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Reducing Farmworker Residential Pesticide Exposure: Evaluation of a Lay Health Advisor Intervention

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Abstract

The goal of this analysis is to evaluate the effectiveness of a promotora program for teaching women in Latino farmworker families about pesticide safety and increasing pesticide safety behaviors. Volunteer promotoras delivered a pesticide safety curriculum (intervention) and nutrition curriculum (control) to farmworker women residing in western North Carolina and Virginia. Pre- and post-intervention interviews assessed differences in delivery of the intervention, recognition of the intervention, pesticide knowledge, pesticide exposures behaviors, and integrated pest management behaviors. Participants in the intervention group reported significantly more receipt of pesticide education and greater recognition of the key messages. However, their knowledge, pesticide exposure behaviors, and integrated pest management behaviors did not change. A more structured program is needed to be sure that the dose of interventions is large enough to overcome educational and cultural characteristics of immigrant communities. Policy changes are needed to address circumstances outside of farmworkers' control that affect pesticide exposure.

Introduction

Residential pesticide exposure among farmworker families is an environmental health concern (Arcury et al., 2005; Quandt et al., 2004). Farmworker families are at double jeopardy for residential pesticide exposure. Farmworker families can be exposed to pesticides due to residential application (Arcury et al., 2005; Bradman et al., 1997). Because most farmworkers live in substandard housing, which is often infested with pests, their exposure to residential application pesticides could be extensive (Early et al., 2006). Farmworker families also experience para-occupational exposure due to pesticides brought home from work on the skin, clothes, and boots of workers, and to pesticides that drift into

their homes from application in nearby agricultural fields (Quandt et al., 2006). Complicating the potential for residential exposure among farmworker families is the limited knowledge of pesticides and cultural beliefs that farmworker families have about pesticides in their homes (Rao et al., 2006a). For example, members of farmworker families often believe that the presence and strength of a pesticide is indicated by its odor, and that, because no one in the family has become acutely ill, they have not been exposed to a pesticide.

The health consequences that adults and children experience due to residential pesticide exposure are difficult to document. Fortunately, severe, acute, unintended poisonings are relatively rare. However, the number of non-severe, acute poisonings is not known because their symptoms are non-specific (e.g., nausea, muscle ache, dermatitis), few health care providers are trained to recognize pesticide poisonings, and few states have a mandatory reporting system for pesticide poisoning (Calvert et al., 2004; Hiott et al., 2006; Reigart & Roberts, 1999). The long-term effects of pesticide exposure, even low-level exposure, include delayed neurobehavioral development and neurological deficits, as well as increased risk for several types of cancer, birth defects and reproductive problems (Reigart & Roberts, 1999). However, making the causal linkage of specific symptoms or diseases to indeterminate pesticide exposures that occurred in previous years poses insurmountable challenges for even the skilled clinician.

Most existing interventions to reduce farmworker pesticide exposure are focused on occupational exposures. These include regulatory requirements such as the US-EPA Worker Protection Standard (United States Environmental Protection Agency, 1992), as well workplace intervention programs (e.g., Quandt et al., 2001; Vela Acosta et al., 2005). However, existing intervention and training materials do not address the residential pesticide exposure for farmworker families. McCauley et al. (2001) and Thompson et al. (2001) have developed interventions to reduce the pesticide exposure of children who live in farmworker homes, but the content of these interventions or their evaluations have not been reported in the literature.

To address the need for a program addressing farmworker residential pesticide safety, a community-academic collaboration implemented a lay health advisor or promotora intervention program, La Familia: Pesticide Safety for Farmworker Families. The partners in this collaboration included the North Carolina Farmworkers Project, a non-profit farmworker and service advocacy organization, and Wake Forest University School of Medicine. Lay health advisors can include individuals who vary in activities and training, but generally are members of a community and serve a natural helping role in that community (Eng et al., 1997; Kegler et al., 2003; Balcázar et al., 2006). The goal of this analysis is to evaluate the effectiveness of the La Familia promotora program in teaching women in farmworker families about pesticide safety and increasing residential pesticide safety behaviors.

Methods

Communities

The La Familia promotora program was conducted in five counties of northwest North Carolina (Alleghany, Ashe, Avery, Mitchell, Watauga) and three counties of southwest Virginia (Smyth, Grayson, Carroll). Agriculture in this region is dominated by the production of Christmas trees, with some ornamental plants, burley tobacco, vegetables, and fruits being produced. Many Latino women in the area also work seasonally making Christmas wreaths. An array of insecticides, herbicides and fungicides are used in mountain agriculture. As is the case in other parts of the Southeast and the nation (Carroll et al., 2005),

the majority of farmworkers in these counties are Latino immigrants and from Mexico (Quandt et al., 2002).

The La Familia Promotora Program

The La Familia promotora pesticide safety program was directed at women in farmworker families, most of whom were not farmworkers themselves. The training program was based on formative research that showed that agricultural and residential pesticides were in virtually all farmworker dwellings, with a greater likelihood of being present if a house was located adjacent to fields, was judged difficult to clean, and had non-family residents (Quandt et al., 2004). Most farmworker family members had urinary organophosphorus pesticide metabolites levels above the 50th percentile compared to national reference data (Arcury et al., 2005). Presence of non-family residents and living in rental property were associated with greater metabolite levels. Ethnographic data showed that women had received little pesticide safety training and had limited pesticide knowledge, and traditional gender roles made enforcing desirable household sanitation practices among resident males difficult (Rao et al., 2006a).

A multi-lesson residential pesticide safety curriculum was developed, to be delivered by the promotoras to individual women in farmworker households using adult education approaches and a variety of media (Arcury et al., 2004a). Conceptually, the intervention was based on the Theory of Reasoned Action (Ajzen & Fishbein, 1980). The intervention was designed to change pesticide safety behaviors within households by first providing information to women in these households about the health affects of pesticide exposure on family members, particularly children, as well as the sources of both residential and agricultural pesticide exposures. Finally, these women were instructed on the behaviors that would remove the sources of residential and agricultural pesticide exposure. The curriculum emphasized the creation and communication of norms and behaviors for protecting children from pesticide exposure. The lessons were designed to give women skills and knowledge to recognize which substances are pesticides, to reduce their families' exposure to take-home agricultural pesticide and drift, to implement integrated pest management in their homes, and to become more empowered to control the household contamination caused by other residents. A promotora-delivered multi-lesson nutrition curriculum was also developed for women in farmworker households who were part of a comparison group (Arcury et al., 2004b).

The promotoras were Spanish-speaking women living in the study area who were well-connected within their local Latino communities. These women had experience living in farmworker households, even if they had not done farmwork themselves. Promotoras were volunteers who received an honorarium, but not a salary for their efforts, and who were reimbursed for their travel expenses. Each promotora was asked to recruit up to 20 participants to receive monthly health education lessons on pesticide safety or family nutrition. An eligible participant had to live in a household with at least one farmworker and at least one of her own children 13 years of age or younger. Generally, promotoras recruited women in their social networks or living nearby. Due to the low population density, most promotoras also went beyond their social networks and neighborhoods to identify participants.

To try to prevent contamination, the study area was divided into a Northern and Southern area, with half of the promotoras in each area. One area was assigned the pesticide curriculum for year one by a flip of a coin. In year 2, the promotoras who had delivered the pesticide curriculum changed to nutrition, and vice versa. At the beginning of year 2, promotoras enrolled additional women who had settled in the area. The analysis presented here includes year 1 data from all women enrolled who completed a pre- and post-test

interview, and year 2 data from women newly enrolled in year 2 who completed both a pre- and post-test interview in year 2. Multivariate analyses were adjusted for year whenever possible to account for potential systematic differences over time.

A total of 115 women completed an initial interview, prior to receiving the pesticide safety or nutrition intervention, and also completed a post-intervention follow-up interview. Of these women, 65 participated in the Pesticide Curriculum and 50 participated in the Nutrition Curriculum. Each participant's pretest interview provided her baseline data. Participants were given a \$20 incentive for completing each interview. The research protocol was approved by the Wake Forest University School of Medicine Institutional Review Board.

Program Evaluation

Pre- and post-test interviews were conducted by trained interviewers who did not participate in the promotora program. The questionnaires were translated into Spanish by native Spanish speakers and pretested with members of the target population to ensure that vocabulary was appropriate and that there was no loss of meaning. Interviews were conducted in Spanish or English based on the participant's preference. Background information on the participant and her family included personal characteristics, household composition, farmwork experience, social integration, and language preferences. A core set of questions about the intervention was repeated during pre- and post-test interviews to assess changes in knowledge and behavior due to the intervention.

Variables from five domains were measured as intervention outcomes: (1) recalled delivery of the intervention; (2) recognition of the intervention; (3) pesticide knowledge; (4) pesticide exposures behaviors; and (5) integrated pest management behaviors. Recalled delivery of the intervention was based on the number of occasions reported in response to the questions, "Has anyone come to your home in the past 12 months and spoken with you about pesticide safety for your family? If yes, about how many times did they speak with you?" Recognition of the intervention was based on how many of five phrases presented in the intervention a respondent recognized and correctly defined. These phrases included, Pesticidas no los traigas a la casa! (Pesticides: Leave them at Work!); El Terror Invisible (The Invisible Terror); Residuos de Pesticidas (Pesticide Residues); Plagas: No las dejes entrar! (Pests: Keep them out!), and Plagas: Mátalas de hambre! (Pests: Starve them out!). Pesticide knowledge included four outcomes based on correct answers to questions on the meaning of "pesticide" (a substance used to control pests), where pesticides are used (homes as well as farms), the possible effects of pesticides on the health of children (rashes, cancers, neurodevelopment), and on the number of components identified correctly on a pesticide label (product name, EPA registration number, active ingredient list, storage instructions, package disposal instructions emergency information). Pesticide exposure behaviors included the proper storage of bug sprays in the home (in a locked cabinet or closet versus other), the location used by the farmworker usually to change out of his/her farm work clothes (outside the house versus inside the house), and the time interval between the farmworker's arrival at home and showering (less than 15 minutes versus 15 minutes or longer). Integrated pest management behaviors included the number of practices used, out of ten possible (e.g., taking out trash every day, using bug traps, not using bug spray in the house).

Data Analysis

Participant characteristics (including outcome measures evaluated at baseline) were summarized and compared between curriculum groups. Significance testing for differences between groups was performed, using the two-sample t-test or Wilcoxon rank-sum test for

continuous variables; chi-square or Fisher's exact testing was used for dichotomous variables. $P \leq 0.05$ was considered statistically significant.

The pesticide curriculum was evaluated in comparison with the nutrition curriculum using both bivariate methods (as for baseline comparisons) and multivariate methods, as follows. Each outcome measure was used as the response variable in a multiple regression model (linear, Poisson, or logistic) after adjusting for covariates: the baseline value of the outcome, and indicators for the curriculum (pesticide, nutrition), year (1, 2), age (<30 years, ≥ 30), education (at least high school, less than high school), employment status (employed, not employed), number of adults living in the home (<3 , ≥ 3), number of unrelated adults living in the home (0 , ≥ 1), type of home (mobile/one-family detached home, other), and home ownership (own, rent). These covariates were selected as potential confounders *a priori*. Covariates were reduced in models when the number of participants in cells was low, preventing reliable inference; covariates were selected for removal if there was little evidence of association with the outcome in the bivariate analysis.

The pesticide curriculum was also evaluated by summarizing and comparing baseline and post-intervention values for each outcome in the pesticide curriculum. Paired analyses were performed for hypothesis testing using Wilcoxon signed-rank test or McNemar's chi-square test. Multiple regression models (linear, Poisson, or logistic) were used to assess for predictors of those outcome measures that were statistically significant in the paired analysis; i.e., those outcomes that changed significantly in the women who participated in the pesticide curriculum. Covariates in these regression models were: the baseline value of the outcome, and indicators for the year (1, 2), age (<30 years, ≥ 30), employment status (employed, not employed), number of adults living in the home (<3 , ≥ 3), number of unrelated adults living in the home (0 , ≥ 1), number of children in home (<3 , ≥ 3), type of home (mobile/one-family detached home, other), and time period residing in the home (<1 year, ≥ 1 year). These variables were selected a priori as potential predictors of the outcomes with the pesticide curriculum. All analyses were performed using Stata Statistical Software, version 8.2 (Stata Corporation; College Station, TX).

Results

Participants

Promotora program participants ranged in age from 16 to 47 years, with over half being less than 30 years of age (Table 1). About 90% were married or living as married. Over 90% were born in Mexico, and had been in the US for at least one year. About three-quarters had been in their current home for at least one year. Few of the women had been educated to the equivalent of high school, and about 85% preferred using Spanish. About one-third were employed, and about 90% had a spouse or partner who was employed. The households in which the participants lived were generally large, with over 40% having 3 or more adults, and over one-quarter having 3 or more children. About 90% of the women lived in a mobile home or single-family detached house, and about 20% owned their homes.

More of those receiving the pesticide safety curriculum were employed (43.1% versus 24.0%). More of those receiving the nutrition curriculum had unrelated adults residing with them (34.8% versus 14.3%). Fewer of those receiving the pesticide safety curriculum lived in a detached dwelling (81.5% versus 98.0%), and fewer owned their house (12.3% versus 28.0%).

Evaluation

At baseline, the participants in the two curricula did not differ significantly in their recall of having been delivered the pesticide intervention, recognition of the intervention, pesticide

exposure behaviors, or integrated pest management behaviors (Table 2). Significantly more of those receiving the pesticide curriculum knew the effects of pesticides on children than did those receiving the nutrition curriculum (76.9% versus 58.0%). They did not differ significantly in the remaining three measures of pesticide knowledge.

Post intervention, those receiving the pesticide curriculum reported receiving more intervention visits focused on pesticides on average (4.6 versus 1.7) (Table 3). They recognized more of the pesticide safety messages on average (3.5 versus 1.6). More of those receiving the pesticide curriculum knew the effects of pesticides on children than those receiving the nutrition curriculum (90.8% versus 72.0%). The participants in the two curricula did not differ significantly in pesticide exposure behaviors, residential integrated pest management behaviors, or the other three of the four measures of pesticide knowledge.

When controlling for the baseline value of the outcome, cohort, participant age, education, current employment, number of adults living in the home, number of unrelated adults living in the home, type of home, and home ownership, the differences between pesticide and nutrition curriculum groups remained statistically significant for recalled number of pesticide intervention visits ($p < 0.001$), and recognition of the pesticide safety messages ($p < 0.001$). The difference in knowledge of the effects of pesticides on children was not significant in the regression analysis ($p = 0.057$). However, the greater number of pesticide label items recognized by those receiving the pesticide versus the nutrition curriculum on average (1.6 versus 1.2) was statistically significant in the regression analysis ($p < 0.001$) after adjusting for the covariates.

The pesticide curriculum participants improved significantly on three of the measures between baseline and post intervention (Table 4). At the post intervention, pesticide curriculum participants reported receiving more pesticide intervention visits (0.6 versus 4.6), recognized more of the pesticide safety messages (1.1 versus 3.5), and more knew the effects of pesticides on children (76.9% versus 90.8%). Though not statistically significant ($p = 0.078$), pesticide exposure behaviors also changed in that more of the participants reported properly changing out of work clothes at post intervention (59.3% versus 44.2%). Regression models found that current employment was an independent predictor of number of intervention visits (estimated regression coefficient 2.04; 95% Confidence Interval 0.14 – 3.94; $p = 0.036$), and number of pesticide safety messages recognized estimated regression coefficient 1.21; 95% Confidence Interval 0.26 – 2.16; $p = 0.013$) for the post intervention after adjusting for the baseline value of the outcome, cohort, participant age, current employment, number of adults living in the home, number of unrelated adults living in the home, number of children in home, type of home, and time period residing in the home.

Discussion

Our analysis of La Familia promotora program indicates that the intervention was delivered; persons in the intervention group (pesticide curriculum) reported significantly more receipt of pesticide education than those in the control group (nutrition curriculum), and the participants in the intervention recognized the key messages. However, the analysis also shows that the intervention did not change the knowledge measures in general, and did not change the pesticide exposure or integrated pest management behaviors.

The educational attainment of some participants may have limited their ability to understand the information presented in the curriculum. Some participants were illiterate in Spanish as well as English. Further, our formative research showed that the concepts surrounding pesticide exposure and safety were foreign to many members of this community (Rao et al., 2006a). Our development and presentation of pesticide curriculum used techniques for lower

literacy and lower educational attainment adults (Doak et al., 1996). However, the pesticide safety concepts may still have been too difficult for some participants.

Adoption of pesticide safety behaviors may have been hindered by the beliefs of the Latino women. Many of the participants did not feel susceptible enough to harm to change their behaviors. Our formative research showed that Latino women really did not believe residential pesticide exposure to be an important problem (Rao et al., 2006a). Further, other health beliefs may have played a part in limiting behavior changes. For instance, we have found adherence to humoral medicine beliefs among many Mexican immigrants in North Carolina (Weller, 1983). Within the humoral medicine system it is considered harmful to mix metaphorically cold” and “hot” substances; for example, putting water, which is metaphorically cold (regardless of thermal quality), on a body that is hot from work. These beliefs might have affected the willingness of some individuals to change a behavior to shower immediately after work: if the cultural rule is to cool down, it may take more powerful intervention to overcome this than we implemented.

Gender roles may have also hindered intervention effectiveness. Women told us that they did not have the control or power to change the behaviors of other co-resident adults, particularly men. We included a lesson in the pesticide curriculum to address this specific issue (Arcury, 2004a; “Pesticide Safety Lesson 6: Talking about Change!”/“Lección de Pesticidas 6: ¡Hablar sobre Cambio de Conducta!”). While the participants indicated that they liked this lesson, and found it useful, it is not clear if they were successful in its implementation.

The dwellings and households of the immigrant farmworker families did not allow some behaviors to change. Dwellings were usually small and crowded making changing from work clothes and storing soiled work clothes difficult. It would also make the safe storage of pesticides impossible (Early et al., 2006; Rao et al., 2006b).

Several methodological issues make it difficult for community interventions to show an effect, three of which are pertinent to our promotora program. First, participants may not have received the full “dose” of the intervention. Due to conflicting employment (the unanticipated availability of short-term jobs) and family (women having the major responsibility for child care) demands among promotoras and participants, the promotoras may not have been able to deliver the curriculum to the community participants as planned. Some participants may not have received all of the lessons; other participants who did receive all of the lessons may have had these lessons in fewer than the planned number of sessions (i.e., a promotora contacted a participant on four occasions instead of six and delivered the information for multiple lessons at each meeting). Second, a secular trend toward greater pesticide safety may have occurred in the region. Service providers may have increased their emphasis on pesticide safety in the region. A new migrant clinic was established in the region during the course of the study, and the clinicians were interested in pesticide safety. North Carolina cooperative extension agents began a Spanish language pesticide safety training program after learning about our intervention. Finally, contamination may have occurred. While the two arms of the intervention were geographically separated, the mobility of the Latino population in the region along with the limited number of social events may have brought individuals from the two arms together. These methodological problems were reported by Thompson and colleagues (2006) in a community intervention to increase cancer prevention behavior among Latinos in Washington State.

Conclusions

The use of promotoras is an effective method for getting health education materials on pesticides, and probably other topics, into the homes of Latino immigrants in rural communities. However, a more structured model is needed to be sure that the duration and dose of the intervention are large enough to overcome educational and cultural characteristics of the population. At the same time, some life circumstances common among residents of low income communities, such as substandard housing, cannot be improved by a health education intervention, and can limit the effectiveness of such interventions. Higher level policy changes (e.g., requiring payment of a living wage, provision of low-income housing) are needed to address these life circumstances.

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TABLE 1

Baseline Characteristics for Pesticide Curriculum, Nutrition Curriculum and All Participants

Participant Characteristics	Pesticide Curriculum	Nutrition Curriculum	All	P-value ^b
	(N =65) ^a	(N =50) ^a	(N =115) ^a	
	Mean ± SD or Count (%)	Mean ± SD or Count (%)	Mean ± SD or Count (%)	
Age (in years)	27.7 ± 6.3	27.1 ± 6.1	27.4 ± 6.2	0.61
16–19	6 (9.2)	3 (6.0)	9 (7.8)	-
20–24	15 (23.1)	14 (28.0)	29 (25.2)	-
25–29	18 (27.7)	16 (32.0)	34 (29.6)	-
30–34	17 (26.2)	12 (24.0)	29 (25.2)	-
35–47	9 (13.9)	5 (10.0)	14 (12.2)	-
Married or living as married	59 (90.8)	46 (92.0)	105 (91.3)	1.0
Born in Mexico	62 (95.4)	44 (88.0)	106 (92.2)	0.17
Have lived in US ≥ 1 year	61 (93.8)	48 (96.0)	109 (94.8)	0.70
Reside in current house ≥ 1 year	51 (78.5)	36 (72.0)	87 (75.7)	0.42
At least high school education	0 (0)	3 (6.0)	3 (2.6)	0.079
Prefer Spanish language	56 (86.2)	41 (82.0)	97 (84.4)	0.54
Employed	28 (43.1)	12 (24.0)	40 (34.8)	0.033
Husband/partner currently employed	59 (90.7)	43 (86.0)	102 (88.7)	0.42
Number of adults in house ≥ 3	24 (36.9)	27 (54.0)	51 (44.3)	0.068
Any unrelated adults in house	9 (14.3)	16 (34.8)	25 (22.9)	0.012
Number of children in house ≥ 3	19 (29.2)	11 (22.0)	30 (26.1)	0.38
Mobile or one-family detached house	53 (81.5)	49 (98.0)	102 (88.7)	0.0057
Own house	8 (12.3)	14 (28.0)	22 (19.1)	0.034

^aThe sample sizes (N) exclude 12 participants in the Pesticide Curriculum arm and 20 participants in the Nutrition Curriculum arm who did not complete the training.

^bP-values are for comparisons between Pesticide Curriculum and Nutrition Curriculum arms.

TABLE 2

Baseline Comparison of Outcome Measures for Pesticide Curriculum and Nutrition Curriculum Participants

Outcome Measures	Pesticide Curriculum	Nutrition Curriculum	All	P-value
	(N =65) ^a	(N =50) ^a	(N =115) ^a	
	Mean ± SD or Count (%)	Mean ± SD or Count (%)	Mean ± SD or Count (%)	
Delivery of the intervention				
Number of visits	0.6 ± 1.0	0.4 ± 0.7	0.5 ± 0.9	0.42 ^b
Recognition of the intervention				
Number of messages	1.1 ± 1.5	0.9 ± 1.3	1.0 ± 1.4	0.70 ^b
Knowledge				
Pesticide definition	26 (40.0)	20 (40.0)	46 (40.0)	1.00 ^c
Pesticide usage	38 (58.5)	27 (54.0)	65 (56.5)	0.63 ^c
Pesticide effect on children	50 (76.9)	29 (58.0)	79 (68.7)	0.030 ^c
Number of label items	1.3 ± 1.9	1.2 ± 2.1	1.3 ± 2.0	0.32 ^b
Pesticide exposures behaviors				
Pesticide storage	2 (3.1)	6 (12.0)	8 (7.0)	0.076 ^d
Change out of work clothes	23 (44.2)	13 (33.3)	36 (39.6)	0.29 ^c
Shower after work	37 (71.2)	30 (76.9)	67 (73.6)	0.54 ^c
Residential integrated pest management behaviors				
Number of pest management items	5.2 ± 1.8	5.8 ± 1.8	5.5 ± 1.8	0.12 ^b

^aThe sample sizes (N) exclude 12 participants in the Pesticide Curriculum arm and 20 participants in the Nutrition Curriculum arm who did not complete the training.

P-values are for comparisons between Pesticide Curriculum and Nutrition Curriculum arms:

^bTwo-sample Wilcoxon rank-sum test

^cChi-square test

^dFisher's exact test

TABLE 3

Post Intervention Comparison of Outcome Measures for Pesticide Curriculum and Nutrition Curriculum Participants

Outcome Measures	Pesticide Curriculum	Nutrition Curriculum	All	P-value
	(N =65) ^a	(N =50) ^a	(N =115) ^a	
	Mean ± SD or Count (%)	Mean ± SD or Count (%)	Mean ± SD or Count (%)	
Delivery of the intervention				
Number of visits	4.6 ± 3.0	1.7 ± 3.0	3.3 ± 3.3	<0.0001 ^b
Recognition of the intervention				
Number of messages	3.5 ± 1.9	1.6 ± 1.7	2.7 ± 2.0	<0.0001 ^b
Knowledge				
Pesticide definition	26 (40.0)	21 (42.0)	47 (40.9)	0.83 ^c
Pesticide usage	36 (55.4)	31 (62.0)	67 (58.3)	0.48 ^c
Pesticide effect on children	59 (90.8)	36 (72.0)	95 (82.6)	0.0085 ^c
Number of label items	1.6 ± 2.2	1.2 ± 1.8	1.4 ± 2.0	0.56 ^b
Pesticide exposures behaviors				
Pesticide storage	4 (6.2)	4 (8.0)	8 (7.0)	0.73 ^d
Change out of work clothes	32 (59.3)	22 (59.5)	54 (59.3)	0.98 ^c
Shower after work	38 (70.4)	32 (86.5)	70 (76.9)	0.073 ^c
Residential integrated pest management behaviors				
Number of pest management items	5.6 ± 1.5	5.4 ± 1.9	5.5 ± 1.7	0.81 ^b

^aThe sample sizes (N) exclude 12 participants in the Pesticide Curriculum arm and 20 participants in the Nutrition Curriculum arm who did not complete the training.

P-values are for comparisons between Pesticide Curriculum and Nutrition Curriculum arms:

^bTwo-sample Wilcoxon rank-sum test

^cChi-square test

^dFisher's exact test

TABLE 4

Baseline and post Intervention Comparison of Outcome Measures for Pesticide Curriculum Participants (N=65)^a

Outcome Measures	Baseline	Post Intervention	P-value
	Mean ± SD or Count (%)	Mean ± SD or Count (%)	
Delivery of the intervention			
Number of visits	0.6 ± 1.0	4.6 ± 3.0	<0.0001 ^b
Recognition of the intervention			
Number of messages	1.1 ± 1.5	3.5 ± 1.9	<0.0001 ^b
Knowledge			
Pesticide definition	26 (40.0)	26 (40.0)	1.0 ^c
Pesticide usage	38 (58.5)	36 (55.4)	0.85 ^c
Pesticide effect on children	50 (76.9)	59 (90.8)	0.035 ^c
Number of label items	1.3 ± 1.9	1.6 ± 2.2	0.38 ^b
Pesticide exposures behaviors			
Pesticide storage	2 (3.1)	4 (6.2)	0.69 ^c
Change out of work clothes	23 (44.2)	32 (59.3)	0.078 ^c
Shower after work	37 (71.2)	38 (70.4)	0.79 ^c
Residential integrated pest management behaviors			
Number of pest management items	5.2 ± 1.8	5.6 ± 1.5	0.19 ^b

^aThe sample size (N) excludes 12 participants in the Pesticide Curriculum arm who did not complete the training.

P-values are for comparisons between baseline and post intervention:

^bWilcoxon signed-rank test

^cMcNemar's chi-square test