J Immigrant Minority Health (2012) 14:460–466
DOI 10.1007/s10903-011-9484-3

ORIGINAL PAPER

Adoption of Safety Eyewear Among Citrus Harvesters in Rural Florida

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Published online: 4 June 2011

Abstract The community-based prevention marketing program planning framework was used to adapt an evidence-based intervention to address eye injuries among Florida's migrant citrus harvesters. Participant-observer techniques, other direct observations, and individual and focus group interviews provided data that guided refinement of a safety eyewear intervention. Workers were attracted to the eyewear's ability to minimize irritation, offer protection from trauma, and enable work without declines in productivity or comfort. Access to safety glasses equipped with worker-designed features reduced the perceived barriers of using them; deployment of trained peer-leaders helped promote adoption. Workers' use of safety glasses increased from less than 2% to between 28% and 37% in less than two full harvesting seasons. The combination of formative research and program implementation data provided insights for tailoring an existing evidence-based program for this occupational community and increase potential for future dissemination and worker protection.

Keywords Migrant farm workers · Eye injuries · Community health workers · Occupational health · Rural health

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Background

Occupational safety and health has recognized the need to hasten the translation of research to practice [1]. For example, the National Institute of Occupational Safety and Health has a research to practice effort focused on "the transfer and translation of research findings, technologies, and information into highly effective prevention practices and products which are adopted in the workplace" [2].

Concomitantly known as *evidence-based practice* or *translational research*, this process involves "the development, implementation, and evaluation of effective programs and policies in public health through application of principles of scientific reason, including systematic uses of data and information systems and appropriate use of behavioral science theory and program planning models" [3]. Some experts suggest that social marketing is a promising strategy for adapting evidence-based interventions and disseminating them to new audiences [4, 5]. This paper describes how an existing eye injury prevention program was adapted and tailored for Florida's citrus workers using the community-based prevention marketing (CBPM) planning framework [6, 7]. It emphasizes the consumer (i.e., worker) research phase of the project and

how results contributed to making the intervention more responsive to citrus harvesters' needs.

Conceptual Framework

The citrus worker health and safety program, the *Partnership for Citrus Work Health* (PCWH), began as a Florida Prevention Research Center (FPRC) demonstration project. The FPRC is one of 37 centers that form the network of 32 comprehensive and five developmental Prevention Research Centers funded by the Centers for Disease Control and Prevention [8].

The FPRC uses CBPM for promoting health and preventing disease and disability in vulnerable populations. CBPM is a data-driven framework that combines community organization principles and social marketing's conceptual framework of *product benefits*, *product costs* (i.e., price), *placement*, and *promotional strategies* to design, implement, and evaluate health interventions [6, 7]. The planning process is guided by principles of community participation, empowerment, and competence. Community members are given responsibility and authority to make key decisions to enhance their ability to identify and respond to local health problems. Program development follows the prevention research cycle as community members work with university-based researchers to identify modifiable risks, prioritize health-promoting behaviors, design and implement intervention, efficacy, and effectiveness trials, and create marketing plans to disseminate effective interventions.

In the PCWH project, the FPRC and a migrant worker advocacy group, the Farmworker Association of Florida (FWAF) recruited citrus harvesters, citrus industry supervisors (health and safety officers and human resources personnel), health department staff, and other stakeholders to serve on a community board. Researchers corresponded with, and made visits to individuals and industry groups to explain the goals of the project and invite them to attend organizational meetings. The FWAF used its connections in the migrant community to recruit citrus workers to join the board. This board directed the project, selecting eye injuries as a priority health problem, and the use of safety eyewear as the target behavior because it effectively prevents most eye injuries [9–11]. The board also approved plans to implement an eye injury prevention program developed by the Great Lakes Partnership for Agricultural Safety and Health [12]. This particular intervention engaged community health workers (CHWs) to promote using safety glasses and provide education on eye health to Midwest farmworkers.

Eye injuries are frequently identified health problems with farmworkers [13–17]. Among citrus harvesters, eye irritants include exposure to ultraviolet light, dust, mildew and fungus on tree leaves, sand, citrus flowers, water droplets contaminated by chemicals, and insects. Moreover, direct trauma occurs when branches recoil and strike a worker, dry twigs at the tree canopy base puncture an eye, falling oranges bruise an eye, or the edge or tip of leaves produce lacerations. Despite the injury risk, estimates of use of safety glasses among farmworkers range from about 5.1% in a North Carolina study [18] to less than 2% in Florida [19].

Objective

The objective of this study was to determine whether a consumer-focused behavioral change process would increase the acceptance and use of safety glasses among citrus harvesters who have traditionally disdained use of protective eyewear, and examine the utility of CBPM as a planning framework for adapting an intervention for a different population and setting.

Methods

Setting

Most of Florida's citrus is hand-harvested using ladders that extend up to 20 feet into the tree canopy. Harvesting is carried out by crews of 15–40 workers supervised by a crew leader (*chivero*). Each day, the chivero picks up workers at their camps or trailer parks and transports them to the groves.

Harvesters work at their own pace, moving ladders tree-to-tree until each tree is stripped of fruit. Fruit is placed in a canvas bag slung over the shoulder. Full bags weigh over 90 pounds when they are emptied into a tub. Harvesters work largely unsupervised except when a crew leader transfers the harvest from the tub to his truck. When tubs are emptied, the chivero credits the harvester for his work; he, in turn, receives payment for a percentage of every tub filled by his crew. Productivity varies depending on the grove's condition, the amount of easily picked fruit, and individual capabilities. A "typical" citrus worker harvests 3–5 ton of fruit daily. Ideally, workers fill 6–12 of the 900-pound tubs during a 10-h shift [19].

Citrus companies contract with workers to harvest fruit on a piece-rate calculated for a 90-pound box of oranges. These rates depend on the ease with which citrus can be harvested and generally increase during the season (January–June) as temperatures rise and work becomes more demanding. Rates are measured by the number of filled tubs—each of which contains up to 10 boxes of fruit at $6 to $15 per tub. For workers to maximize their wages, this piece-rate system demands both expedience and efficiency.

Consequently, it also contributes to eye injuries by encouraging workers to pick rapidly with few breaks or preventive measures.

Participants

Estimates of Florida's migrant farmworker population vary [20]. The US Department of Health and Human Services reports 286,725 workers, including accompanying family members [21].

FPRC personnel conducted research in Southwest Florida, where approximately 4,600 workers harvest about one-fourth of the state's citrus crop [22]. Most of these migrant workers are Mexican, male, 20–40 years old, single or traveling without families, have less than six years of schooling, work only in the citrus industry, have an annual farm labor income approximating $7,000, and lack formal permission to work in the United States [22].

Two citrus companies including nine intervention (i.e., CHW-led) and four control crews participated. Harvesting crews could not be randomly assigned to intervention or control conditions because of restrictions placed on the researchers by the companies. Pragmatically, one company's workers all lived in the same labor camp maintained on company property. They comprised the intervention group as mixing of members of intervention and control crews would have created a "contamination" effect. All observed workers were men ($n = 108$), with an average age of 30 years. About 65% were married, with their spouses and families residing in Mexico. Workers averaged four years of Florida citrus harvest experience. Just over one-third of workers were in their first harvest season.

Data Collection

Two members of the citrus harvesting community worked with researchers to conduct consumer research to clarify workers' perceptions of eye injuries and protective eyewear. Several qualitative methods helped gain understanding of workers' perceptions of occupational hazards, their personal injury experiences, and perceptions of safety eyewear. Participant observation was conducted throughout the study (2003 and 2004 harvest seasons). For instance, FPRC personnel and their community partners accompanied workers on buses as they traveled to and from the groves, harvested fruit alongside them, and spent time in workers' homes and camps. One FPRC researcher conducted key informant interviews with 10 citrus company representatives for their perspective on workers' risks, their experience with injury prevention, and views on worker acceptance of safety eyewear. FPRC and community researchers conducted eight focus groups with 50 citrus harvesters at workers' homes. During the 2004 season, seven citrus workers voluntarily underwent training as CHWs. They received a stipend of $10/h (the average hourly wage for experienced harvesters) for 4 h/week. They incorporated their CHW duties into their work schedules and evenings in the camps.

Measures

During the pilot program phase, FPRC personnel observed CHWs and other workers in the groves to determine the proportion wearing safety glasses and obtain feedback about their experiences with them. An industry representative on the community board facilitated researchers' entrée for making eight unannounced visits to intervention and control crews. Researchers also observed CHW training sessions, CHW educational sessions with co-workers, and obtained feedback from CHWs and other workers. At the end of the season, researchers interviewed CHWs as a group to obtain opinions about program strengths and weaknesses. A face-to-face interview was completed by 74 of the 108 workers at the end of the 2004 season. Table 1 summarizes data collection initiatives.

Data Analysis

Except for key informant interviews, all data were collected and recorded in Spanish by native speakers. FPRC personnel analyzed the data and prepared summaries for the FWAF and PCWH boards to review, provide feedback, and offer interpretation. Focus group transcripts, individual interview notes, and field notes were coded to identify themes. Of special interest were topics related to marketing's conceptual framework (product benefits and costs, placement, and promotional strategies) and other factors that influence workers' use of safety eyewear. Observational data were tabulated by hand. The Social and Behavioral Science Division IRB at the University of South Florida approved the study protocol.

Results

Occupational Hazards

Eye irritation from foreign objects and trauma were the most frequently reported worker injuries. Workers also noted seasonal, environmental, and grove conditions that increase eye injury risk as the following worker comments illustrate.

> When there is heat, there is more dust from the ground. The goat [truck] is running fast and it stirs it up. The dust gets on the leaves and when we pick it

Table 1 Summary of evaluation strategies, findings, and methodological limitations

Research methods	Design features	Respondents	Major findings	Limitations
Brief intercept surveys	Trained community members to ask about health and safety priorities in the citrus industry	30 citrus harvesters waiting in line for immigration services	Eye injuries most common among a variety of hazardous exposures for citrus harvesters	Limited ability to establish rapport in public settings
Key informant interviews	Open-ended interviews administered by FPRC researchers	Citrus company managers, agricultural researchers	Company perspective on cost of eye injuries and failure of safety programs; limited possibility for change due to structure of work	Company managers lack the perspective of workers who often distrust them
Focus group interviews	Community partners recruited and helped facilitate interviews in worker housing	50 harvesters in eight focus groups	Workers demonstrate detailed knowledge of exposures that lead to eye injuries; most injuries not reported; negative perceptions of safety glasses and impact on earnings	Participants relaxed in home setting but with a plethora of ambient noise and distractions
Participant-observer methods	Research team picked citrus in the grove side-by-side with regular workers	Repeated with 10 different crews	Expanded number of risk exposures (including changing environmental conditions) and behaviors that lead to injury	Time and resource intensive method of data collection
Non-random observations of crews participating in CHW program	Research team makes unannounced visits to groves and observes each individual worker	108 workers in six crews observed	An average of 37% of workers observed wearing protective safety glasses; few workers wear them in the morning when trees are wet	Logistical problems limit number of visits and prevent randomization
Post-intervention survey	30-min interview with majority of workers that had a CHW on their crew	74 face-to-face surveys completed.	Most workers now report that safety glasses do not impede work efficiency and therefore, do not cause lower earnings; 44% respond that they wear the glasses "most of the time."	Social-desirability response bias with self-reported behavior; no random selection of interviewees
Focus group with CHWs	Request for feedback on lessons learned during intervention	One focus group with five participants	CHWs satisfied with program and report administering 114 first-aid measures	Increase in education not measured for crews

> gets in our eyes. When we are picking above our heads, the dust falls in eyes. You have to be careful. I have a lot sand on my gloves when the grove is wet, and the sand falls into my eyes every time I grab an orange.
>
> When the grove is wet, the chemicals sprayed on the leaves fall into my eyes every time I climb up the tree and shake it.

Harvesters frequently encounter foreign objects. However, even when irritation persists, few workers seek medical treatment, relying instead on over-the-counter medicines and assistance from co-workers. Most workers also self-treat eye abrasions they receive from branches and leaves. Even when traumas are painful and infected, workers frequently delay treatment. This postponement reflects harvesters' view of eye injuries as unavoidable in citrus work, the economic consequences of missing work, and the fear of alienating crew leaders and employers.

> It is hard to go to the clinic for services. If you go, you miss work, and you have to be there very early, but sometimes you don't have a ride. And if you go and get there late, they don't want to see you and they tell you to come back the next day at 3 PM. And you go there at 3 PM the next day, and they tell you that it is too late, that they cannot see you. And if you go with a private doctor, well, that is very expensive.

Perceptions of Safety Eyewear

Workers recognized the protection that safety glasses could provide them, particularly against the dangers of foreign objects and the risk of greater injury.

> These protect you from the sun and the basura (garbage).

Initially, few workers wore safety glasses and most had formed negative attitudes towards them because of the *costs* they associated with them. Most companies had provided glasses to workers without charge, but workers were deterred by fears that they would impede harvesting efficiency, resulting in lower wages. They also believed the glasses would be uncomfortable. Specific complaints included: they are too hot to wear in warmer months; the

extra perspiration and dirt they accumulate necessitate pause from working to clean them, thereby slowing the harvesting; glasses fog in Florida's humid climate; glasses get caught in tree branches and fall off; and tinted lenses impede vision, obscure the fruit, and increase risk of falling. With wage incentives based primarily on speed, any perceived barrier to expedience becomes magnified. The following remarks reflect this belief:

> Yes (I would wear glasses) these would protect from the garbage, the problem is the heat. I picked one day with sunglasses and they protected me from the garbage. But it was slower. By the hour it would be no problem.
>
> We would have to try them [the glasses]. But I am not sure, the sweat may bother [me]. But who knows, perhaps these glasses don't let the sweat fall into your eye. But if the glasses don't stop the sweat, it will be worse because you will have to clean the glasses all of the time.
>
> We can't wear them all day when it gets hot. It fogs up inside and you have to take it off and clean it with your shirt.

Although harvesters worked independently, they usually lived with other crew members in camps or trailer parks and became familiar with their peers' experience and skills. In some cases, workers had been recruited by relatives or friends from their home towns in Mexico with whom they worked and came to trust as mentors. Workers, especially those classified as illegal aliens, trusted few people outside their peer network, making skilled harvesters the most credible and trustworthy information sources about injury prevention and other subjects.

Regarding promotional methods, most citrus harvesters relied on Spanish-speaking radio and television for information and entertainment. Some camps had cable television that included Mexico-based channels featuring soccer and other entertainment. Although educational posters were displayed in some housing units, low literacy made print materials ineffective. Word-of-mouth was the most effective channel for providing health and safety information.

Pilot Program

The pilot program demonstrated the value of using peer workers as CHWs, the characteristics of safety glasses suited for harvesting citrus, and the benefits of wearing them. The CHWs attended training sessions on weekends, wore glasses during most of each day, provided educational messages and first-aid to co-workers, and kept activity diaries. At the end of the season, CHWs reported satisfaction with the program. They felt they had acquired important skills and enjoyed helping peers. Several CHWs believed that their role and knowledge enhanced their status within the crew. CHWs felt the weakest aspect of the program was their effectiveness during educational sessions with groups. They recommended additional training and skill-building to prepare them better.

CHWs tested approximately 20 commercially available safety glasses and provided feedback about features that affected their use when harvesting. The style selected as most suitable for the groves was lightweight, had low distortion and high quality optics, frameless lenses that could be elevated off the face to relieve heat, a soft nosepiece for comfort, a gap in the top of the frame to provide ventilation, thereby reducing fogging, and a short, sports-style band that kept them attached with low likelihood of becoming entangled with tree branches.

The pilot program during 2004 was associated with increased use of safety glasses. At the onset, <2% of workers wore safety glasses in the groves, and industry representatives reported that distribution of free safety eyewear and policies encouraging use had no impact on rates. However, after the pilot phase, 28% of harvesters on CHW crews were observed wearing glasses at all times of the day, and 37% wore them after 11 AM (when effects of dew and humidity decline).

Finally, the pilot program made it possible to assess changes in workers' perceptions of safety eyewear as a result of their being able to field test different models. Workers wearing glasses no longer believed they reduced productivity and earning capacity, suggesting that this barrier could be reduced if workers could be persuaded to participate in a trial period with this eyewear. Also, they reported less eye irritation from dust, sand, insects, and chemicals, suggesting that the reduction of daily irritation should be added to the product "benefits" promised in future promotional efforts.

Discussion

This study used the CBPM framework to tailor an eye injury prevention program for citrus harvesters. A feature of the program was using CHWs as peer role models. Thus, full-time citrus harvesters, most of whom have little formal education, can disseminate information on eye safety, serve as role models, provide first-aid, and promote behavior change effectively. These findings corroborate other studies of CHW effectiveness as health promoters [23, 24]. CHWs have been used extensively throughout Latin America, Africa, and Asia [25, 26]. In the United States, most CHWs are women of color hired to be cultural bridges between health care providers and members of economically disadvantaged communities [27]. Because of

their knowledge of local community norms, CHWs can make personal connections with clients more effectively than traditional health care providers, enabling them to provide community residents with much needed information on a variety of health topics [28]. CHWs have been especially useful in reaching Hispanic populations in rural communities where few people speak English [29]. Their success in the PCWH project suggests they also can be valuable in occupational settings. By serving as role models and promoting a different social "norm," they improve the safety climate that has been shown to increase employees' compliance with safety standards and reduce injury rates [30].

A further advantage of CHWs is the access they can provide researchers to other community members. As trust developed between CHWs and FPRC personnel, CHWs helped researchers establish rapport with workers. They also played an important role in evaluating and adapting the training to fit their needs and preferences. In addition, they participated in research activities, testing commercially available glasses and providing feedback on features that enhanced comfort and performance.

Limitations

Certain limitations should be noted. First, crews could not be randomly assigned to CHW and non-CHW conditions so subtle differences among workers and company cultures were beyond researcher control. Second, repeated observation was a proxy measure for adoption of safety eyewear. Workers would have to be tracked longitudinally to confirm user maintenance. Third, crew size, composition, and seasonal turnover introduce unknown variation to measurement of behavior change. Fourth, CHWs may not represent "typical" workers because of their experience, education, and social status with crew members. Fifth, some CHWs lived in close quarters with a small subset of workers whom they may have influenced more strongly. Additionally, CHWs have different social networks based on kinship, community of origin, and age. Finally, the extent to which participating companies and crews represent other citrus harvesters is unknown.

New Contribution to the Literature

Guided by the CBPM framework, marketing research identified workers' perceptions of the benefits, costs, and other factors associated with using safety eyewear. CBPM was a useful planning framework that employed consumer research and marketing strategies to "frame" the *product* (safety glasses), lower the perceived *price* of using the product, disseminate messages in an appropriate *place*, and carry out the right *promotion* to improve product adoption. As a result, the FPRC is currently working with a technology firm to develop and test improved coatings for commercial safety eyewear. In addition, CHWs' use of safety glasses and the subsequent adoption by their peers revealed unanticipated benefits. For example, the intrusion of sand, fungi, and other foreign bodies into the eye do not generally result in injury reports, but can cause discomfort that affects workers' quality of life issues and may impede productivity. Consequently, the CHW curriculum now emphasizes the value of safety glasses in preventing the more common, albeit minor, irritants as well as protection from more serious injuries. This research fostered numerous changes in the training materials to accommodate citrus workers' literacy, schedules, and occupational demands. Most importantly, the study revealed the value of a trial period in changing workers' attitudes towards adopting safety glasses. After partial completion of a single harvest season, many workers discovered that their initial impressions of safety eyewear were incorrect and they could work without compromising productivity or comfort.

Conclusions

The combination of formative research and pilot program data yielded valuable insights into modifications needed to tailor the program for this occupational community. The value in these lessons is that they reinforce the argument made by social marketers that marketing's conceptual framework and reliance on consumer research are critical for tailoring evidence-based strategies, such as the one adapted from the Great Lakes Partnership for Agricultural Safety and Health, for use in other venues [4, 5]. Finally, the project's promising trial period suggests that CBPM has utility as a planning framework and can help translate and tailor public health-related "best practices" for culturally appropriate, occupation-specific interventions.

Acknowledgments This project was supported by the CDC/Health Promotion and Disease Prevention Centers U48/CCU415803-05, Cooperative Agreement Number 1-U48-DP-000062), Community Based Prevention Marketing: Building Local Capacity for Disease Prevention and Health Promotion, Citrus Worker Pilot Project; NIOSH/CDC Grant Number HHS CCU516863-01; Reducing Eye Injuries in Latino Farm Workers; and ASPH Trans-Association Grant, T3287-22/22 and T3119-23/23 Eye Injury Prevention in Migrant Farmworkers in Florida.

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