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Macro-activity patterns of farmworker and non-farmworker children living in an agricultural community



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ABSTRACT

Background: Children of farmworkers have significantly higher exposure to pesticides than do other children living in the same agricultural communities, but there is limited information about how and where older farmworker children (> 6) spend their time and how their activities might influence the risk of pesticide exposure.

Objectives: Using data from the Community Based Participatory Research Study for Healthy Kids, we compared activity patterns recorded over 7 days during two agricultural seasons (pre thinning and thinning) between farmworker and non-farmworker children aged 6–12 years old living in Eastern Washington State.

Methods: Parents completed a 7-day activity diary recording the activity patterns of their children. Mean differences in individual-level activity patterns across season were analyzed using paired *t*-tests and the Signed Rank Test. Differences in mean activity patterns comparing farmworker and non-farmworker children were analyzed using the Wilcoxon Sum Rank Test to assess differences in distributions across independent samples.

Results: We observed substantial differences in child activity patterns between the two seasons. The children in this sample spent more time outdoors ($p < 0.001$) and were more likely to engage in behaviors, such as playing in the fields ($p = 0.01$) and accompanying their parents to work in the fields ($p = 0.001$) during the high-spray thinning season. There were some differences in activities and behaviors between farmworker and non-farmworker children during the thinning season.

Conclusion: This study demonstrates that multiple factors, including agricultural season and parental occupation, may be associated with differences in activity patterns that could influence risk of pesticide exposure among children living in agricultural communities. As such, these factors may influence variation in exposure risks and should be considered when analyzing pesticide exposure measurements in these groups.

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1. Introduction

Children of farmworkers have significantly higher exposure to pesticides than do other children living in the same agricultural communities (Thompson et al., 2003; Lu et al., 2000; Coronado et al., 2011). Factors such as the take-home pathway and the proximity of the farmworkers' homes to agricultural fields have been shown to influence pesticide exposure risk (Thompson et al., 2003; Lu et al., 2000; Coronado et al., 2011; Fenske et al., 2000). In addition, children living in agricultural communities have significantly

higher pesticide exposure levels during seasons when pesticides are applied to the fields relative to seasons when pesticides are not applied (Koch et al., 2002; Griffith et al., 2011). However, very little is known about whether individual activity patterns also contribute to differences in pesticide exposures between farmworker and non-farmworker children and within children across agricultural season. This descriptive study aims to compare child activity patterns recorded over 7 days during the pre-thinning and thinning seasons between farmworker and non-farmworker children aged 6–12 years old living in an agricultural community in Eastern Washington State.

Pesticide exposure pathways are complex as they involve spatial, temporal, and individual-level factors and farmworker children may be particularly vulnerable to exposures from multiple pathways (Faustman et al., 2000). Therefore, information is needed about various exposure routes, including child activity,

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to understand the range of potential risk factors (Bradman et al., 2007; Quandt et al., 2006; Cohen Hubal et al., 2000; Quackenboss et al., 2000). A number of studies have shown that farmworker children are exposed to higher levels of pesticides in their homes compared with their non-farmworker counterparts (Thompson et al., 2003; Lu et al., 2000; Coronado et al., 2011; Fenske et al., 2000; Bradman et al., 2007). In addition, farmworker children may be spending a significant amount of time in other physical environments with high exposure levels, such as schools or daycare centers or engaged in activities that could heighten their risk (Wilson et al., 2007; Freeman et al., 2005; Cooper et al., 2001). Results from focus group sessions with farmworker children showed that they were engaged in activities such as swimming in irrigation ditches, playing near agricultural fields after pesticide spraying, and working in the fields with their parents during the summer (Cooper et al., 2001). Given the multitude of potential risks there is a need to understand how activity patterns might be affected by a child's family characteristics and seasonal factors.

Previous research has examined farmworker children's exposure in the context of the home environment (Quandt et al., 2006). The emphasis of such research has been on crowding and parental behavior, such as hygiene and sanitation practices and use of personal protective equipment at work (Quandt et al., 2006). Limited research has assessed risk in the context of where and how children, especially those over the age of 5, spend their time. Micro-activity studies have quantified exposure risk for young farmworker children by observing hand to mouth behaviors (Freeman et al., 2005; Zartarian et al., 1995; Beamer et al., 2008). However, these studies have generally focused on children under the age of 6 in the home environment. The few studies that did examine macro-activities among farmworker children did so as a secondary focus and did not report consistent or conclusive findings (Lu et al., 2000; Bradman et al., 2007).

Individual attributes also influence activity patterns (Koch et al., 2002; Cohen Hubal et al., 2000; Freeman et al., 2001). A population-based study observed children between the ages of 3 and 13 years old and found that boys spent more time outdoors than girls, but girls had a higher frequency of hand to mouth behaviors than boys (Freeman et al., 2001). Younger children (aged 3–4 years) also demonstrated a higher frequency of object to mouth behaviors. Temporal factors, such as season, may also influence behaviors and risks. Studies have found significantly higher levels of pesticide metabolites in children during the spring and summer months which coincided with the agricultural pesticide spray season (Koch et al., 2002; Griffith et al., 2011). We were unable to find any studies that examined macro-activity patterns across season, but it is possible that differences in child activities and behaviors during the summer months contribute to higher exposure levels.

There is limited information about how and where older farmworker children (> 6) spend their time and how activity patterns might influence individual risks of pesticide exposure. This study describes where children living in agricultural communities spend their time (home, school or other), the amount of time they spend outdoors versus indoors, and the frequency with which they engage in behaviors, such as spending time in the agricultural fields. Further, we will examine how these patterns differ across two agricultural seasons and differences in activity patterns between farmworker and non-farmworker children.

2. Methods

2.1. Setting

This study was conducted in an agricultural valley of Eastern Washington State in 2011–2012 where approximately 67% of the residents are Hispanic, and 94% of them are of Mexican heritage.

2.2. Recruitment

At the time of enrollment, 120 subjects (60 adults and 60 children) were members of families where at least one adult was employed in agricultural work. Simultaneously, 80 subjects (40 adults and 40 children) were members of families where no one was employed in agricultural work. This cohort (formed in 2011) is part of a larger cohort of 100 farmworker families and 100 non-farmworker families that was recruited in 2006 for the purpose of examining pesticide exposure among farmworkers, non-farmworkers, and the children of both during different agricultural seasons (Coronado et al., 2011). The 2006 cohort was not subject to inclusion requirements regarding occupational status, such as a minimum amount of time spent per year working as a harvester or thinner. For inclusion in the 2011 study all participants had to have the same occupational designation (farmworker versus non-farmworker) as they had when they were enrolled in the 2006 study. This establishes a fairly long-term occupational trend among participants in this study.

For this 2011 follow-up study, we re-contacted a subset of farmworker families and non-farmworker families to further explore differences in exposures to organophosphate pesticides (OPs). Cohort members of this particular investigation were recruited by *promotores*, local community members who were trained and paid by the project. *Promotores* went to the homes of previous participants and asked if the family would like to be part of the new study. If the response was affirmative, the project was explained in more depth and, for those who continued to be interested, informed consent was reviewed and signed in accordance with the protocol approved by the Institutional Review Board at the Fred Hutchinson Center Research Center. Participants were given a household total of \$250 for participation in all three phases of data collection which was spread out over a year.

2.3. Inclusion criteria

Farmworkers needed to be aged 18 or older, have a child in the household aged six to 14 who could participate in the study, plan to be in the Valley for an entire year, and work as a thinner or harvester in apple or pear crops. For non-farmworkers, the inclusion criteria required that the participant, be 18 or older, has a child aged six to 14 who could participate in the study, plan to be in the Valley for an entire year, and not work as a farmworker or in a fruit-packing warehouse.

2.4. Study procedures

Data collection for this phase of the study occurred between March and December 2011 at three different time periods corresponding with seasons in which various types of pesticide sprays were used—pre-thinning season (March through April), thinning season (June through July), and non-spray season (November through December). Pre-thinning is when chlorpyrifos is used on orchards. During the thinning season buds are picked to allow orchard crops ample space to grow and azinphos-methyl and phosmet are the most commonly used pesticides during this time. During winter no pesticide sprays are applied to orchards. This study compares child activity patterns between the pre-thinning and the thinning seasons only. The thinning season is the high-spray pesticide season though some pesticides are applied during the pre-thinning season. The non-spray season takes place during the winter months when there is no pesticide spray and so data from this observation period is not included.

Participants answered a number of survey questions in each season that included demographics, eating habits, activity patterns, protective practices, and pesticide exposure at work and at home. Information about activity patterns was collected over a 7 day period. Trained staff administered two questionnaires and provided detailed instructions to participants about how to complete a 7-day macro-activity diary. Activity questionnaires were completed by the adult respondent about the same referent child during each data collection period. Adult participants recorded the amount of time within a 24 h period that their child spent 1) inside and outside the home, 2) inside and outside school, and 3) doing other activities. Time inside and outside the house is defined as the time that the child spent around the home. Time inside and outside school refers to the time that children spent in and around the school. Time doing other activities refers to other time in which the children were neither around the school or at home.

Participants were also asked about specific activities undertaken by the child enrolled in the study including the number of times in the past week the child had played in the fields or orchards and the number of times in the past 30 days that the child had accompanied a parent to work in the agricultural fields (this question did not apply to non-farmworker children). All instruments were approved by the Institutional Review Board at the Fred Hutchinson Cancer Research Center.

2.5. Analysis

We combined the macro-activity information (time inside and outside the home, inside and outside school) to create a variable that represented the total number of hours the children spent outdoors and indoors during the 7-day data

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