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Nonfatal Injuries to Household Youth on Native American Operated Farms in the U.S., 2000

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ABSTRACT. In 2000, there were an estimated 7,381 youth living on 9,556 U.S. farms operated by Native Americans. Most of these youth (5,454, 74%) lived on livestock operations (6,833 farms, 72%). In that year, youth living on Native American operated farms sustained an estimated 177 nonfatal injuries. The majority of all injuries to household youth (147, 83%) occurred on livestock operations. Males accounted for 112 (63%) of the injuries to household youth. Overall, household youth on Native American operated farms had an injury rate of 24.0 injuries per 1,000 household youth compared to a rate of 8.1 injuries per 1,000 household youth on all other minority-operated farms. The rate ratio for work-related injuries to household youth on Native American farms compared to other minority-operated farms was 2.1. Although female youth on these farms experienced a similar non-work injury rate of 13.8 injuries per 1,000 female household youth compared to a rate of 15.1 injuries per 1,000 male household youth, the work-related injury rate for male youth (30.2 per 1,000 male household youth) was substantially higher than the work-related injury rate for female household youth (18.3 per 1,000 female household youth).

These data indicate an elevated risk of injury for youth living on farms operated by Native Americans. This result is attributed to the large percentage of livestock operations for this population and the hazards associated with this type of farming. However, further research is needed to more fully understand these results and to guide culturally appropriate interventions within this population. doi:10.1300/J096v11n03_07 *[Article copies available for a fee from The Haworth Document Delivery Service: 1-800-HAWORTH. E-mail address: <docdelivery@haworthpress.com> Website: <http://www.HaworthPress.com>.]*

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INTRODUCTION

Youth living on farms in the U.S. are exposed to the hazards of the farming environment whether at work or play.[1] The farm is generally recognized as a hazardous environment; the mechanisms for farming present unique hazards to workers and non-workers alike. In addition, many individuals living and working on farms are under 20 years of age. To address these issues, the Centers for Disease Control and Prevention (CDC), National Institute for

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Occupational Safety and Health (NIOSH) developed the 1998 Childhood Agricultural Injury Survey (CAIS) to provide detailed information on injuries sustained by the youth population on U.S. farms.[2] These data, however, were not specific to farms operated by minorities. Since less than 3% of the 1,911,859 farms in the U.S. identified in the 1997 Census of Agriculture were operated by minorities,[3] minority-operated farms are not represented well in most general surveys, including CAIS. To gain a better understanding of injuries on these minority-operated farms NIOSH developed the Minority Farm Operator Childhood Agricultural Injury Survey (M-CAIS).

The 2000 M-CAIS provided data on an estimated 531 nonfatal work and non-work injuries to youth under 20 years of age occurring on racial minority operated U.S. farms.[4] Sixty-six percent (348) of these injuries occurred to youth living on the farm (i.e., household youth). An estimated 12.2 injuries per 1,000 household youth occurred on these farms in 2000. The survey also provided data allowing for the analyses of demographic factors such as sex and age. In addition, these data allow for analyses based upon the specific race of the operator.

Although household youth on Native American operated farms accounted for only 26% (7,381) of all household youth on racial minority operated farms (28,577), they accounted for 51% (177) of all injuries (348).[5] This disproportionate share of the injury burden is consistent with the general injury literature for Native American populations. According to the Centers for Disease Control and Prevention (CDC), injuries are the leading cause of death for Native Americans under 45 years of age and, including violence-related injuries, account for 75% of all fatalities to Native American youth under 20 years of age.[6,7] Native American youth were more than twice as likely as White youth to incur fatal injuries related to motor vehicles, pedestrian events, and suicides during 1989 to 1998. Among Native American youth, males age 15 to 19 years were the most at risk for fatal injuries related to motor vehicles, pedestrian events, firearms, suicide, drowning, and suffocation.[7] In addition, Crandall et al.[8] indicated that Native Americans and Hispanics in New Mexico were more likely than Whites to die on U.S. farms. These studies, however, did not address non-fatal injuries to youth, nor did they specifically address injuries on farms operated by Native Americans. To address the disproportionate number of injuries to household youth on Native American-operated farms found through a general examination of the 2000 M-CAIS, this paper provides the results of a detailed assessment that focuses on these Native American youth. Results presented include specific characteristics of injuries and a comparison of work and non-work related injuries.

METHODS

The M-CAIS data were obtained through a survey conducted for NIOSH by the United States Department of Agriculture (USDA), National Agricultural Statistics Service (NASS). The USDA sampling frame contained 49,270 minority-operated farm households nationwide, of which 35,084 were operated by racial minorities categorized as Black, Asian, Native American, and Other.[3] Of the 49,270 minority-operated farms in the USDA sampling frame, 36,424 were contacted to complete the survey. Approximately 75% (27,170) completed the survey, 19,083 of which were racial minority-operated farms. Of these 19,083 racial minority-operated farms, 9,556 were operated by Native Americans and were included in this study. When conducting the survey, interviewers requested to speak with the female head of household, but accepted responses from the adult male when the female was unable to complete the survey.

Demographic data collected through the M-CAIS included information on the farm, members of the farm household, and youth under 20 years of age visiting and/or working on the farm. This study, however, is limited to household youth. It must be noted that the household youth were assumed to be of the same race as the operator. In addition to demographic data, information was collected on the four most recent on-farm non-fatal injuries occurring to youth under 20 years of age during the 2000 calendar year, and the exposure of household youth to specific farm hazards.

Injuries were defined as any event occurring on the farm operation that resulted in at least

four hours of restricted activity or required the individual to seek professional medical attention. Work and non-work injuries to youth living on the farm were included in these data. Work, for both work-related injuries and working youth, was defined as the youth performing activities that had a direct impact on the farming operation as a business, regardless of whether the activity was performed for pay. For the purposes of this study, injuries incurred by a non-working youth as the result of another individual's work were not defined as work-related.

The injury and demographic data collected were used to determine national estimates utilizing unbiased estimators for a stratified simple random sample.[9] All results were benchmarked to the 1997 Census of Agriculture based upon race and region (i.e., estimates based on 35,084 farms were weighted to match the published 1997 farm count of 47,658).[3] The type of injury, body part injured, and a narrative description of the injury were collected for all reported injuries. Standardized coding of source of injury and event was completed by the authors using the Occupational Injury and Illness Classification System (OIICS).[10] Injury rates per 1,000 household youth were calculated as the estimated number of injuries, divided by the estimated number of household youth obtained from the M-CAIS. In addition, rates for work-related injuries were calculated based on working household youth, while non-work injury rates were calculated for all household youth. The variance for all rates was estimated by pooling the variances from the numerator and the denominator.[9] The covariance term was ignored because it was generally small in comparison to the overall variances. All confidence intervals (CI) provided are at 95%.

RESULTS

Demographics

In 2000, there were an estimated 28,577 youth living on U.S. farms operated by racial minorities. Approximately 26% (7,381) of these youth lived on farms operated by Native Americans. Out of the 9,556 Native American operations, 3,852 (40%, $CI_{95\%}$ 3,786 to 3,918) reported having household youth. Seventy-four percent (2,865, $CI_{95\%}$ 2,771 to 2,959) of the farms reporting household youth were livestock operations and 74% (5,454) of all household youth living on Native American-operated farms lived on livestock operations. The population was evenly distributed according to sex of the youth. Males accounted for 50% (3,718) of the population and females for 48% (3,528). The majority of household youth included in this study (5,155, 70%, $CI_{95\%}$ 4,957 to 5,353) were under the age of 16, with 2,355 (32%) less than 10 years of age. Table 1 shows various characteristics for youth living on Native American-operated farms.

Nonfatal Injuries

Youth living on farms operated by Native Americans sustained an estimated 177 nonfatal injuries in 2000 (Table 2). This represented a rate of 24.0 injuries per 1,000 household youth on these farms. Sixty-three percent (112) of the injuries to household youth on Native American-operated farms occurred to males. The rate of injury for these youth (30.2 per 1,000 male household youth) was substantially higher than the rate of injury for female household youth (18.3 per 1,000 female household youth). The majority (139, 79%) of nonfatal injuries on Native American-operated farms occurred to youth less than 16 years of age. Youth 10 to 15 years of age accounted for the highest rate of injury with 31.2 per 1,000 household youth injured on Native American-operated farms.

Table 2 also shows that injuries to household youth on Native American-operated livestock operations (147, 83%) were almost 5 times as common as injuries to those youth on crop operations (30, 17%). Household youth on livestock operations sustained 27.0 injuries per 1,000 household youth, while on crop operations they sustained 18.9 per 1,000, producing a rate ratio of 1.4. Injuries on beef operations accounted for 65% of all injuries and 78% of injuries on all livestock operations (Table 2).

The most common injury events for household youth on Native American-operated farms were contact with objects (55, 31%, $CI_{95\%}$ 37 to 73) and falls (54, 31%, $CI_{95\%}$ 38 to 70). Over

TABLE 1. Population characteristics of household youth less than 20 years of age on Native American operated farms, U.S. 2000

	Estimate	CI 95%	Percent
Total*	7,381	± 241	100.0%
Sex			
Male	3,718	± 151	50.4%
Female	3,528	± 149	47.8%
Unknown	135		1.8%
Age (Years)			
<10	2,355	± 127	31.9%
10-15	2,800	± 131	37.9%
16-19	2,069	± 104	28.0%
Unknown	158		2.1%
Work Status			
Work	4,222	± 180	57.2%
Non-work	3,023	± 145	41.0%
Unknown	135		1.8%
Farm Type			
Crop	1,583	± 133	21.4%
Grain	*576*	*± 84*	*7.8%*
Fruit	*142*	*± 33*	*1.9%*
Vegetable	*122*	*± 47*	*1.7%*
Other Crop	*641*		*8.7%*
Livestock	5,454	± 214	73.9%
Beef	*4,370*	*± 196*	*59.2%*
Equine	*488*	*± 69*	*6.6%*
Sheep	*143*	*± 43*	*1.9%*
Dairy	*122*	*± 41*	*1.7%*
Other Livestock	*92*		*1.2%*
Specific Hazard Exposure			
Operated an ATV	2,597	± 128	35.2%
Rode a Horse	3,486	± 130	47.2%
Operated a Tractor	2,344	± 125	31.8%

*Subtotals may not sum to total due to missing values and/or rounding.
CI–confidence interval.

half of the fall related injuries (37, 69%, $CI_{95\%}$ 21 to 53) were falls from an elevated position to a lower level, such as falls from structures or falls from horses. The most common source of injury to household youth was structures/surfaces (which includes floor, ground, etc.), accounting for 70 (40%, $CI_{95\%}$ 50 to 90) incidents. Vehicles were the second most common source of injury on these farms (30, 17%, $CI_{95\%}$ 18 to 42) with all-terrain vehicles (ATVs) accounting for half of all vehicle injuries (16, 53%, $CI_{95\%}$ 8 to 24).

As shown in Figure 1, the extremities were the body parts injured most often. The hand/wrist/arm/finger (72, 41%, $CI_{95\%}$ 53 to 91), foot/ankle/leg/toes (37, 21%, $CI_{95\%}$ 24 to 50) and head/face (29, 16%, $CI_{95\%}$ 17 to 41) were more likely to be injured than all other body parts. Figure 2 shows that fractures were the most commonly reported types of injuries with an estimated 58 (33%, $CI_{95\%}$ 40 to 76) injuries. Lacerations were the second most commonly reported injury with an estimated 44 (25%, $CI_{95\%}$ 30 to 58) nonfatal incidents. Fractures were the most common injuries on livestock operations, accounting for 36% (53, $CI_{95\%}$ 36 to 70) of all injuries, while lacerations were the most common injury on crop operations (13, 43%, $CI_{95\%}$ 5 to 21).

Comparison of Work and Non-Work Related Injuries

When examining injuries to household youth who were performing work on Native American-operated farms, we found an annual injury rate of 17.7 per 1,000 working household youth, which was higher than the non-work rate of 13.8 per 1,000 household youth (a rate ratio of 1.3). As shown in Figure 3, this difference in injury rates was specific to the working male household youth. Although work and non-work injuries both accounted for 56 injuries to household males, the rate ratio for the work-related injury rate (23.0 per 1,000 male working household youth, $CI_{95\%}$ 15.6 to 30.4) and the non-work injury rate (15.1 per 1,000 male household youth, $CI_{95\%}$ 10.6 to 19.6) was 1.5. The injury rates among female household youth, for both work injuries (10.5 per 1,000 female working household youth, $CI_{95\%}$ 6.0 to 15.0) and non-work injuries (13.1 per 1,000 female household youth, $CI_{95\%}$ 10.0 to 16.1), was similar to the non-work injury rate for male household youth of 15.1 injuries per 1,000 male household youth.

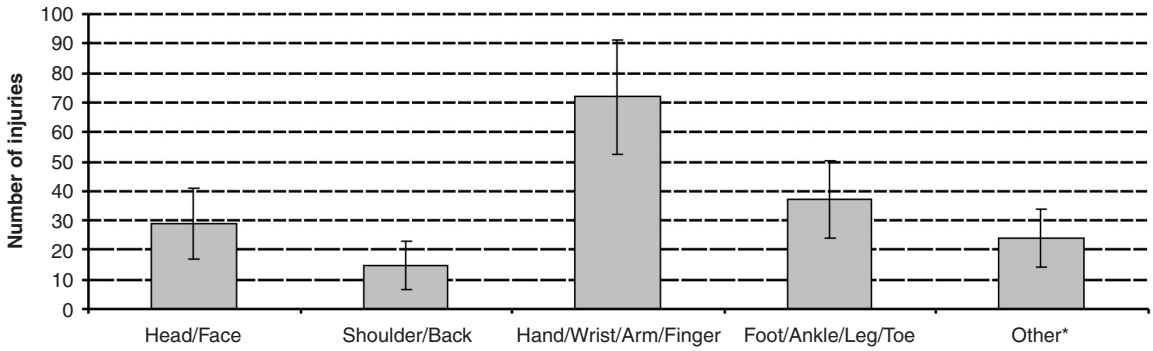
When considering both work status and age (Figure 4) we found that the oldest age group (16 to 19 years) had a significantly higher work-related injury rate per 1,000 working household youth (18.0, $CI_{95\%}$ 10.2 to 25.8) than the non-work rate for all household youth in this

TABLE 2. Estimates of injuries and injury rates for household youth less than 20 years of age on Native American operated farms, U.S. 2000

	Number of Injuries*			Injury Rates**	
	Estimate*	CI 95%	Percent	Rate**	CI 95%
Total	177	± 31	100.0%	24.0	± 4.4
Sex					
Male	112	± 25	63.3%	30.2	± 6.8
Female	65	± 18	36.7%	18.3	± 5.2
Age (Years)					
< 10	52	± 18	29.4%	22.0	± 7.4
10-15	87	± 22	49.2%	31.2	± 7.6
16-19	38	± 14	21.5%	18.3	± 6.7
Work Status					
Work	75	± 22	42.4%	17.7	± 5.1
Non-work	102	± 24	57.6%	13.8	± 3.1
Farm Type					
Crop	30	± 14	16.9%	18.9	± 8.6
Grain	*12*	*± 10*	*6.8%*	*20.8*	*± 17.8*
Livestock	147	± 29	83.1%	27.0	± 5.4
Beef	*115*	*± 25*	*65.0%*	*26.3*	*± 6.0*

*Subtotals may not sum to total due to missing values and/or rounding.
** Injury rate per 1,000 household youth.
CI–confidence interval.

FIGURE 1. Nonfatal injuries to household youth less than 20 years of age on Native American operated farms by body part injured, U.S., 2000.

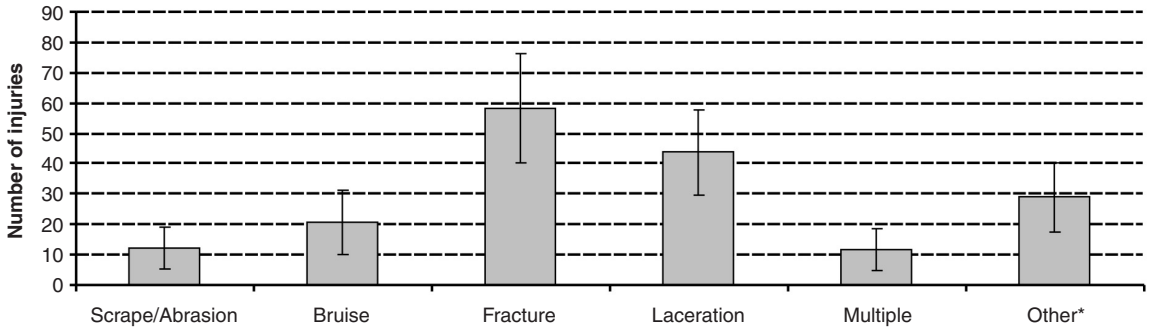


* Includes neck, abdomen, pelvis, internal, multiple, and unknown.

age group (5.2, $CI_{95\%}$ 1.7 to 8.7). Although household youth under 10 years of age had the highest rate for work-related injuries (21.8 per 1,000 working youth, $CI_{95\%}$ 7.3 to 36.3), there were no significant differences for work-related injury rates across the age groups.

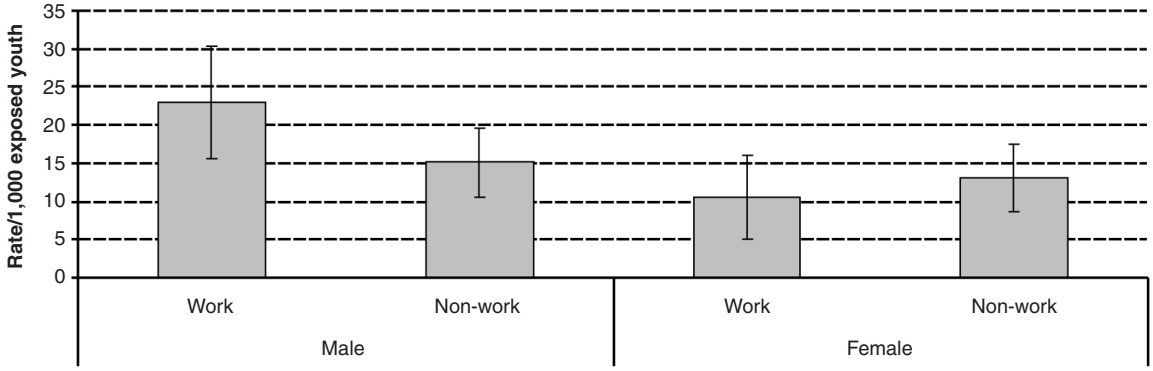
The most common types of work-related injuries to household youth on Native American-operated farms were lacerations (23, 31%, $CI_{95\%}$ 14 to 32) and fractures (20, 27%, $CI_{95\%}$ 8 to 32). In general, the injured body parts were the extremities: the arm (including hand, wrist, and finger) accounted for 27 (36%, $CI_{95\%}$ 14 to 40) injuries and an estimated 21 (28%, $CI_{95\%}$ 11 to 31) injuries occurred to the leg (including foot, ankle, and toe). For non-working injuries to household youth on these farms, fractures (38, 37%, $CI_{95\%}$ 25 to 51) were more common

FIGURE 2. Nonfatal injuries to household youth less than 20 years of age on Native American operated farms by nature of injury, U.S., 2000.



* Includes dislocation, puncture, crush, burn, sprain/strain, amputation, nerve damage, and unknown

FIGURE 3. Nonfatal injury rate for household youth less than 20 years of age on Native American operated farms–sex by work status, U.S., 2000.



than lacerations (21, 21%, $CI_{95\%}$ 11 to 31). Forty-four percent (45, $CI_{95\%}$ 31 to 59) of the non-working injuries were to the arm (including hand, wrist, and finger) and 16% (16, $CI_{95\%}$ 7 to 25) were to the leg (including foot, ankle, and toe).

Thirty-one (41%, $CI_{95\%}$ 18 to 44) of the reported work-related injuries to household youth were classified as occurring when the youth made contact with an object. Twenty (27%, $CI_{95\%}$ 10 to 30) of the reported injuries resulted from falls. The most common source of work-related injury to household youth was structures/surfaces (includes fences, the ground, and floors), which accounted for 29 (39%, $CI_{95\%}$ 17 to 41) injuries. Non-working household youth were most often injured in falls (34, 33%, $CI_{95\%}$ 22 to 46) and from contact with an object (24, 24%, $CI_{95\%}$ 13 to 35). Again, structures/surfaces were the most common source of non-working injury (42, 41%, $CI_{95\%}$ 28 to 56).

DISCUSSION

The 2000 M-CAIS provides a unique nationwide perspective on racial minority-operated farms. Overall, in 2000, there were approximately 12.2 injuries per 1,000 household youth on racial minority-operated farms in the U.S., which was not significantly different from the 1998 CAIS injury rate for household youth in the general farm population (18.7 per 1,000 household youth).[2,4,5] However, the injury rate on farms operated by Native Americans was significantly higher than both the overall 2000 M-CAIS and 1998 CAIS rates at 24.0 injuries per 1,000 household youth.

FIGURE 4. Nonfatal injury rate for household youth less than 20 years of age on Native American operated farms–age by work status, U.S., 2000.

The rate for youth living on Native American-operated farms was almost 4 times greater than the rate of injury for youth on Black farm operations (6.4 injuries per 1,000 household youth) and 5 times greater than the rate for youth on Asian farm operations (4.5 injuries per 1,000 youth). In fact, with Native American operations removed, the overall injury rate to household youth on racial minority-operated farms dropped from 12.2 to 8.1 per 1,000 household youth.

On Native American-operated farms, over three times as many youth lived on livestock operations compared to crop operations; for all other racial minority-operated farms these populations were equivalent.[5] General M-CAIS data show that household youth on racial minority-operated livestock farms were twice as likely to be injured as their counterparts on crop operations, and three times more likely to sustain a work-related injury.[5] Although this may contribute to the overall high rate of injury for Native American household youth, it does not adequately explain the deviation from the other races. For example, youth living on Native American crop operations (18.9 injuries per 1,000 youth) were twice as likely to be injured than their counterparts on Black-operated farms (7.4 injuries per 1,000 youth).[5]

On Black, Asian, and Other racial minority-operated farms, the rate for non-work injuries was higher than the rate for work-related injuries, while on Native American-operated farms the work-related rate was higher than the non-work rate.[5] In addition, the rate ratio of work-related injuries for household youth on Native American-operated farms compared to all other racial minority-operated farms combined was 2.1. A possible explanation may be the variation in farm type found in the two populations.

For non-work injuries, female household youth on Native American-operated farms were injured at a rate similar to the rate of non-work injuries to male household youth. For all other races, the non-work related injury rate for household males was 6.8 injuries per 1,000 youth compared to 3.5 non-work injuries per 1,000 female household youth. The result for all other races is consistent with previous work such as the 1998 CAIS where household males were more likely to sustain a non-work injury than household females.[2] This elevated rate of non-work injuries to female household youth on Native American-operated farms may be related to horses, since recent research has shown horse injuries to female youth are increasing.[11] In addition, as shown in Table 1, 47% of all household youth on Native American-operated farms rode a horse in 2000. However, there is insufficient data to explore this adequately due to reporting constraints resulting from further breakdown of the data by farm type and the sex of the injured youth.

The high rate of injury on Native American farms suggests a need for specific prevention and education efforts targeted to Native American farms in the U.S. For example, a suggested prevention strategy to prevent fatalities to African-American farmers in North Carolina is to

address the impacts of financial constraints on the utilization of safe equipment, which is an area identified as causing fatal injuries to these farmers specifically.[12] This strategy could be implemented through economic assistance or programs to encourage the pooling of resources by these farmers. M-CAIS data may be used in a similar fashion to determine specific prevention strategies for Native American farm youth. As an example, the high work-related injury rate for Native American household youth under 10 years of age suggest that work tasks assigned to these youth may exceed their capabilities as suggested by the North American Guidelines for Children's Agricultural Tasks (NAGCAT).[13] Therefore, age-appropriate task assignment is a topic for potential intervention. To be effective, an intervention must be presented in a culturally appropriate manner that will resonate with the at-risk population and be considered practical to their operations. For example, Westaby and Lee[14] suggest that participation in safety activities, such as teaching safety courses, produce greater safety consciousness among youth, thereby reducing injuries. To be effective for Native American youth, these safety activities would need to be focused upon hazards specific to the population and presented in a manner that is culturally appropriate for the audience. Further research in these areas is warranted to better guide future prevention efforts.

Although the M-CAIS data provide a unique look into the Native American farming community, there are limitations to its utility. Comparison to the general farming population is hindered by the lack of directly comparable data for the year 2000. Also, data for other time periods does not yet exist, making inferences regarding changes in injury rate over time impossible. Therefore, few meaningful comparisons to other populations can be made from the 2000 M-CAIS data.

In addition, the survey results are potentially subject to both recall and response bias. Obtaining injury data for events that occurred over the course of a year may introduce recall bias. The authors have attempted to reduce recall bias by focusing on the most recent and severe injuries, as recall bias is generally not as strong for severe injury recollection.[15] No attempt was made to determine the impact of survey refusals on these results. However, post-stratification of the survey data by race and region, which accounts for refusals in the weighting, should have diminished any potential impact of these refusals.

Finally, some subsets of the population are not reportable due to low estimates and/or high standard errors, making comparisons of rates for these groups impossible. For example, detailed stratification based on the type of farming operation is not possible due to low estimates and reporting requirements. In addition, low estimates do not allow for detailed examination of injury events based upon factors such as severity or source of injury. Also, the survey instrument was not designed to address the potential cultural determinants of injuries to these youth. Despite these issues, M-CAIS is an important first step in providing an accurate analysis of youth injuries on farms operated by Native Americans.

CONCLUSION

The M-CAIS data indicate that household youth on Native American-operated farms are at greater risk for injury than household youth on other racial minority-operated U.S. farms. This risk is generally greater across demographic factors, indicating a clear need for injury prevention strategies tailored to the Native American population. These efforts may be greatly enhanced through collaboration with public health groups already familiar with this specific population such as the Indian Health Service and other tribal specific organizations. In addition, it may be advantageous to direct future research activities toward a better understanding of these elevated injury rates and identification of potential prevention strategies. To ensure safety on the American farm, occupational safety and health experts must constantly consider the nature of not only the injuries occurring, but the cultural and ethnic context in which injury prevention strategies are being presented.

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