Youth Living on Hispanic Operated Farms in the United States: An Examination of Population Growth and Changes in Risk Exposure and Injury Patterns between 2000 and 2003.

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Purpose: Farming presents increased morbidity and mortality for youth. Youth living on Hispanic operated farms pose unique challenges as Hispanic operated farms are increasing more rapidly than any other type of minority farm, showing a 51% increase between 1997 and 2002.

Methods: Survey data for youth less than 20 years of age living on Hispanic operated farms in calendar years 2000 and 2003 were collected via telephone interviews. Phone calls were attempted for all farms listed on the 1997 and 2002 U.S. Department of Agriculture's Census of Agriculture sampling frames that indicated Hispanic ethnicity for the farm operator. Statistical weights were benchmarked to the USDA's Census estimates adjusted for non-coverage of farms not on the sampling frame. Error estimates were calculated using SAS SurveyMeans procedure, which incorporated the stratified sample design.

Results: During the three year period, the number of youth less than 20 years of age living on Hispanic operated farms increased 59%, from an estimated 21,630 (CI95% ± 694) in 2000 to 34,495 (± 1,250) in 2003. The total number of injuries increased during this time from 307 (± 40) to 335 (± 70), but the overall injury rate declined from 14.2 (± 1.9) per 1,000 household youth to 9.7 (± 2.1). The injury rate for males significantly decreased from 20.2 (± 3.6) to 10.7 (± 3.1), while the injury rate among females increased slightly from 8.2 (± 3.0) to 9.2 (± 3.7). Youth living on livestock operations comprised 62% and 65% of the injuries in 2000 and 2003, respectively. The injury rate on livestock operations decreased from 17.5 (± 3.7) to 11.8 (± 3.4), while the injury rate on crop operations dropped from 11.3 (± 3.7) to 8.1 (± 3.5). Demographic exposure data from the two survey periods for youth aged 4-19 years showed similar proportions of household youth reported performing work activities (49% and 52% in 2000 and 2003, respectively), riding horses (32% and 34%), driving ATVs (30% and 31%), and operating tractors (28% and 26%). Injury rates decreased for work tasks from 14.2 (± 3.7) in 2000 to 8.9 (± 3.2) in 2003. Changes in injury rates were nonsignificant for driving ATVs [4.7 (± 3.3) and 3.5 (± 2.9) in 2000 and 2003, respectively] and horse riding [4.6 (± 2.9) and 5.5 (± 3.5)]. Females accounted for 65% and 71% of horse riding injuries during the two time periods. In 2000, there were 22 (± 16) tractor-related injuries. In 2003, the estimated number of incidents that involved a tractor did not meet reporting requirements.

Conclusions: Incidents related to work activities, ATVs, and horses continue to account for a significant proportion of injuries to youth on Hispanic operated farms. The injury rate for females is now similar to males. Targeted intervention and surveillance efforts among youth living on Hispanic operated farms are necessary for exposure to horses and ATVs, for farm tractor usage, and for the changing injury patterns observed between the sexes.

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Introduction

Growing up on a family farm has many positive attributes including opportunities to learn and participate in all aspects of the farming operation. It also provides the opportunity for the youth's progression to a fulltime partner on the family farm or to become an independent farm operator. These opportunities however, lead to occupational injury exposures at a younger age than if the youth were working in a non-agricultural industry due to cultural, legal and other factors (National Committee for Childhood Agricultural Injury Prevention, 1996; Swanson et al., 1987).

Increased injury morbidity and mortality in agriculture production is well established for adults, but until recently, there has been a dearth of injury information for youth on farms (National Research Council, 1998). Recent studies have demonstrated the increased risk of injury to children on farms that is associated with tractors, machinery, and large animals (Hendricks et al., 2005; McCurdy and Carroll, 2000; Munshi et al., 2002; NIOSH, 2006; NIOSH, 2005; NIOSH, 2001; Parker and Wahl, 1999; Stueland et al., 1991; Swanson et al., 1987). For youth living on the farm, injuries are associated with both work and non-work activities (McCurdy et al., 2002; NIOSH, 2006; NIOSH, 2005; NIOSH, 2001; Stueland et al., 1991). The number of jobs that a youth is employed and hours of work are also important factors for youth injury (Munshi et al., 2002; Parker et al., 2002).

Demographic trends for minority farm operations vary from those of the general farming population in the U.S. Overall, the number of farms in the U.S. decreased by about 4% between 1997 and 2002 (USDA, 2004-a). Over the last century, the number of farms remained between

6.4 and 6.8 million from 1910 to 1940, but declined to 5.6 million in 1950, and down to 2.2 million farms in 2000 (USDA, 2002-a). In contrast, the number of racial and ethnic minority operated farms have been increasing. American Indian or Alaska Native operated farms increased 20% from 1997 to 2002, and Black or African American operated farms increased by 9%. Principal operators reporting an ethnicity of Spanish, Hispanic, or Latino increased 51% over this same five year period (USDA, 2002-b). Not only did Hispanic operated farms increase at a faster rate than any other minority category, but they represented the largest number of minority operated farms, accounting for 50,592 farms according to the 2002 Census of Agriculture (USDA 2004-a).

It was previously reported that only about 6% of all youth on Hispanic operated farms lived on the farm, with the remainder of youth either visiting (92%) or on the farm as hired workers (2%). While comprising only 6% of the total youth on the farm, household youth accounted for 71% of all injuries (Layne et al., 2003). Due to the greater exposure to agricultural hazards incurred by household youth, it is not surprising that they accounted for the vast majority of the injury burden. This current paper examines data from calendar years 2000 and 2003 for youth living on Hispanic operated farms, which are both the largest and fastest growing minority farm population in the U.S. Demographic data for the youth living on Hispanic operator farms is presented, as well as exposure information for youth who perform work tasks, operate tractors, drive ATVs, and ride horses. Injury information is presented along with exposure-specific injury rates for these activities.

Methods

Survey

The cross-sectional survey data for youth less than 20 years of age living on Hispanic operated farms were extracted from the 2000 and 2003 Minority Farm Operator Childhood Agricultural Injury Survey (M-CAIS). The 2000 and 2003 M-CAIS sampling frames covered all farms listed on the U.S. Department of Agriculture's Census of Agriculture for which the farm operator's (1) ethnicity was positive for Hispanic, or (2) a racial minority was indicated in the race item. For this paper, only data for Hispanic operated farms are utilized.

The 2000 M-CAIS sampling frame used the 1997 Census of Agriculture, and the 2003 M-CAIS sampling frame was based upon the 2002 Census of Agriculture. The M-CAIS survey is conducted by the National Agricultural Statistics Service (NASS) in collaboration with the National Institute for Occupational Safety and Health. Data were collected using telephone interviews, in English or Spanish as appropriate and conducted from NASS calling centers during February and March of 2001and 2004 for calendar year data for 2000 and 2003, respectively. The 2000 M-CAIS included interviews for 10,862 farms and a 52% crude response rate, while the data for 2003 included 13,197 interviewed farms for a crude response rate of 55%.

Statistical Estimates

Statistical weights for the 2000 M-CAIS data were derived by post-stratifying the farms by geographic region and benchmarking the data to the 1997 Census of Agriculture ***revised estimates*** for Hispanic farms. In 2004, the USDA revised the weighting scheme for estimating farms in the 1997 Census of Agriculture. This new estimating procedure allows for the inclusion of farm operations that did not appear on the census list (USDA, 2004-b). Because this paper

benchmarked the data to the new USDA estimating procedures, the statistical estimates in this paper do not match those reported in previous papers that examined the Hispanic youth from the 2000 M-CAIS data (Hendricks et al., 2005; Layne et al., 2003). The 2003 M-CAIS statistical weights were derived by post-stratifying the farms by geographic region and benchmarking the data to the 2002 Census of Agriculture. The 2002 Census of Agriculture also includes estimates for farms not on the census list.

Injury rates were calculated by dividing the estimated number of injuries by the exposed population estimates, and expressed per 1,000 youth (both the injury and population estimates were obtained from the 2000 and 2003 M-CAIS). Injury rates for work-related incidents used estimates for household youth (aged 4-19 years) that were positive for work tasks. Injury rates for riding horses, driving ATVs, and operating tractors followed a similar format, using only those youth aged 4-19 years that were positive for these activities, thus providing '*exposure-specific*' injury rates. The population used for non-work incidents included all household youth as working youth could incur both a work and non-work injury.

Variance estimators for calculation of ninety-five percent confidence intervals around the injury and population estimates were derived from the SAS Proc SurveyMeans procedure (V8.2). This SAS procedure provides the technique to incorporate the sampling design of stratifying by region and clustering the injuries by farm. Variance calculations did NOT include an adjustment for the finite population correction, resulting in a conservative estimate for the confidence interval that is a few percentage points higher than if the finite population correction had been factored into the calculations. Confidence intervals for the injury rates and rate ratios were approximated by use of a linear combination of the relative standard errors, assuming the relative covariance between the injury and population estimates was negligible (Cochran, 1977).

Results

Demographic and Injury Estimates

During the three year period, the number of youth less than 20 years of age living on Hispanic operated farms increased 59%, from an estimated 21,630 in 2000 to 34,495 in 2003. The total number of injuries increased during this time from 307 to 335. Increases were not consistent across all age and sex categories as shown in Table 1. The overall injury rate

Table 1.- Population and injury estimates for youth < 20 years of age living on Hispanic operated farms in the U.S., 2000 and 2003.

Population Estimates						
Total	21,630	± 694	100.0%	34,495	± 1,250	100.0%
Sex						
Male	11,098	± 321	51.3%	17,445	± 582	50.6%
Female	10,096	± 316	46.7%	16,106	± 572	46.7%
Unkn	436		2.0%	944		2.7%
Age						
<10	7,224	± 333	33.4%	11,930	± 608	34.6%
10-15	7,919	± 288	36.6%	11,982	± 502	34.7%
16-19	5,982	± 243	27.7%	9,281	± 421	26.9%
Unkn	506		2.3%	1,302		3.8%
Injury Estimates						
Total	307	± 40	100.0%	335	± 70	100.0%
Sex						
Male	224	± 39	73.0%	187	± 53	55.8%
Female	83	± 30	27.0%	148	± 59	44.2%
Age						
<10	99	± 33	32.2%	104	± 48	31.0%
10-15	133	± 34	43.3%	179	± 56	53.4%
16-19	71	± 26	23.1%	49	± 27	14.6%
Unkn	4		1.3%	3		0.9%

* May not add to total due to rounding.

declined from 14.2 (± 1.9 (95% confidence interval)) per 1,000 household youth in 2000 to 9.7 (± 2.1) in 2003. Figure 1 shows that the injury rates for males decreased significantly compared to a small nonsignificant increase among females, leaving little difference in injury rates between the sexes in 2003. The injury rates decreased from 2000 to 2003 for each of the three age categories displayed in Figure 2, but the only injury rate decrease that approached statistical significance was for the 16-19 year olds.

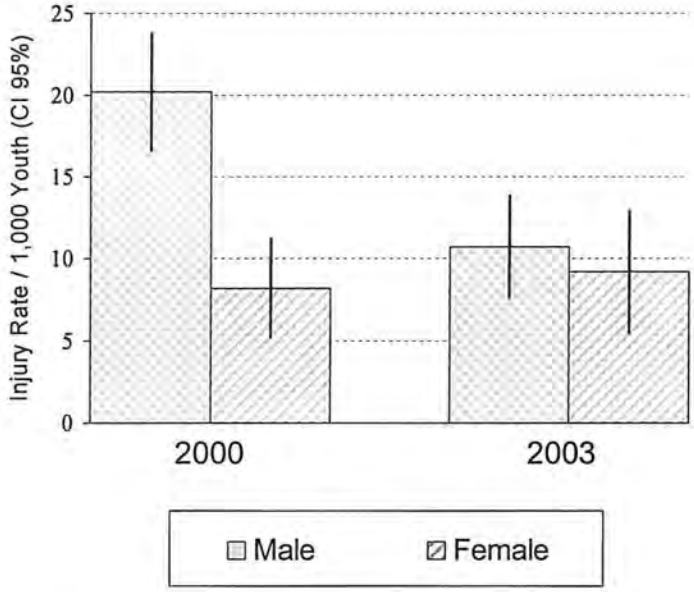


Figure 1.- Injury rate by sex for youth < 20 years of age living on Hispanic operated farms, U.S. 2000 and 2003.

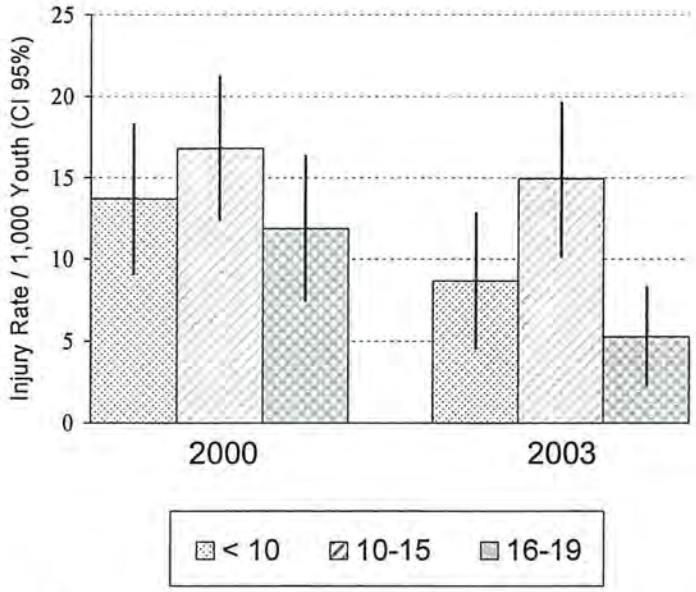
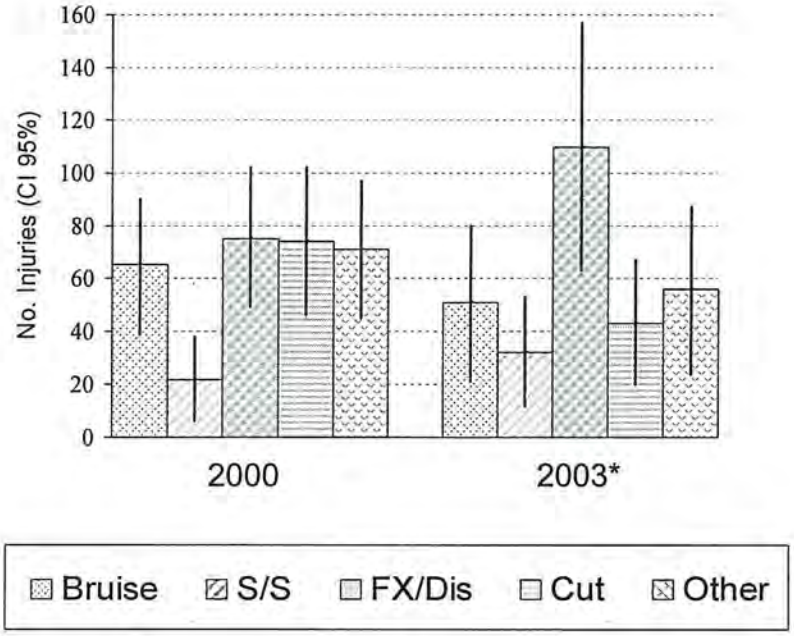


Figure 2.- Injury rate by age group for youth < 20 years of age living on Hispanic operated farms, U.S. 2000 and 2003.

Injuries to the upper and lower extremities accounted for the majority of injuries. Injuries to the arm, hand, and fingers comprised 31% of the total in 2000 and 36% in 2003. The leg, knee, foot, and toes accounted for 32% of the injuries in 2000 and 28% in 2003. The head and neck were involved in 16% and 18% in 2000 and 2003, respectively. The distributions for the nature of injury are shown in Figure 3. Fractures and dislocations comprised a larger percent of injuries in 2003 as shown in Figure 3.



2003*-- 13% missing (n=293 cases shown in figure).

Bruise: Bruise, contusion, scrape and abrasion.
S/S: Sprain, strain, and torn ligament.
FX/Dis: Fracture and dislocation.
Cut: Cut and laceration.
Other: Puncture, crush, amputation, burn, internal, blunt head trauma, multiple injuries and unknown.

Figure 3.- Nature of injury for youth < 20 years of age living on Hispanic operated farms, U.S. 2000 and 2003.

The number of youth living on Hispanic operated farms classified as crop operations increased 48% between 2000 and 2003, from 9,712 (± 416) to 14,353 (± 688). Fruit operations accounted for 30% of the total youth in 2000 and 36% in 2003 among crop operations. Youth on grain operations comprised 20% of the total crop-related operations in 2000 and 16% in 2003. Youth on livestock operations increased 70%, from 10,900 (± 425) in 2000 to 18,583 (± 784) in

2003. Among the livestock operations, 72% of the youth were living on beef farms in 2000 and 65% in 2003. The number of youth living on equine operations increased 300% between 2000 and 2003, from 782 (± 139) to 2,346 (± 368).

Injuries on crop operations comprised 36% of the total in 2000 and 35% in 2003. Livestock operations comprised 62% and 65% of the injuries in 2000 and 2003, respectively. The injury rate on crop operations dropped from 11.3 (± 3.7) per 1,000 household youth to 8.1 (± 3.5) from 2000 to 2003. The injury rates decreased from 17.5 (± 3.7) to 11.8 (± 3.4) on livestock operations. The majority of injuries on livestock operations occurred on beef operations. Beef operations accounted for 55% (106 ± 32) of the injuries on livestock operations in 2000 and for 53% (116 ± 45) in 2003. Beef operations had an injury rate of 13.4 (± 4.1) in 2000 and 9.6 (± 3.8) in 2003.

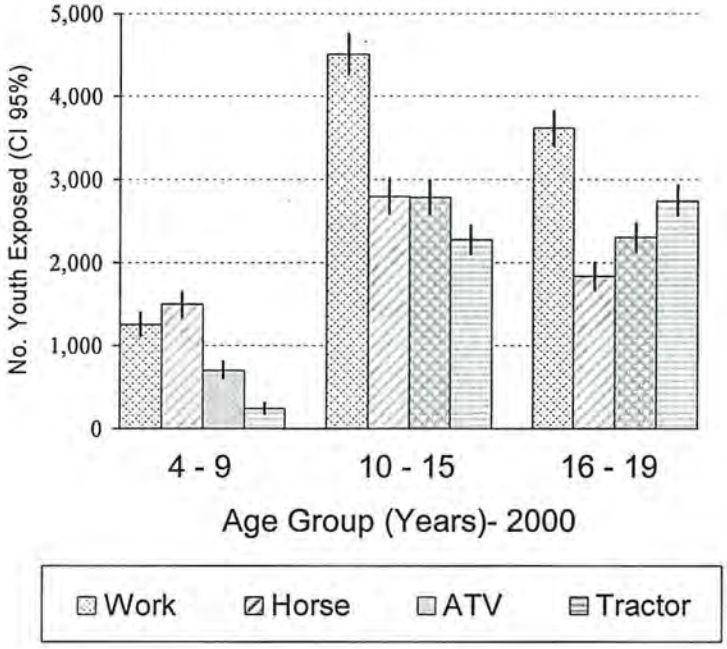
Exposure-specific data for Work, Horses, ATVs, and Tractors

Demographic exposure data from the two survey periods for youth aged 4-19 years (youth < 4 years old were removed from the exposure-specific analysis) showed similar proportions of household youth reported performing work activities (49% and 52% in 2000 and 2003, respectively), riding horses (32% and 34%), driving ATVs (30% and 31%), and operating tractors (28% and 26%). Figure 4 shows the number of youth by age group who reported positive for these four activities. While youth 4-9 years of age accounted for the smallest number of positive measures for these four exposures, 5% and 6% were positive for operating tractors in 2000 and 2003, respectively; 14% and 15% for driving ATVs; 24% and 31% for work; and 29% and 31% were positive for riding horses. The largest differences from this youngest age group and those 10-15 years old were seen for operating tractors, where 29% and

26% were positive in 2000 and 2003, respectively; and driving ATVs with 35% and 36% positive.

In 2000, 48% (133 ± 34) of all injuries to youth 4-19 years of age involved work activities, 13% (37 ± 20) involved horses, 10% (27 ± 18) were ATV-related, and 8% (22 ± 16) involved tractors. (Please note these injury numbers include all incidents involving horses, ATVs, and tractors, and are not restricted to only those involved in riding horses, driving ATVs, or operating tractors.) Work- and ATV-related incidents remained essentially the same in 2003, with work involved in 45% (136 ± 49) of the injury incidents and ATVs involved in 12% (36 ± 27) of the total. The percent of injury incidents involving horses increased to 23% (69 ± 39) in 2003, while the number of incidents involving tractors did not meet reporting requirements.

Injury rates decreased for work tasks from 14.2 (± 3.7) per 1,000 household youth to 8.9 (± 3.2) between 2000 and 2003. The work-related injury rates for males decreased from 16.9 (± 5.6) to 8.9 (± 4.0). Work-related injury rates for females decreased from 9.9 (± 5.5) to 8.8 (± 5.9). There were nonsignificant changes in injury rates for driving ATVs and horse riding. Injury rates for driving ATVs decreased from 4.7 (± 3.3) in 2000 to 3.5 (± 2.9) in 2003. Injury rates for horse riding increased from 4.6 (± 2.9) in 2000 to 5.5 (± 3.5) in 2003. Females accounted for 65% and 71% of the horse-related injuries during the two time periods. Incident rates for operating tractors were not calculated due to minimum reporting requirements not being met.



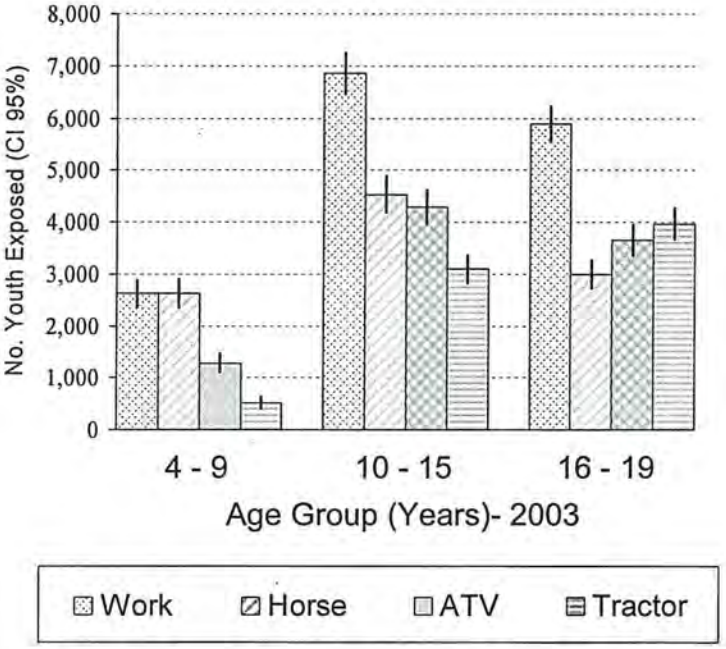


Figure 4.- Number of youth positive for exposure to work, riding horses, driving ATVs, and operating tractors by age group: Youth < 20 years of age living on Hispanic operated farms, U.S. 2000 and 2003.

Discussion

Limitations

The data were collected using two cross-sectional surveys conducted in 2001 and 2004 to derive demographic and injury estimates for youth during calendar years 2000 and 2003. The injury data were collected by use of a proxy (usually a parent or guardian) with a recall period from 2- to 15-months. Cummings et al., 2005, reported that the ability of parents to recall their children's injuries in telephone interviews varied from 82% for injuries one day after occurrence down to 37% for injuries 12-months prior to the telephone interview. This potential recall bias suggests that the injury estimates presented should be considered conservative. Injury comparisons between the two surveys should not be affected by the recall bias assuming the recall bias is about the same in both surveys.

The injury rates are based on the number of youth who worked as opposed to 'actual hours' of exposure. The same is true for riding horses and driving ATVs. Because exposure is usually part-time, using the number of youth as opposed to 'actual hours' leads to an under-reporting of injury rates. A strength of exposure-specific injury rates, however, is that they are based only on youth who were positive for these exposures as opposed to using all youth on the farm (which is the usual method when actual exposure measures are not available).

Results and Previous Research

It has previously been noted that there is a need to establish more accurate data for persons living and working on U.S. agricultural production operations (Rautiainen and Reynolds, 2002). Several surveys have been completed for youth in the general farm population. These surveys collected demographic and injury information for the years 1998 and 2001 (Hendricks et al., 2004; NIOSH, 2001). A weakness of these surveys that covered all farming operations was

that an examination of the data by race and ethnicity was not possible due to the small number of cases for these minority groups in the sample. Based on the lack of data for racial minority and Hispanic youth in these general farm surveys, two separate surveys were conducted (to collect data for calendar years 2000 and 2003) that included all minority operators listed on the 1997 and 2002 Census of Agriculture. By contacting or attempting to contact all minority operators on the Census of Agriculture lists, a sample of sufficient size was obtained for examination of the demographic and injury data, and development of exposure-specific injury rates for the leading causes of serious injury to youth on farms.

During the three year period, the number of youth less than 20 years of age living on Hispanic operated farms increased 59%. This rate of increase is not unexpected as the 1997 and 2002 Census of Agriculture show that Hispanic operated farms increased 51% over the five year period between 1997 and 2002 (USDA, 2002-b). The total number of injuries to youth on Hispanic operated farms showed a marginal increase from 307 (± 40) in 2000 to 335 (± 70) in 2003, while the overall injury rate declined from 14.2 (± 1.9) per 1,000 household youth to 9.7 (± 2.1).

The decline in the overall injury rates was not consistent across all youth on Hispanic operated farms. The injury rate for males significantly decreased compared to a slight increase among females. These changes resulted in a relatively small, nonsignificant difference in injury rates between the sexes in 2003. These injury patterns have only recently been registered in injury surveillance systems and remain largely unexplained, but they have been noted in other recent studies. Data for the general youth farm population showed a convergence of rates between the sexes (Hendricks et al., 2004; NIOSH, 2001). This pattern was also observed in

rural adolescents in Minnesota, where females had higher work-related injury rates than males for farming, but lower rates for non-farm injuries (Munshi et al., 2002).

Available demographic information may shed some light on these emerging patterns, including gender-based work assignments and the increasing role of women as partners or independent farm operators. Marlenga et al., 2001, reported that work tasks among youth on farms are differentially assigned by sex, with males undertaking tractor (with implement) duties and females assigned more often to animal care. Large animals have been identified as a leading cause of agricultural injury to youth (Hendricks et al., 2005; NIOSH, 2006; NIOSH, 2005; NIOSH, 2001; Swanson et al., 1987). And based on data from the Census of Agriculture, McCoy et al., 2002, reported that more females are becoming partners on the family farm or entering the agriculture industry as an independent operator. Also, a larger proportion of women are principal operators among Hispanic operators than any other minority group (USDA, 2004-a). It is unknown if these patterns are leading to changes in work task assignments among female youth on the farm.

Demographic exposure data of the two survey periods for youth 4-19 years old showed similar proportions of household youth performing work activities, riding horses, driving ATVs, and operating tractors. Because of the 59% increase in the number of youth on Hispanic operated farms, the similar proportions of youth exposed to these activities between 2000 and 2003 indicates that a larger number of youth 4-19 years old during 2003 worked on the farm, rode horses, drove ATVs, and operated tractors. Injury rates decreased for work tasks from 14.2 (± 3.7) to 8.9 (± 3.2). There were nonsignificant changes in injury rates for riding horses and driving ATVs. Females accounted for the majority of horse-related injuries. While the tractor-

related injury measures did not meet reporting requirements in 2003, the large number of youth operating tractors in the younger age categories should be of great concern.

The exposure-specific data captured for work, horses, ATVs, and tractors provides for more precise measures of true risk that is associated with each. Without these exposure measures, the injury rates would have been based on the total number of youth on the farms rather than only youth who are exposed, thus greatly underestimating the risks. Injury rates for work based on the total population of youth would have under-estimated the 'exposure-specific' risk by a magnitude of at least two; injury risk for horses would have been under-estimated by a factor of three; and the risk associated with driving ATVs would have been under-estimated by a factor of nearly four. More precise measures of risk are needed for development of appropriate injury prevention strategies and subsequent evaluation.

Conclusions

Incidents related to work activities, ATVs, and horses continue to account for a significant proportion of injuries to youth on Hispanic operated farms. The injury rate for females is now similar to males, a pattern also observed for the general youth farm population. Tractor related injuries decreased to the extent of non-reporting, but a large proportion of youth continue to report operating farm tractors. Targeted intervention and surveillance efforts among youth living on Hispanic operated farms are necessary for exposure to horses and ATVs, for farm tractor usage, and for the changing injury patterns observed between the sexes.

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