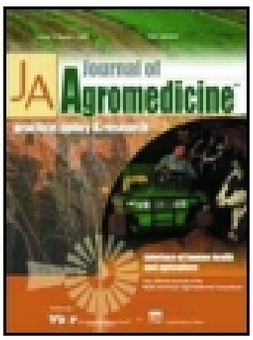

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Farm Activities Associated with Eye Injuries in the Agricultural Health Study

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ABSTRACT. Farmers are at risk for work-related eye injuries, some of which can be very serious. This study describes the farm activities that were related to eye injury in a group of 36 Iowa farmers in the Agricultural Health Study who sustained 40 farmwork-related eye injuries requiring medical advice or treatment. Farm activities of grinding or cutting metal accounted for 11 (27.5%) of the eye injuries, welding for 3 (7.5%), and drilling for 2 (5%). The other 24 eye injuries were related to diverse farm activities. One injury was caused by an animal. Only one injury was caused by a chemical exposure. Foreign body in the eye was the most frequent type of eye injury overall, accounting for 32 (80%) of the eye injuries. Of those, 20 were metallic foreign bodies. Although none of the injuries required hospitalization, 10 eye injuries (25%) resulted in the farmer missing 1 to 5 days of work. At least three injuries occurred while farmers were wearing safety glasses/goggles. These results suggest that farmers are at risk for eye injury from activities such as grinding and cutting metal, welding,

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and drilling and from other diverse activities on the farm for which eye hazards may not have been anticipated. In addition, these findings have implications for use of appropriate eye protection during all farm activities.

KEYWORDS. Eye injury, farmer, agriculture

INTRODUCTION

Eye injury is a frequent and preventable type of occupational injury. The National Institute for Occupational Safety and Health has estimated that over 700 000 US workers require medical treatment for eye injuries annually.[1] It has been estimated that about 283 000 occupational eye injuries required treatment in US hospital emergency departments in 1999.[2] Those who work on the farm are exposed to a variety of ocular hazards. According to the Traumatic Injury Surveillance of Farmers (TISF) survey, eye injuries accounted for 3.3% of all traumatic injuries resulting in lost work time among farmers in 1995.[3] A study of compensable work-related eye injuries in West Virginia reported that the highest incidence rate for any industrial sector was observed in agriculture.[4] Some farmwork-related injuries can lead to serious visual impairment or blindness.[5–8] Although the use of appropriate eye protective equipment is a recognized strategy to prevent eye injury, farmers report infrequent use of goggles or safety glasses.[9] Few data are available on the work activities that lead to eye injuries in farmers.

The aim of this study was to describe farm work activities that are associated with eye injuries in Iowa farmers.

METHODS

Although the present study is descriptive in nature, the data for the study were derived from a larger case-control study of traumatic injury among Iowa farmers.[10] That case-control study was nested in the large prospective study, the Agricultural Health Study.[11] Methods for the case-control study have been described in detail in previous publications.[10,12] In brief, we randomly selected 6999 of 30 009 certified Iowa private pesticide applicators in the Agricultural Health Study to receive a screening questionnaire. Almost all of these private applicators are farm operators. They received this screening questionnaire through the mail with telephone follow-up. A total of 6115 farmers completed the screening questionnaire (87.4% response rate). Of those 6115, 521 reported a farmwork-related injury in the last year. A total of 431 injured farmers (82.7% response rate) and 473 uninjured farmers (78.4% response rate) then completed a detailed computer-assisted telephone interview. Each participant who completed the detailed telephone questionnaire received $10. Among other questions, farmers were asked to describe the injury and the circumstances of the injury (free text), to identify the body part affected, and to report on any resulting lost work time, hospitalization, or disability. Data were also collected on age, education, marital status, numbers of years worked on the farm, and whether the farmer wore eyeglasses. Farmers were defined as those whose farms had gross annual sales of $1000 or more of agricultural goods in the past year. The case-control study resulted in 510 cases of farmwork-related injury among 431 farmers. Thirty-six of the 431 injured farmers reported at least one eye injury. Those 36 farmers had a total of 40 farmwork-related eye injuries. The 36 farmers with at least one eye injury form the basis for this report.

Farmers who had sustained farmwork-related eye injuries were defined as follows:

1. Subject answered “yes” to two inclusion questions: “During the past 12 months, were you injured seriously enough that you got medical advice or treatment?”[13] and “Was the injury in any way related to your farm operation?”[14]
2. In assessing the computer-assisted interview description of the injury obtained from the

subject, a trained coder categorized the body part injured as the eye (code 032 of the Occupational Injury and Illness Classification system[15]).

We compared characteristics (age, marital status, education, years worked on the farm, and whether the farmer wore eyeglasses) between those with eye injuries and controls, first using unadjusted chi-square analysis, followed by unconditional logistic regression analysis, adjusted for age as a categorical variable (≤49 vs 50 and above). To further analyze the relationship between wearing eyeglasses and eye injury, we stratified by age (20–49 compared with 50 and older) and then calculated odds ratios for each age category using the Mantel Haenszel method[16] and StatXact software (StatXact 8 Statistical Software for Exact Nonparametric Inference, Cytel, Inc, Cambridge, Mass). We repeated this approach to assess modification by age for the following variables, marital status, education, and years worked on the farm. In the multivariate model, we also assessed each independent variable for any effect modification by age, using interaction terms for each variable by age.

RESULTS

There were 40 farmwork-related eye injuries among the 36 injured farmers. Thirty-three farmers had one eye injury, two had two eye injuries, and one had three eye injuries.

The 36 farmers who reported eye injuries were similar in age, education, and marital status to the 473 farmers who reported no injury (Table 1). The unadjusted analysis showed that eye-injured farmers had worked fewer years on the farm and were less likely to report that they wore eyeglasses (for vision, not safety glasses). However, results of logistic regression analysis, adjusted for age, showed that wearing glasses was associated with a doubling of the risk for eye injury, whereas education, marital status, and years of farmwork were not significantly associated with eye injury (Table 2). This apparent reversal of the direction of the association between wearing eyeglasses and eye injury was due to differences based on age strata. Only 47% of all farmers in the younger age category (20–49) wore glasses, whereas 88% of all farmers in the older age category (50 and older) wore glasses. When stratified by age, 5 out of 20 eye injuries in the younger age group

TABLE 1. Characteristics of 36 Farmers with Eye Injuries Compared with 473 Uninjured Farmer Controls

Characteristic	Eye Injury No. (%) N = 36	Controls No. (%) N = 473	p-Value*
Age			
20–49	25 (69.4)	254 (53.7)	0.0675
≥50	11 (30.6)	219 (46.3)	
Education			
>Grade 12	13 (36.1)	206 (43.5)	0.385
≤Grade 12	23 (63.9)	267 (56.5)	
Married			
Yes	30 (83.3)	426 (90.1)	0.2
No	6 (16.7)	47 (9.9)	
Years of farmwork			
≤25	24 (66.7)	206 (43.5)	0.0073
>25	12 (33.3)	267 (56.4)	
Wears glasses			
Yes	16 (44.4)	317 (67)	0.0061
No	20 (55.6)	156 (33)	

*Obtained from unadjusted chi-square analysis.

TABLE 2. Age-Adjusted Odds Ratio and 95% CI for Characteristics of 36 Farmers with Eye Injuries Compared with 473 Uninjured Farmer Controls; Effect Modification by Age Shown for Eyeglass Wearers

Variable	Odds Ratio*	95% CI
Education > grade 12	1.51	0.74–3.08
Married	0.56	0.22–1.43
Years of farm work ≤ 25	0.37	0.13–1.06
Wears glasses (all ages)	2.22	1.03–4.77
Age 20–49	0.26	0.09–0.71
Age 50+	Cannot be calculated**	Cannot be calculated**

*Obtained from unconditional logistic regression analysis adjusted for age.

**Odds ratio and 95% CI for those at least 50 years of age cannot be calculated because all farmers with eye injury in this age group wore eyeglasses.

occurred in farmers who wore eyeglasses, in comparison with 11 out of 11 eye injuries in the older age group occurring in those who wore eyeglasses. In the younger age group, the odds ratio for eye injury in eyeglass wearers was 0.26 with a 95% confidence interval of 0.09 to 0.71, suggesting a protective effect of wearing eyeglasses. We did not find any effect modification by age for the other variables; ie, marital status, education, or years worked on the farm.

Table 3 shows that most of the eye injuries were caused by a variety of operations on the farm. Grinding or cutting metal was the most common work activity, followed by welding and drilling. Together, these three categories accounted for 16 (40%) of the 40 injuries. All other categories accounted for only one eye injury each. One injury was caused by an animal (during milking). Only one injury was caused by a chemical exposure (during dehorning). Overall, foreign body in the eye was the most frequent type of eye injury, accounting for 32 (80%) of the eye injuries. Of those, 20 were metallic foreign bodies. None of those injured required hospitalization or reported lasting disability from the injury. However, 10 eye injuries (25%) resulted in the farmer missing 1 to 5 days of work. Four of those 10 were working with metal (cutting, grinding, or drilling) and 2 were welding. The others described doing various farm activities at the time of eye injury, including moving an auger, working on a sprayer or other farm equipment, and filling a silo. Six of the 10 had metallic foreign bodies in the eye. The others had a variety of eye injuries, including silage in the eye, broken glasses cutting the eye, and a welding burn.

TABLE 3. Job Activities and Types of Eye Injuries for 40 Eye Injuries (Reported by 36 Farmers) Requiring Medical Advice or Treatment in the Past Year

Job Activity	Number of Injuries	Eye Injury
Grinding or cutting metal	11	Metal foreign body
Welding	3	1 burn; 1 injury from a spark; 1 metal foreign body
Drilling	2	Metal foreign body
Working with steel	1	Metal foreign body
Wire-brushing	1	Metal foreign body
Working on sprayer	1	Metal foreign body
Putting joints in pickup truck	1	Metal foreign body
Repairing hog feeding equipment	1	Metal foreign body
Working on farm equipment	1	Metal foreign body
Working on combine	1	Foreign body
Changing silo doors	1	Foreign body
Loosening a bearing with chisel	1	Foreign body
Power washing	1	Foreign body
Filling silo	1	Piece of silage as foreign body
Cutting weeds	1	Plant material as foreign body
Operating combine	1	Dust foreign body
Gathering bedding for poultry	1	Dirt foreign body
Fixing ceiling of milk house with screwdriver	1	Paint chip foreign body
Cleaning barn with skid loader	1	Nail foreign body
Moving auger	1	Broken eyeglasses cut the eye
Putting air in tire of pickup truck	1	Injured when tire blew up
Mixing cement	1	Ulcer from cement dust
Removing a building board	1	Hit in eye with board
Milking	1	Cow's tail contacted eye
Dehorning calves	1	Caustic chemical in eye
Unknown	2	Foreign body

Protective Equipment

Because the study did not focus on any one type of injury but all farmwork-related injuries, we did not ask specific questions about protective equipment use for any one type of injury. However, several farmers with eye injuries volunteered this information; two farmers using grinders reported that they were wearing safety glasses at the time of injury; one grinder reported that he had removed his goggles to examine the work and then resumed the work without remembering to put the goggles on again. The farmer repairing hog equipment reported that he got a piece of metal in his eye even though he was wearing safety goggles. One welder reported that he was not wearing safety glasses.

DISCUSSION

The major finding from this study is the diverse nature of farm activities related to eye injury. Although grinding or cutting metal accounted for 27.5% of the 40 eye injuries and welding or drilling accounted for 12.5%, the remaining 60% were associated with varied activities on the farm. This distribution of injuries may have important implications for prevention of eye injuries on the farm. An eye injury prevention plan, including engineering and administrative controls as well as appropriate eye protection, would be important not only for known hazardous activities, such as grinding and cutting metal, welding, and drilling, but may be advisable for all work-related activities on the farm.

The results also suggest that, in those younger than 50, wearing eyeglasses may offer some protection against eye injury on the farm. It is possible that younger farmers wear their eyeglasses more consistently than older farmers, who may need them only for reading or near-vision tasks. While it is possible that impact-resistant corrective lenses used by younger farmers may offer some protection against some types of eye injury, they are not considered to be appropriate or safe eye protection. Rather, special safety eyewear specific for each farm task and potential exposure is recommended.[17]

More comprehensive approaches to prevention of eye injury on the farm may be needed. A recent study aimed at eye injury prevention assessed 28 farms that employed migrant and seasonal Latino farmworkers. These authors recommended multiple control approaches, including engineering and administrative controls, as well as personal protective equipment.[18]

There have been few comparable reports of work activities leading to eye injury among groups of farmers or agricultural workers. A population-based study of Minnesota farmers and adult farm family members[9] collected questionnaire responses during on-farm visits. Those authors described 11 farm-related eye injuries in 10 study participants. Of the 11 eye injuries, 7 were caused by foreign bodies and 4 were caused by chemicals. The authors described the associated farmwork activities as working with hand and power tools, welding, grinding, cutting metal, and augering grain. Comparisons between the Minnesota report and the present study are limited because of small numbers in both studies. However, the severity of injuries in their study appears similar to ours in that all (our study) or most (Minnesota study) farmers required medical advice or treatment and several farmers lost work time in both studies. Neither study reported residual disability or restrictions from the eye injuries.

Case reports from the literature confirm the variety of farm activities that can lead to serious eye injury. These include injury from exploding tractor tires,[6,8] cow horns,[7] and the hydraulic injection stream from pesticide spraying.[19]

In a separate report from this study population that assessed associations with all 453 farmers' injuries,[10] wearing eyeglasses was not significantly associated with all farmwork-related injuries, whereas several factors, including higher education and younger age, were associated with all farmwork-related injuries. This comparison is consistent with the explanation that eyeglasses would afford some protection against eye injury directly as a barrier for some types of eye hazards but would not be associated with protection from other types of farmwork-related injury.

A strength of this descriptive study is a contribution to the scant literature available on work activities leading to eye injuries in farmers. From the brief descriptions of the eye injuries reported in the present study, it appears that most of the injuries could have been prevented by use of appropriate eye protection equipment. It has been suggested that eye protection is both practical and cost effective for farmers in prevention of eye injuries.[9] Information on current use of safety glasses and other eye protection is limited. The Minnesota study found that 50% of farm operators reported never using eye protection for high-risk activities related to spraying pesticides.[9] A study among Latino farmworkers in Illinois and Michigan found that, prior to an intervention and specific education in their use, only 2 (0.4%) of 491 farmworker subjects were observed using safety eyewear.[20] Aside from small numbers, a further limitation of the present study is that we did not obtain information about

use of safety glasses or goggles at the time of the eye injury. Three of the subjects in the present study volunteered that they were wearing safety glasses or goggles when the eye injury occurred. Further studies of frequency of use of appropriate eye protection and evaluation of specific intervention strategies would be helpful to define best practices for prevention of eye injury.

In summary, this study suggests that the eye hazards in agriculture can occur during known hazardous activities, such as welding and working on metal, and less well-known but potentially hazardous farmwork-related activities. These findings would support the need for education and training about the scope of eye hazards on the farm. These results suggest that the use of appropriate eye protection may be needed for all farmwork-related activities.

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