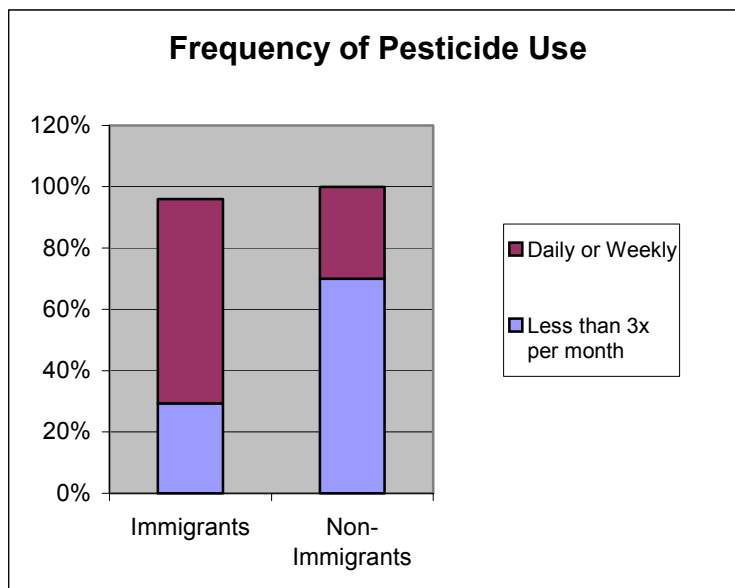


Figure 7: Frequency of Pesticide Use

Results indicate no significant difference in use, knowledge, or perception of pesticides among households with children.

Discussion

Although the sample population is representative of the Latino and Black populations in Fruitvale, it was not representative of the population as a whole due to limitations of the survey. The Vietnamese population of Fruitvale was extremely under-represented, as the survey was only available in English and in Spanish. In addition, the White population of Fruitvale was over-represented and the Black population was slightly over-represented. It is possible that respondents who spoke English as their first language were more apt to stop and answer the questionnaire. The sample population, however, was representative enough of the immigrant vs. non-immigrant population that I assumed a representative sample for the purposes of my discussion.

The result that 71% of respondents use some form of pesticide supports the hypothesis that the majority of the population use pesticides. Similarly, the hypothesis that cockroaches and ants are the pests most commonly controlled for is true based on the results. The high usage of ant/roach spray indicates that the population is highly exposed to the chlorpyrifos/pyrethroid combination that is found in the typical ant and roach killer. The fact that the kitchen is the room most commonly sprayed adds an increased risk to the use of pesticides, as the chemicals can then settle in the area where food is prepared or even stored. Since 42% of the respondents believe that pesticides can prevent health problems, and 17% believe that pesticides can create safer homes for children, it is possible that these groups do not take strict precautions when using pesticides around food or other parts of the house. This also indicates the need for education programs regarding the truth about pesticides.

Results of the chi-square tests (Figure 6) indicate that education level affects awareness of the dangers of pesticides, as hypothesized. This could be because pesticide awareness is a part of education, or because more highly educated people have educated themselves on pesticide safety. Although the chi-square test for user status v. education level was not statistically significant ($p=0.072$), it is low enough that I hypothesize a larger sample population would show significant results. Similarly, I hypothesize that a larger sample size would show statistically significant data for the relationship between Awareness and user status ($p=0.067$).

As anticipated, there is a strong correlation between immigrant status and lower education level. There is also a correlation between immigrant status and awareness. This indicates that

the immigrant population is less aware of the dangers of pesticides, possibly due to less access to education. Assuming that a larger sample size would indicate a correlation between user status and awareness, these data indicate there would be higher use of pesticides among the immigrant population. I hypothesized that there would be a correlation between immigrant status and signs of pests inside the homes. The chi-square test showed a p-value of only 0.079. This could either be due to the small sample size, or to the fact that the immigrant population uses pesticides more frequently, and therefore sees fewer pests.

As seen in Figures 6 and 7, the immigrant population uses pesticides significantly more often. The frequent use of pesticides (daily or weekly) puts the immigrant population at a significantly higher risk of exposure to pesticides, as hypothesized. Future studies should determine why there is such an increased frequency of pesticide use among the immigrant population of Fruitvale.

The result that there is no difference in use and perception patterns among households with children and households without children further emphasizes the need for pesticide education programs, since children are more susceptible to the adverse effects of pesticide exposure (Eskenazi *et al.* 1999).

As mentioned previously, results are not fully representative of the Fruitvale community, due to the low response of the Asian population. A future study should be done that offers questionnaires in Vietnamese as well as in English and in Spanish. Other limitations of this study were the small sample size and the possibility of respondent bias. A larger sample size would produce more reliable statistics. In addition, self-administered questionnaires introduce the possibility that the respondents interpret questions differently. If this occurred, it would bias my results. Furthermore, the self-administered questionnaire does not include illiterate people in the sample, which could have biased my results in favor of the more educated population, depending on the illiteracy rate in Fruitvale. Similarly, respondents all shared the willingness to stop and fill out the survey, which introduces bias into the results, as non-respondents are not represented in the sample.

In addition, in order to understand how income affects pesticide use, knowledge, and perception, I recommend a similar study take place that compares results of a high income community with results of the Fruitvale community.

Since such a large percentage of respondents use pesticides, there is a high risk of pesticide exposure in the home. I recommend a more in-depth health study of Fruitvale residents to assess actual exposure levels and to determine if household pesticides play a role in the high rate of pediatric asthma in Latino communities. Furthermore, since there is a strong correlation between education and awareness, immigrant status and education, and immigrant status and pesticide use, I recommend community-based education programs regarding pesticide safety and alternatives.

Claudio and colleagues emphasize the need for community empowerment, especially in low-income and minority communities (Claudio *et al.* 1998). Their study indicates that in order to eliminate adverse environmental exposure it is necessary to empower and educate the community. More than just empowerment, however, there is the need for education programs that can inform the population regarding the potential risks of using pesticides, alternatives to pesticides, and how to use pesticides properly.

Recent studies indicate that Environmental Health Education and Home Health Programs are effective in changing household behavior and decreasing risk of exposure to environmental toxins (Leung *et al.* 1997, Claudio *et al.* 1998). From the results obtained in Fruitvale, it is clear that there is the need for environmental health education programs in order to educate the community on how to make their homes safer environments and to provide alternatives to pesticide use.

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Appendix 1

Fruitvale Residents and Pesticide Use

Hi, I am a student at U.C. Berkeley studying how and why people use pesticides inside their homes. I would really appreciate you taking a couple of minutes to fill out this survey. If you have any questions about the survey, please ask me. If you do not want to answer a question, you can leave it blank.

Pests and Pesticide Use

1. please circle the appropriate responses in the questions in the chart

	Roaches/Ants/ Insects	Rodents	Fleas	Termites
Have you seen signs of the following pests in or around your home?	Yes No	Yes No	Yes No	Yes No
Do you or have you used pesticides in or around your home to kill these pests?	Yes No	Yes No	Yes No	Yes No
How often do you apply this pesticide? 1.Daily 2.Weekly 3.1 to 3x per month 4.Less than 1x per month 5.Don't Know	1. 2. 3. 4. 5.	1. 2. 3. 4. 5.	1. 2. 3. 4. 5.	1. 2. 3. 4. 5.
In what room of your house do you mostly use this pesticide? 1.kitchen 2.bedroom 3.bathroom 4.living room 5.outside	1. 2. 3. 4. 5.	1. 2. 3. 4. 5.	1. 2. 3. 4. 5.	1. 2. 3. 4. 5.
Do you wear any gloves or mask when applying this pesticide?	Yes No	Yes No	Yes No	Yes No
How often do you have fears or concerns about using this pesticide?	Daily Weekly Monthly When I use them Never	Daily Weekly Monthly When I use them Never	Daily Weekly Monthly When I use them Never	Daily Weekly Monthly When I use them Never

2. Do you think using pesticides creates a safer house for your children? Yes No

3. Do you think using pesticides can cause health problems? Yes No

If Yes, how significant are these health problems?

Significant Moderately significant Not significant at all

4. Do you think using pesticides can prevent health problems? Yes No

If Yes, how significant are these health problems?

Significant Moderately significant Not significant at all

Demographic Information

1. Male or female?

2. In what country were you born?

United States

Mexico

Other _____

3. What language do you use at home?

Spanish

English

Other _____

4. What ethnic group or race best describes you?

Latino

Asian or Pacific Islander

White non-Latino

Black non-Latino

Other _____

5. Do you have children under 5 years old living in your home? Yes No

If yes,

On average, how many hours does your child spend inside the home per day? ___ __ hours

Does your child carry and/or sleep with a blanket or stuffed toy? Yes No

6. What is your level of education?

None, never attended school

High School

Some college

College graduate or more

7. How much money do you and other people who live in your home bring home each month?

\$800 or less

\$801-\$1600

\$1601 and above

Don't Know

Thank you for participating in my survey.