Nonfatal Injuries to Household Youth on Racial Minority-Operated Farms in the U.S., 2000

E. M. Goldcamp, K. J. Hendricks, L. A. Layne, J. R. Myers

ABSTRACT. *The National Institute for Occupational Safety and Health (NIOSH) estimated that 32,808 nonfatal injuries occurred to youth less than 20 years of age on U.S. farms during 1998. These data, however, do not allow for the identification of minority farm operators. The Minority Farm Operator Childhood Agricultural Injury Survey (M-CAIS) was conducted to provide an overview of the number of youth on minority-operated farms and their associated farm-related injuries during 2000. M-CAIS was conducted by the USDA for NIOSH through a telephone survey of 49,270 minority-operated farms identified in the 1997 Census of Agriculture. These minority-operated farms included four racial categories (black, Asian, Native American, and other) and operators of Hispanic ethnicity. This study included only racial minority-operated farms for analysis, white Hispanic farms were excluded. In 2000, there were an estimated 28,577 youth living on U.S. farms operated by racial minorities. In that year, these youth sustained an estimated 348 nonfatal injuries. Males accounted for 245 (70%) of the injuries to household youth. The majority of all injuries to household youth (247, 71%) occurred on livestock operations. Native American household youth accounted for both the largest number of injuries (177) and the highest rate of injury (24.0/1,000 household youth) on these farms. M-CAIS data indicated significant variation in injury rates among specific racial categories. Results of the M-CAIS suggest the need for prevention strategies to address issues found within these specific sub-populations of the agricultural community.*

Keywords. *Agriculture, Injuries, Racial minority, Surveillance, Youth.*

The farm is recognized in occupational safety and health research as a hazardous environment for workers. However, the environment and mechanisms for farming present unique hazards to workers and non-workers alike, including those living on the farm. In addition, many individuals living and working on farms are less than 20 years of age. According to Rivara (1997), "By virtue of the fact that children and adolescents live on farms, they are constantly exposed to hazards of farm equipment." The Centers for Disease Control and Prevention (CDC), National Institute for Occupational Safety and Health (NIOSH), developed the Childhood Agricultural Injury Survey (CAIS) to provide detailed information on nonfatal injuries sustained by the youth population on U.S. farms.

The 1998 CAIS provided data on an estimated 32,808 nonfatal work and non-work injuries to youth less than 20 years of age occurring on U.S. farms (Myers and Hendricks,

Submitted for review in September 2005 as manuscript number JASH 6090; approved for publication by the Journal of Agricultural Safety and Health of ASABE in March 2006.

The findings and conclusions in this article are those of the authors and do not necessarily represent the views of the National Institute for Occupational Safety and Health.

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  ISSN 1074-7583

2001). The majority of these events involved injuries to youth living on farms (i.e., household youth) (23,640, 72%). An estimated 18.7 injuries per 1,000 household youth occurred on these farms in 1998. The survey also provided data allowing for the analysis of demographic factors such as sex and age. However, reliable estimates based on race were not possible from these data. Of the 1,911,859 farms in the U.S. identified in the 1997 Census of Agriculture, less than 3% were operated by minorities (USDA, 1999), indicating these farms are not represented well in most general surveys, including CAIS.

Although this population is relatively small, research has shown that the patterns of injury on minority-operated farms may be different from farms operated by whites. Studies such as those by Richardson et al. (1997), Crandall et al. (1997), and Lyman et al. (1999) indicate that race and ethnicity may influence injury rates on U.S. farms. Crandall et al. (1997) indicated that Native Americans and Hispanics in New Mexico were more likely than whites to die on farms, with Native Americans having the highest fatality rate. These authors found that the fatality rate for farm-related deaths among Native Americans (51.2 fatalities per 100,000 person years) was more than twice the rate for whites (21.8 fatalities per 100,000 person years). Richardson et al. (1997) found that, in North Carolina, fatalities to African-American farmers increased from 1977 to 1991. During this same time period, fatalities to white farmers decreased. The authors attributed this finding to disparities in economic conditions that impact pace of work and machinery maintenance. Lyman et al. (1999) found that although white owner/operators in Alabama and Mississippi were approximately twice as likely as African-American owner/operators to have experienced a nonfatal farm-related injury, African-American owner/operators were more likely to have experienced injuries requiring medical attention. Again, economic disparities and their impacts on farming activities were considered to be a potential cause of the injury disparities. Although informative, these studies did not address injuries to youth on farms, nor did they include non-work injuries. In addition, these studies were limited in their geographic scope. Additional work addressing the role of race in farm injury is certainly warranted. To address this need, NIOSH developed the Minority Farm Operator Childhood Agricultural Injury Survey (M-CAIS). This article will examine the M-CAIS results for youth living on racial minority-operated farms by providing an assessment of the specific demographic characteristics of injuries and a comparison of work and non-work related injuries.

Methods

The M-CAIS data were obtained through a telephone survey conducted for NIOSH by the USDA National Agricultural Statistics Service (NASS) in 2001. The USDA sampling frame contained 49,270 minority-operated farm households nationwide (USDA, 1999). Members of a racial minority (black, Asian, Native American, and other) accounted for 35,084 of these farms. Operators of the remaining 14,186 farms were white Hispanics. The "other" race category includes operators of South American, Central American, Native Mexican, or Caribbean descent. Attempts were made by NASS to contact all 49,270 minority-operated farms in their sampling frame to complete the survey; however, contact was made with only 36,424 farms. Of these, approximately 75% (27,170) completed the survey, including 19,083 racial minority-operated farms, for a crude response rate of 54%. For confidentiality purposes, the race and ethnicity distribution of non-contact farms was not provided; therefore, an adjusted response rate for racial minority-operated farms exclusively cannot be calculated. However, the crude response rate for Hispanic farms (52%) was similar to the crude rate for racial minority

farms, suggesting that the adjusted response rate of 75% for the overall survey applies to racial minority farms. Data from the 19,083 racial minority-operated farm responses were analyzed for this study.

The data collected for the M-CAIS included demographic information for the farm, members of the farm household, and youth less than 20 years of age visiting and/or working on the farm. This analysis, however, only included data for youth living on the farm. As approximately 88% of the youth reporting injuries were the child/step-child or relative of the operator, the race of these youth was assumed to be the same as that of the operator. Information was collected on on-farm nonfatal injuries occurring to youth less than 20 years of age during the 2000 calendar year, and the exposure of household youth to specific farm hazards. To increase the validity of this telephone survey, the interviewers asked for information on the most recent injuries and made attempts to obtain information from the female head of the household if the injured party was less than 16 years of age (Gerberich et al., 2001).

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 farms were included in these data. Work 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. In addition, rates for work related injuries were calculated based on working household youth, while non-work related injury rates were calculated for all household youth.

The injury and demographic data collected were used to determine national estimates utilizing unbiased estimators for a stratified simple random sample (Cochran, 1977). All results were benchmarked to the 1997 Census of Agriculture based upon race and region (i.e., estimates based on the 35,084 sampled racial minority farms were re-weighted to match the published 1997 farm count of 47,658 racial minority farms) (USDA, 1999). Regions were defined through the nine Bureau of the Census geographic regions (Bureau of the Census, 1975). 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) (BLS, 1992). 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. All confidence intervals (CI) are at the 95% level ($CI_{95\%}$) and were derived by multiplying the estimated standard error times the large sample normal approximation (1.96).

Results

Demographics

In 2000, there were an estimated 28,577 youth living on U.S. farms operated by racial minorities. Over half these youth lived in the Western South Central region (Arkansas, Louisiana, Oklahoma, and Texas; 8,372 youth; 29%) and the Pacific region (Alaska, California, Hawaii, Oregon, and Washington; 7,816 youth; 27%). Table 1 shows various characteristics of the population including the racial category, which ranged from 5,700 Asian household youth to 7,808 household youth classified as "other" race. The number of household youth was similar on livestock and crop operations, with 43% (12,265) living on crop operations and 52% (14,711) on livestock operations. The population was also similar according to sex of the youth. Males accounted for 51% (14,643) of the

Table 1. Population characteristics of household youth less than 20 years of age on racial minority-operated farms, U.S. 2000.

		Estimate[a]	CI 95%	%
Total		28,577	±497	100.0
Race	Black	7,688	±227	26.9
	Native American	7,381	±241	25.8
	Asian	5,700	±249	19.9
	Other	7,808	±278	27.3
Sex	Male	14,643	±313	51.2
	Female	13,042	±296	45.6
	Unknown	892		3.2
Age (years)	<10	9,339	±267	32.7
	10-15	10,577	±263	37.0
	16-19	7,648	±206	26.8
	Unknown	1,013		3.5
Work status	Work	11,753	±311	41.1
	Non-work	15,924	±364	55.7
	Unknown	900		3.2
Farm type	Crop	12,265	±358	42.9
	Grain	2,063	±152	7.2
	Fruit	3,508	±194	12.3
	Vegetable	2,173	±176	7.6
	Other crop	4,521		15.8
	Livestock	14,711	±371	51.5
	Beef	11,547	±324	40.4
	Poultry	522	±98	1.8
	Sheep	478	±74	1.7
	Equine	928	±98	3.2
	Other livestock	1,236		4.3

[a] Subtotals may not sum to total due to missing values and/or rounding.

population and females for 46% (13,042). The majority of household youth included in this study (19,916, 70%) were under the age of 16, with 9,339 (33%) less than 10 years of age.

Nonfatal Injuries

Youth living on farms operated by racial minorities sustained an estimated 348 nonfatal injuries in 2000 (table 2). This represented a rate of 12.2 injuries per 1,000 youth on these racial minority-operated farms. Approximately half of all reported injuries occurred in the months May to August (177, 51%, $CI_{95\%}$ 144 to 210) when youth are not in school. Native American household youth experienced approximately half (177, 51%) of all reported injuries and had the highest rate of injury (24.0 per 1,000), while Asian youth had the lowest injury rate at 4.6 per 1,000 household youth. The geographic distribution of the injuries was consistent with the distribution of the Native American population. The East North Central region (Illinois, Indiana, Michigan, Ohio, and Wisconsin) and West North Central region (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota) had the highest percentage of Native American household youth and the highest injury rates at 25.5 and 24.9 injuries per 1,000 household youth, respectively. Seventy percent of the injuries to household youth (245) occurred to males. The rate of injury for males (16.7 per 1,000 male household

Table 2. Estimates of injuries and injury rates for household youth less than 20 years of age on racial minority-operated farms, U.S. 2000.

		Number of Injuries			Injury Rates	
		Estimate[a]	CI 95%	%	Rate[b]	CI 95%
Total		348	±48	100.0	12.2	±1.7
Race	Black	49	±17	14.1	6.4	±2.4
	Native American	177	±31	50.9	24.0	±4.4
	Asian	26	±12	7.5	4.6	±2.2
	Other	96	±29	27.6	12.3	±3.7
Sex	Male	245	±39	70.4	16.7	±2.7
	Female	103	±25	29.7	7.9	±2.0
Age (years)	<10	112	±56	32.1	12.0	±3.1
	10-15	161	±30	46.3	15.2	±2.8
	16-19	73	±20	20.9	9.5	±2.6
	Unknown	2	––	0.7	N/A[c]	N/A
Work status	Work	138	±29	39.8	11.7	±2.5
	Non-work	210	±36	60.2	7.3	±1.3
Farm type	Crop	101	±27	29.0	8.2	±2.2
	Grain	42	±21	12.1	20.4	±10.8
	Fruit	17	±9.4	4.9	4.8	±2.7
	Vegetable	9	±7.6	2.6	4.1	±7.0
	Other crop	33	––	9.5	N/A	N/A
	Livestock	247	±40	71.0	16.8	±2.7
	Beef	162	±32	46.6	14.0	±2.7
	Poultry	11	±9	3.2	21.1	±17.7
	Sheep	22	±12	6.3	46.0	±26.9
	Equine	31	±15	8.9	33.4	±16.7
	Other livestock	21	––	6.0	N/A	N/A

[a] Subtotals may not sum to total due to missing values and/or rounding.
[b] Injury rate per 1,000 household youth.
[c] N/A = not applicable.

youth) was substantially higher than the rate of injury for female household youth (7.9 per 1,000 youth). The majority (273, 78%) of nonfatal injuries occurred to youth less than 16 years of age. The rate of injury to household youth less than 16 years of age was 13.7 ($CI_{95\%}$ 10.7 to 16.7) injuries per 1,000 household youth. In general, Native American household youth injuries follow similar patterns to all minority household youth injuries, although the estimates were higher.

Table 2 also shows that injuries to household youth on racial minority-operated livestock operations (247, 71%) were twice as common as injuries to youth on crop operations (101, 29%). Household youth on livestock operations sustained 16.8 injuries per 1,000 household youth, while youth on crop operations sustained 8.2 per 1,000, producing a rate ratio of 2.0. Injuries on poultry, sheep, and equine operations all occurred at much higher rates than the overall livestock rate (table 2). Injuries on grain farms occurred at almost three times the overall rate for all crop operations (table 2).

The most common injuries for household youth on racial minority-operated farms were falls (109, 31%, $CI_{95\%}$ 84 to 134) and contact with objects (108, 31%, $CI_{95\%}$ 83 to 133). Transportation events accounted for 49 (14%, $CI_{95\%}$ 53 to 65) of all nonfatal injury events to household youth. The most common source of injury to household youth was structures/surfaces (which includes floor, ground, etc.), accounting for 117 (34%, $CI_{95\%}$ 91 to 143) incidents.

The extremities were the body parts injured most often. The hand/wrist/arm (106, 30%, $CI_{95\%}$ 90 to 122), foot/ankle/leg (95, 27%, $CI_{95\%}$ 80 to 110), and head/face (71, 20%, $CI_{95\%}$ 57 to 85) were significantly more likely to be injured than all other body parts. Cuts and lacerations were the most commonly reported type of injury, with an estimated 95 (27%, $CI_{95\%}$ 71 to 119) injuries. Fractures were the second most commonly reported injury, with an estimated 78 (22%, $CI_{95\%}$ 58 to 98) nonfatal incidents.

Comparison of Work and Non-Work Related Injuries

When examining injuries to household youth who were performing work on racial minority-operated farms, we found an annual injury rate of 11.7 work-related injuries per 1,000 working household youth, which was significantly higher than the non-work rate of 7.3 per 1,000 household youth (a rate ratio of 1.6). However, as shown in figure 1, this difference in injury rates was specific to the working male household youth; no significant difference between work and non-work injuries for females was found. When considering both work status and age (fig. 2), we found that the oldest age group (16 to 19 years) showed significant variation between work injuries (11.4 per 1,000 working household youth, $CI_{95\%}$ 7.6 to 15.2) and non-work injuries (2.8, $CI_{95\%}$ 1.4 to 4.2), with a rate ratio of 4.1. Overall, the rate for injuries at work was relatively stable across age groups. The rate for non-work related injuries, however, decreased with age.

Variation among racial categories was found for household youth. The rate ratio for work-related injuries to black household youth (7.7 per 1,000 working household youth, $CI_{95\%}$ 3.6 to 11.8) compared to the non-work rate for black household youth (3.5 per 1,000 household youth, $CI_{95\%}$ 2.2 to 4.8) was 2.2. However, Native American household youth experienced similar injury rates for work injuries (17.8 per 1,000 youth, $CI_{95\%}$ 12.7 to 22.9) and non-work injuries (13.8 per 1,000 youth, $CI_{95\%}$ 11.8 to 15.8), a rate ratio of 1.3. Comparisons could not be made for other racial categories because of the small number of reported work injuries for household youth.

Working household youth sustained work-related injuries at a rate of 4.6 per 1,000 working household youth on crop operations. On livestock operations, however, this rate climbed to 16.2 injuries per 1,000 working household youth (fig. 3). The injury rate for non-working household youth was not significantly different when farm type was considered, although the rate for livestock farms was still higher than the rate for crop

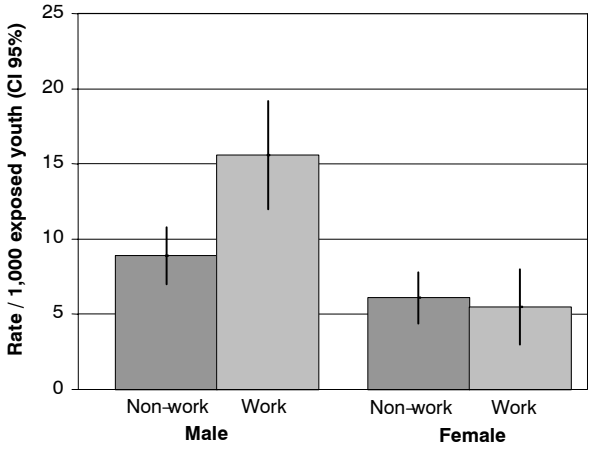

Figure 1. Nonfatal injury rates for household youth less than 20 years of age on racial minority-operated farms: sex by work status, U.S. 2000.

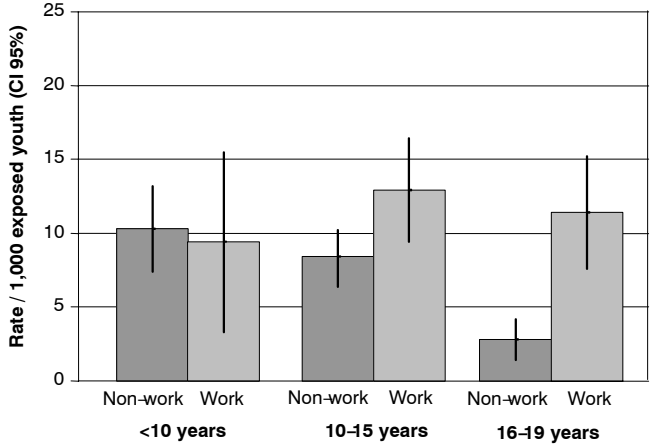

Figure 2. Nonfatal injury rates for household youth less than 20 years of age on racial minority-operated farms: age by work status, U.S. 2000.

farms. Within the farm types, there was no significant difference between work and non-work injury rates for crop farms. However, on livestock operations, the work related injury rate for household youth (16.2 per 1,000 household youth, $CI_{95\%}$ 12.5 to 19.9) was almost double the rate for non-work related injuries (8.7 per 1,000 household youth, $CI_{95\%}$ 6.8 to 10.6). The rate ratio of work to non-work related injuries on livestock farms was 1.9.

The most common types of work-related injuries to household youth on racial minority-operated farms were cuts/lacerations (36, 26%, $CI_{95\%}$ 23 to 49) and broken/fractured bones (25, 18%, $CI_{95\%}$ 12 to 38). In general, the injured body parts were the extremities: the arm (including hand and wrist) accounted for 34 injuries (25%, $CI_{95\%}$ 25 to 43), and an estimated 49 injuries (36%, $CI_{95\%}$ 39 to 59) occurred to the leg (including foot and ankle). This pattern of injury was consistent with the most common

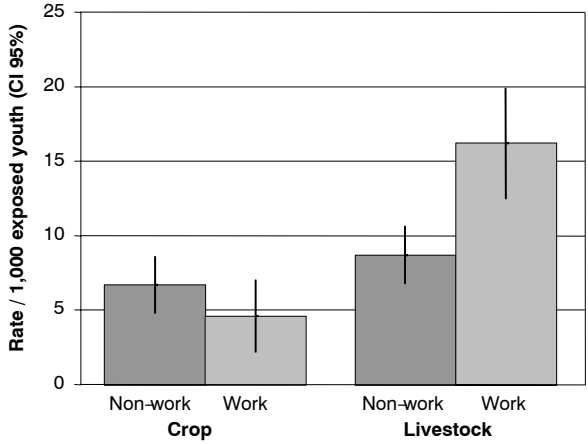

Figure 3. Nonfatal injury rates for household youth less than 20 years of age on racial minority-operated farms: farm type by work status, U.S. 2000.

types of injuries found in non-working household youth on these farms. Cuts/lacerations accounted for 28% (59, $CI_{95\%}$ 38 to 80) of all non-working injuries to household youth on racial minority-operated farms, while broken/fractured bones accounted for 25% (53, $CI_{95\%}$ 38 to 68). Thirty-four percent (72, $CI_{95\%}$ 53 to 91) of the non-working injuries were to the arm (including hand and wrist) and 22% (45, $CI_{95\%}$ 28 to 62) were to the leg (including foot and ankle).

Sixty-one (44%, $CI_{95\%}$ 43 to 79) of the reported work-related injuries to household youth were classified as occurring when the youth made contact with an object. Thirty-three (24%, $CI_{95\%}$ 20 to 46) of the reported injuries were the result of falls. The most common source of injury was structures/surfaces. This source (which includes fences, the ground, and floors) accounted for 41 (30%, $CI_{95\%}$ 26 to 56) of the total work-related injuries. This pattern was reversed for non-working household youth, with 36% (76, $CI_{95\%}$ 55 to 97) of all injuries resulting from falls and 22% (47, $CI_{95\%}$ 51 to 73) of the injuries resulting from contact with an object. Again, structures/surfaces were the most common source of non-working injury (76, 36%, $CI_{95\%}$ 55 to 97).

Discussion

The 2000 M-CAIS provides a unique nationwide perspective on racial minority-operated farms. Although the time period covered by M-CAIS data is not the same as the time period of the 1998 CAIS data (Myers and Hendricks, 2001), some comparison can be made to provide insight into differences between the overall population of U.S. farms and the sub-population of minority-operated farms.

The 1998 CAIS data for the general farm population indicate that household youth were injured at a rate of 18.7 per 1,000 household youth ($CI_{95\%}$ 16.2 to 21.6), while the 2000 M-CAIS data indicate a significantly lower injury rate of 12.2 per 1,000 household youth ($CI_{95\%}$ 10.5 to 13.9). Injury rates for household youth on minority-operated farms were lower than the 1998 CAIS rates for both crop and livestock operations. In addition, the injury rate for household youth on racial minority-operated farms in 2000 indicates that children on Native American operated farms were injured at a rate (24.0 per 1,000 household youth), almost double and significantly greater than the overall rate for racial minority household youth. Although the injury rate for Native American farm operations is high, it is not significantly different from the overall 1998 CAIS rate. The injuries on Native American farms exhibit similar patterns to those reported for all races.

M-CAIS data indicate that household males on racial minority-operated farms are significantly more likely to incur a nonfatal work-related injury than they are to incur a non-work injury and are more likely than females to be injured regardless of work status (fig. 1). In addition, household youth performing work on livestock operations are significantly more likely to be injured than their counterparts on crop operations (fig. 3). These data are again consistent with the 1998 CAIS findings. In general, the data obtained for racial minority-operated farming operations are similar to those found in the general farming population. However, there was variation by race within the M-CAIS data.

When looking across the household youth populations by operator race, population sizes did not vary greatly, but the injury rates did. This indicates that the low M-CAIS rate may be the result of the very low injury rates experienced by black and Asian household youth. Native American household youth appear to be at greater risk for injury than all other youth. The injury rate for working household youth on Native American operated farms was almost double the rate for working household youth on black farms; further, the non-work related injury rate for household youth on Native American farms was four times greater than the non-working injury rate for household youth on black farms. In

addition, injury rates on Native American farms were significantly higher than rates on black farms for both crop and livestock farms. This information is crucial to promoting safe farm work as it indicates specific audiences that should be the focus for increased prevention efforts (Vela Acosta and Lee, 2001).

The high rate of injury on Native American farms suggests a need for culturally specific prevention and education efforts targeted to Native American operated farms in the U.S. For example, Richardson et al. (1997) suggest prevention strategies that address utilization of safe equipment, which is an area identified as affecting fatal injuries to African-American farmers in North Carolina. In a similar fashion, these data may be used to determine specific prevention strategies for Native American farm youth. In addition, the difference between injury rates among crop and livestock operations suggests a need to address hazards specific to livestock operations operated by racial minorities. Identification of hazards or injuries that are more prevalent within a specific sub-group of the farming population indicates an area of need for intervention. To be effective, this intervention must be presented in a manner that will resonate with the at-risk population and be considered practical to their operations.

Although the M-CAIS data provide a unique look into a specific sub-population in the farming community, there are limitations to its utility. There is no direct data comparison group to allow for inferences over time or comparison to other populations. Data are only available for the year 2000, and data are not available for the general farming population during the same time period, which would allow for direct comparisons using differing demographics. In addition, the self-reported nature of the race variable allows the possibility that individuals are not wholly accurate in reporting their race, and the race of the operator may not accurately reflect the race of the youth population on the farm.

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 through a focus upon the most recent and severe injuries, as recall bias is generally not as strong for severe injury (Harel et al., 1994). 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 the 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. In addition, the scope of the survey with regard to detailed data was limited due to the overall length of the survey. However, despite these issues, M-CAIS is an important first step in providing an accurate analysis of youth injuries on farms operated by racial minorities.

Conclusion

The M-CAIS data indicate that household youth on racial minority-operated farms may be at less risk for injury than household youth in the general population of U.S. farms. In addition, the scope of the data allowed for further analyses using specific demographic and occupational factors. These analyses showed important differences in factors such as race of the operator and the farm type. Two important results are the significantly high injury rate among youth on Native American farms and the lower rate for youth on black farms, which is consistent with results for the general population of black farmers in state-specific research (Lyman et al., 1999). In addition, these results suggest that youth on Asian-operated farms are also at much lower risk for farm injuries than youth in the general farm population and on farms operated by Native Americans.

However, it must be noted that only 16% of all household youth on Asian farm operations live on livestock farms. This may account for the relatively low risk associated with Asian farm operations.

Future surveys of the minority farm operator population will allow researchers to monitor the change over time in the injury experience faced by this sub-population and how it compares to the injury experience faced by the general farming population. This is an important contribution to agricultural production safety, as the demographics of the nation and the farm are constantly changing in the U.S. To ensure safety on the American farm, occupational safety and health experts must constantly consider the nature of not only the injuries occurring, but also the cultural and ethnic context in which safety messages are being presented.

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