

# Eye Symptoms and Use of Eye Protection Among Seasonal and Migrant Farmworkers

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## ABSTRACT

**Background.** Farmworkers face an array of environmental and workplace hazards that pose risks of eye damage from accidents involving agricultural chemicals and equipment and from exposure to wind, dust, and ultraviolet rays. Eye safety risks are known among industrial and agricultural occupations, yet little is known about the prevalence of eye symptoms and use of eye protection among farmworkers.

**Methods.** A survey of 197 Latino farmworkers in North Carolina used self-report data to measure workers' prevalence of eye symptoms and eye protection use.

**Results.** Eye pain and redness after working all day in the field were reported by more than 40% of workers. Most (98.4%) reported not wearing sunglasses when working in the fields; reasons included lack of sunglasses and interference with field tasks.

**Conclusions.** Eye symptoms are prevalent in this population. Failure to use eye protection indicates the need for further education and training of Latino farmworkers and their employers about occupational risks to eyesight.

WORKERS face a variety of hazards to their eyes, including unintentional injuries; exposure to chemicals, dust, and infectious agents; and exposure to ultraviolet and other radiation. While the potential for eye injuries exists in nearly every occupation, with 1,000 workplace eye injuries occurring every day,<sup>1</sup> agricultural workers have eye injuries and illnesses at a rate 2.5 times that of all industries combined.<sup>2</sup> The Bureau of Labor Statistics reported for 1998 that eye injuries and illnesses accounted for 5.7% of lost workdays in the agricultural sector, with a rate of 16.8 injuries and illnesses per 10,000 workers.<sup>3</sup> The focus of most research and surveillance has been acute traumatic injuries, rather than chronic long-term exposures.<sup>4,6</sup>

Agricultural workers doing fieldwork risk traumatic eye injuries caused by plants, tools, and equipment. In addition, they experience constant exposure to agricultural chemicals, wind, dust, allergens, and ultraviolet (UV) light.<sup>7</sup> These farmworkers spend considerable time outdoors during daylight hours when UV rays

are strongest. Short-term effects of exposure to UV-A and UV-B rays include photokeratitis, eye sensitivity, and irritation. Long-term effects include pterygia, pingueculae, cataracts, and retinal damage.

The population of agricultural workers in the United States includes an estimated 4.2 million migrant and seasonal farmworkers and their dependents, most of them Mexican.<sup>8,9</sup> Because of their working conditions, this group is at high risk for eye injuries and other eye conditions but has limited access to health care.<sup>10</sup> Virtually no research has been published documenting eye injuries, eye illnesses, or eye protection use among these workers. Existing studies in agriculture have surveyed only farm operators and the household members<sup>4</sup> or have relied on hospital admission reports.<sup>5</sup> A survey of health care providers in migrant farmworker clinics conducted for the Migrant Clinicians Network in

## KEY POINTS

- There are an estimated 4.2 million migrant agricultural workers and seasonal farmworkers in the United States.
- This group is at high risk for eye injuries and other eye conditions.
- Symptoms reported among farmworkers include itching, blurred vision, redness, and pain.
- The majority of farmworkers do not wear sunglasses while working.
- Education about eye protection may have to confront cultural barriers.

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TABLE. Self-Reported Frequency Of Eye Conditions Among Farmworkers

Eye Conditions	Always No. (%)	Usually No. (%)	Sometimes No. (%)	Seldom No. (%)	Never No. (%)
Pain	2 (1.0)	4 (2.0)	44 (22.4)	30 (15.3)	116 (59.2)
Redness	9 (4.6)	10 (5.1)	40 (20.4)	26 (13.3)	111 (56.6)
Itching*	1 (0.5)	3 (1.5)	32 (16.3)	12 (6.1)	147 (75.0)
Blurred vision	2 (1.0)	2 (1.0)	15 (7.7)	6 (3.1)	169 (86.7)

\*Missing data in 1 case.

1996 found that refractive errors were the most common eye problems seen in migrant patients, followed by eye infections, diabetes-related eye problems, and pterygia. However, no survey of farmworkers was actually done; questions regarding eye symptoms were not included.<sup>6</sup>

Health care providers in North Carolina note that pterygia are seen among farmworkers. A pterygium is an abnormal fold of membrane that begins to grow over the cornea, affecting vision and causing corneal damage in some cases. Symptoms of pterygia include blurred vision, burning, tearing, a feeling of having sand in the eye, irritation, itching (dry eye syndrome), and corneal irritation.<sup>8</sup> Pterygia typically occur in persons who spend considerable time outdoors for occupational or recreational activities and in people living closest to the equator.<sup>11-14</sup> Welders have also been shown to have significantly high rates of pterygia due to their exposure to UV-C radiation.<sup>15</sup> Ultraviolet light exposure is believed to be the most significant risk factor in the development of pterygia,<sup>13,16-18</sup> though allergens, chemicals and other irritants (eg, wind, dirt, dust, smoke, air pollution), and heredity<sup>19</sup> may contribute to the formation of pterygia.

The effects of UV radiation are cumulative, and research has shown that even low amounts of sunlight can increase the risk of having eye disorders.<sup>20</sup> The best method of protection against UV rays, dust, wind, and other allergens that cause pterygia and other disorders is the use of a wide-brimmed hat and sunglasses.<sup>17</sup> Despite the risk of eye disorders, anecdotal reports and observations indicate that most farmworkers do not wear sunglasses when working outdoors. The reasons for this lack of use are not clearly understood or documented. Although potential occupational and recreational exposures to UV have been examined among workers in several industries (eg, outdoor workers, welders, semiconductor fabrication workers, television and theater personnel, tanning salon clients),<sup>12</sup> such studies have not examined farmworkers. Our study was designed to add to the

occupational health literature for farmworkers by (1) describing the prevalence of eye symptoms among farmworkers; (2) documenting the prevalence of eye protection use among farmworkers; and (3) determining the barriers to the use of eye protection in this population.

#### THE STUDY

Data for this analysis came from interviews conducted with Latino farmworkers during the summer of 1999 in eastern North Carolina. These data were collected as part of the community-based project PACE: Preventing Agricultural Chemical Exposure among North Carolina Farmworkers. This 4-year study, funded by the National Institute of Environmental Health Sciences, is designed to develop and implement culturally appropriate interventions to reduce the workplace exposure of farmworkers to pesticides.<sup>21</sup> North Carolina ranks fifth nationally in its number of farmworkers, having an estimated 140,000 migrant workers and dependents, with twice as many seasonal farmworkers.<sup>22</sup> Like farmworkers in the rest of the United States, the majority of these workers are Latino, coming primarily from Mexico.<sup>9</sup>

#### METHODS

A representative sample of farmworkers working in either cucumbers or tobacco was recruited in the eight-county PACE study area in June 1999, using methods previously described for the 1998 phase of PACE.<sup>23,24</sup> Briefly, farmworker housing sites in the study area were enumerated in early summer. Thirty-six sites were randomly chosen, and 10 workers were selected at each site for an interview. Initial interviews were conducted in Spanish at the housing sites by teams of interviewers who included academic researchers, college students, and former farmworkers. The interview teams returned to the housing sites later in the summer to conduct follow-up interviews with those workers previously interviewed. Data used in the present analysis from the initial interview questionnaire include personal characteristics (sex, ethnicity, age), and farmwork experience. The follow-up question-

naire included questions to assess levels of eye pain and sensitivity, along with questions concerning the use of sunglasses. Farmworkers were asked to report how often their eyes hurt after working all day in the fields. Response categories were *never, seldom, sometimes, usually, or always*. They were also asked to describe how much their eyes hurt (*a little, some, a great deal*) on the days they reported feeling pain after working all day in the fields. Workers were asked how often, after working all day in the fields, their eyes were red, how often their eyes were itchy, and how often their vision was blurred. Response categories were *never, seldom, sometimes, usually, and always*. Farmworkers were asked how many days in the past week they wore sunglasses while working in the fields. If the self-reported number of days worked was greater than the number of days reported having worn sunglasses, the interviewer asked why sunglasses were not always worn. Workers chose from a list of responses: it was overcast/not sunny; no one else wears sunglasses; I don't own/have any sunglasses; I don't like to wear sunglasses; or other. Respondents were asked to choose all applicable responses. Self-rated health was measured in the follow-up interview by asking workers if their overall health was *excellent, very good, good, fair, or poor*.

Descriptive statistics were calculated for sample demographic characteristics and for responses to eye symptom items. Bivariate analyses of eye symptoms with age and with years worked in the United States were conducted using Student *t* tests. Chi-square analyses with Mantel-Haenszel tests of significance were used to examine the relationship of self-rated health to eye symptoms.

## RESULTS

The sample consisted of 197 of the original 293 workers interviewed at the beginning of summer. Of those not interviewed, 22 were still in residence (12 refused; 10 could not be located). The remaining 74 had left the communities: 36 had gone back to Mexico, 20 had gone to other states, 6 were elsewhere in North Carolina, and 12 had left for unknown destinations. Thus, the 197 interviewed constitute 92% of the available sample of farmworkers who were exposed to the risks of farmwork in North Carolina throughout the summer. There were no differences in age, place of birth, or years worked in agriculture between the original and end of season samples. Those present at the end of season were more likely to be working on H2A visas ( $P = .017$ ).

All 197 were Latino. The sample was 91% male. Ninety-four percent had been born in Mexico. The mean age ( $\pm$  SD) was 30.6 years ( $\pm$  10.7). Years worked in agriculture in the United States ranged from 1 to 50, with a median of 2 years. Forty-five percent had come to North Carolina on labor contracts through the H2A visa program.

Approximately 40% of farmworkers reported having eye pain after working all day in the fields (Table). Thirty workers (15.3%) said their eyes seldom hurt, and 44 (22.4%) said their eyes sometimes hurt. Three percent of workers said their eyes usually or always hurt. Redness of the eyes was reported by 43.4% of workers. Almost 10% reported that their eyes were always or usually red after working in the fields. Another 20.4% said their eyes were sometimes red. Itching of the eyes was reported by 25% of workers, and blurred vision was reported by 13.3%. For both itching and blurred vision, 2% of workers reported that they usually or always had these symptoms after work.

When those ever having a symptom were compared with those never having a symptom, significantly poorer self-rated health was reported by those having eye pain ( $\chi^2 = 20.133$ ;  $P < .001$ ), itching ( $\chi^2 = 15.664$ ;  $P < .004$ ), and blurred vision ( $\chi^2 = 18.669$ ;  $P < .001$ ). Eye symptoms were not related to farmworker age or to number of years worked in the United States.

As expected, the majority of farmworkers reported not wearing sunglasses while working during the previous 7 days. Of 193 farmworkers, 190 (98.4%) reported never wearing sunglasses while working in the fields. Almost half (48.4%) reported that they did not wear sunglasses when working because they did not like to wear them. Thirty-seven percent said they did not wear sunglasses because they did not own any. Twenty-seven workers (14.1%) stated that no one else wears sunglasses, and one respondent indicated that he did not wear sunglasses because it was overcast or not sunny. Thirty-nine respondents (20.2%) reported having other reasons for not wearing sunglasses.

Several reasons were given for not wearing sunglasses. First, workers stated that they did not need sunglasses. They noted that their eyes did not hurt or otherwise bother them. One said that he did not need them because his vision was perfect. Another reason for not wearing sunglasses was that sunglasses interfere with work. Because of bending down during tobacco cutting and the profuse perspiration produced by this work, workers claim that sunglasses slide

down and fall off. One worker stated that he could not differentiate leaf color when working in tobacco if he wore sunglasses. Finally, there appear to be cultural barriers against use of sunglasses. Farmworkers indicated that none of their coworkers wear sunglasses, and some mentioned that other farmworkers would make fun of them if they did.

## DISCUSSION

A significant number of farmworkers interviewed reported having eye symptoms after working in the fields. Taking the high frequency categories, 20% to 30% of workers reported pain, redness, and itching *always, usually, or sometimes*. Ten percent reported blurred vision at the same frequencies. Because farmworkers tend to work long hours during the hours of the day when UV rays are strongest and when the heat and dust contribute to eye irritation, these reported symptoms may predict the chances of more serious eye problems developing over time. Lower self-rated health was associated with three of the four eye symptoms. This indicates that eye symptoms may contribute to a lower perceived health status among farmworkers. The lack of association of eye symptoms with age and duration of work in US agriculture suggests a "healthy worker" effect. That is, persons in the best health are in the workforce, while those in poorer health leave farm labor.

Despite being at risk for vision problems due to their working conditions and environment, virtually no farmworkers wear sunglasses to work in the fields. They report they do not own sunglasses, and they do not perceive a need to wear them. Tobacco harvesting requires workers to move quickly between rows of bushy plants, stooping to grab only the leaves starting to turn yellow at the bottom of the stalk. Anything that makes this difficult to do (eg, pushing up glasses, having to stop and examine leaf color) slows the work and can reduce the worker's income. Many other crops have similar postural and speed demands. Wraparound sunglasses with close-fitting frames or the use of elastic straps might help prevent the problem of slipping due to perspiration or bending over. Lenses with a fog resistant coating could help prevent sunglasses from fogging up while working.

This study did not evaluate workers' knowledge of the benefits of eye protection, but reasons given for not needing eye protection indicate that workers are unaware of the risk posed by UV rays. Although they report a fairly high level of eye symptoms, they do not connect

these with a need to use sunglasses. It is therefore unlikely that simply distributing sunglasses without accompanying health education messages would result in significantly greater use. Experience with other occupational safety issues for farmworkers has shown that Latino farmworkers tend to place control over workplace safety outside themselves, placing it in God, in luck, or in their supervisors.<sup>25-28</sup> Thus, education conveying the long-term benefits of eye protection, accompanied by employers and crew leaders promoting and modeling eye protection through the use of wide-brimmed hats and sunglasses, may be necessary to change behavior.

Education about eye protection may also have to confront cultural barriers. The fact that coworkers do not wear sunglasses means that little peer support exists for the practice. Outreach workers from migrant health clinics in the area report that farmworkers have told them that sunglasses are worn by drug dealers in Mexico. Therefore, farmworkers do not want to wear them. Such barriers would need to be overcome to promote the use of eye protection. Whereas common sunglasses would seem to be the most readily available and acceptable form of eye protection to promote, alternatives such as goggles may actually be better accepted. Besides being more culturally acceptable, they may be more comfortable eye gear in which to work, and they could protect against work-related injuries.

This study provides the first published data on eye symptoms and use of sunglasses among migrant and seasonal farmworkers. One of its strengths is that it carefully sampled workers across the study area, rather than relying on clinic patients or other self-selected groups. In addition, because workers were recruited in camps early in the season, all workers surveyed at the end of the season had been exposed to farmwork and were not recent arrivals.

The study also has a number of shortcomings that could be addressed in an expanded study. No comparison data were collected from a population of comparable individuals not engaged in farmwork. Although it was not possible to find such a population at this time in the study area because most other Latino workers are engaged in occupations with similar eye hazards (eg, landscaping or construction), future studies should attempt to include a comparison population to better establish the link of occupational exposures and eye symptoms made in this paper. Data were gathered by self-reports, which

asked workers to retrospectively summarize eye symptoms. Although workers were able to assign their symptoms to frequency categories, further work to validate these is needed. Nevertheless, whether one classifies their responses as ever/never experienced eye symptoms or looks only at the most frequent categories, there still appear to be significant levels of eye symptoms reported. The study did not include a professional eye examination for vision problems or for pterygia, because the survey interviews were conducted by persons not trained in such evaluative techniques. Future studies could validate the self-reports using eye examinations and vision assessments. This would provide data on the level of pterygia in the worker population. In addition, trials of alternative forms of eye protection are needed to determine what farmworkers find acceptable and the best means of changing their behavior. Finally, future studies should assess worker knowledge of eye injuries and protection. Such data can help explain current behavior, as well as serve as a foundation for culturally appropriate behavioral intervention to improve eye protection behavior. Farmworkers need to be aware of the danger of exposure to UV rays in general and the role of sunglasses in eye safety. Health care practitioners can play an important role in educating their Latino farmworker clients in this area.

#### References

- US Department of Labor: Eye protection in the workplace, OSHA Fact Sheet 93-03. <http://www.cdc.gov/niosh/nasd/docs2/oa14800.html>. Accessed July 5, 2000
- Bureau of Labor Statistics: Percent distribution of nonfatal occupational injuries and illnesses involving days away from work by selected injury or illness characteristics and industry division, 1998. <http://www.stats.bls.gov/news.release/osh2.t05.htm>. Accessed July 3, 2000
- Bureau of Labor Statistics: Incidence rates for nonfatal occupational injuries and illnesses involving days away from work per 10,000 full-time workers for selected injury or illness characteristics and industry division, 1998. <http://www.stats.bls.gov/news.release/osh2.t06.htm>. Accessed July 3, 2000
- Eye injuries to agricultural workers—Minnesota, 1992-1993. *MMWR Morb Mortal Wkly Rep* 1995; 44:364-366
- Saari KM, Aine E: Eye injuries in agriculture. *Acta Ophthalmol Suppl* 1984; 161:42-51
- Retzlaff C, Hopewell J: Puntos de Vista: Primary Eye Care in Migrant Health. Eye care needs assessment. MCN Monograph Series, Migrant Clinicians Network, Austin, Tex, 1996
- Villarejo D, Baron SL: The occupational health status of hired farm workers. *Occup Med* 1999; 14:613-635
- HRSA: *An Atlas of State Profiles Which Estimates Number of Migrant and Seasonal Farm Workers and Members of Their Families*. Washington, DC, Health Resources and Services Administration, 1990, No. 525-081/40599
- Mehta K, Gabbard SM, Barrat V, et al: *Findings from the National Agricultural Workers Survey (NAWS) 1997-1998: A Demographic and Employment Profile of United States Farmworkers*. US Department of Labor, Research Report No. 8, 2000
- Rust GS: Health status of migrant farmworkers: a literature review and commentary. *Am J Public Health* 1990; 80:1213-1217
- Adamis AP, Starck T, Kenyon KR: The management of pterygium. *Ophthalmol Clin North Am* 1990; 3:611
- Shusterman DJ, Sheedy JE: Occupational and environmental disorders of the special senses. *Occup Med* 1992; 7:515-542
- Tang FC, Chen SC, Lee HS, et al: Relationship between pterygium/pinguecula and sunlight. *Chinese Med J* 1999; 62:496-502
- Threlfall TJ, English DR: Sun exposure and pterygium of the eye: a dose-response curve. *Am J Ophthalmol* 1999; 128:280-287
- Karai I, Horiguchi S: Pterygium in welders. *Br J Ophthalmol* 1984; 68:347-349
- Kwok LS, Coroneo MT: A model for pterygium formation. *Cornea* 1994; 13:219-224
- Mackenzie FD, Hirst LW, Battistutta D, et al: Risk analysis in the development of pterygia. *Ophthalmology* 1992; 99:1056-1061
- McCarty CA, Fu CL, Taylor HR: Epidemiology of pterygium in Victoria, Australia. *Br J Ophthalmol* 2000; 84:289-292
- Saw SM, Tan D: Pterygium: prevalence, demography and risk factors. *Ophthalmic Epidemiol* 1999; 6:219-228
- West SK, Duncan DD, Munoz B, et al: Sunlight exposure and risk of lens opacities in a population-based study: the Salisbury Eye Evaluation project. *JAMA* 1998; 280:714-718
- Arcury TA, Austin CK, Quandt SA, et al: Enhancing community participation in intervention research: farmworkers and agricultural chemicals in North Carolina. *Health Educ Behav* 1999; 26:563-578
- North Carolina Employment Security Commission: *Estimates of Migrant and Seasonal Farmworkers During Peak Harvest by County*. Raleigh, NC, 1995
- Arcury TA, Quandt SA, Austin CK, et al: Implementation of EPA's Worker Protection Standard training for agricultural laborers: an evaluation using North Carolina data. *Public Health Rep* 1999; 114:459-468
- Quandt SA, Arcury TA, Preisser JS, et al: Migrant farmworkers and green tobacco sickness: new issues for an understudied disease. *Am J Ind Med* 2000; 37:307-315
- Griehop JI, Stiles MC, Villanueva N: Prevention and resiliency: a cross cultural view of farmworkers' and farmers' beliefs about work safety. *Hum Organ* 1996; 55:25-32
- Austin CK, Arcury TA, Quandt SA, et al: Training farmworkers about pesticide safety: issues of control. *J Health Care Poor Underserved* (In press)
- Vaughan E: Chronic exposure to an environmental hazard: risk perceptions and self-protective behavior. *Health Psychol* 1993; 12:74-85
- Vaughan E: Individual and cultural differences in adaptation to environmental risk. *Am Psychol* 1993; 48:673-680

