

implications. *Annual Review of Public Health*, 1981. Ames, IA: Cooperative

Surveillance of Agricultural Injuries in Central Wisconsin: Epidemiologic Characteristics*

Dean Stueland, Barbara Lee, and Peter M. Layde

ABSTRACT: We implemented a hospital-based agricultural injury surveillance system in central Wisconsin in November 1986. The geographic area of the study is heavily agricultural, with a predominance of dairy farmers. This report describes the epidemiologic characteristics of the 913 patients seen during the first two years of the surveillance system. The majority of patients were male (77%), between the ages of 19 and 65 years of age (68.4%), and either the owner/operator of the farm (42.4%), or the spouse of the owner/operator (10.5%). Falls accounted for the greatest number of injuries in children younger than 16 years of age and in those older than age 65, while animals were the most frequent cause of injury in those between the ages of 16 and 65 years. Injuries were most likely to occur in the months of June, July, and August, which together accounted for 37 percent of the total number of injuries. Despite the limitations of the descriptive data derived from surveillance systems, such information may be useful for determining the magnitude of a health problem and suggesting hypotheses to account for the apparent distribution of disease and injury.

According to National Safety Council (NSC) estimates, agriculture is among the most dangerous occupations in the United States (National Safety Council, 1990). Each year more than 1,300 deaths in the United States are attributed to agricultural injuries, resulting in an annual mortality rate of 40 deaths per 100,000 workers (National Safety Council, 1990). In addition, the NSC estimates there are about 120,000 nonfatal agricultural injuries per year that require medical attention or result in at least one half day off from work.

The high occupational injury rate in agriculture has been attributed to the unique working conditions of farming, such as the diversity of the work involved, long hours, fatigue, old machinery, lack of training, and solitary work (Cohen, Moll, Maley, & Linn, 1989; Layde, 1989). In addition to the diversity of the risks in agriculture, there is considerable diversity in the work force involved in farming. For example, part-time seasonal workers or

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family members may not regularly be considered part of the agricultural work force, yet are often at risk of agricultural injuries.

Central Wisconsin is rural, with no large metropolitan areas. The primary agricultural enterprises in the region are family-run dairy farms. There is also a substantial amount of vegetable farming, livestock raising (beef cattle, sheep, pigs, and mink), cranberry growing, and ginseng farming. In order to learn more about agricultural injuries in this region, we began the routine collection of surveillance information on all individuals involved in agricultural injuries who sought care at the only emergency medical care facility in a large region in central Wisconsin. We have previously reported clinical characteristics of these injured patients (Stueland, Zoch, Stamas, Krieg, & Boulet, 1990); here we present the epidemiologic characteristics of the people who experienced agricultural injuries in central Wisconsin during a two-year period.

Epidemiologic surveillance has been defined as the "systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of public health practice" (Centers for Disease Control, 1986, p. 22). Because of the paucity of data on preventable risk factors for agricultural injuries (Layde, 1990), the primary purpose of this surveillance system was to quantify the burden of agricultural injuries and to suggest hypotheses for their causes. Basic data such as the demographic characteristics of those injured, the agents involved in the injuries, and seasonal and weekly temporal trends of injury occurrence are all useful in that regard and may be of interest to other agricultural injury researchers. Based on the results of this surveillance a more in-depth case-controlled study of preventable risk factors for agricultural injuries is currently underway. In addition, the information from this study on the spectrum and seasonal pattern of injuries and the age of those injured may be of interest to clinicians and health care administrators responsible for providing emergency health care services in rural areas. It may also be useful to public health officials charged with monitoring the health of rural populations, or with planning for future health care personnel demand in rural areas.

Methods

The Marshfield Clinic is a 315-physician multispecialty clinic primarily serving central and northern Wisconsin, but also receiving referrals from throughout Wisconsin and the northern peninsula of Michigan. St. Joseph's Hospital, which is contiguous to the clinic, is a 525-bed acute care hospital with an emergency department treating more than 26,000 patients per year. The clinic's "urgent care area" is located in the hospital, adjacent to the emergency department. The urgent care area provides care for about 14,000 patients per year and is primarily oriented to ambulatory care, particularly

follow-up care for emergency hospital medical record system of patient treatments and outcomes.

In November 1986, the staff in the Marshfield Clinic and St. Joseph's Hospital reviewed the medical records of all injury patients seen in the emergency department or urgent care area of the clinic. All injuries associated with machinery or equipment at agricultural work sites even if the injury occurred while speaking, working. Injuries occurring while using agricultural equipment were also included. Injuries not employment related, but were due to recreational activities, were excluded. Data on all accidents were collected routinely from the medical records of initial care for the injury and reviewed 1-3 months after the date of the initial injury. The individual was reviewed to obtain information on injury provided, convalescence, and hospitalization.

The Chi-square test with continuity correction was used to assess the independence of injury occurrence and seasonality was used to assess the distribution of injuries (Edward

Results

From Nov. 1, 1986, through October 31, 1987, 18 agricultural injuries fulfilling our case definition were seen in the emergency department. The age distribution of these injuries is shown in Table 1. Seventy-seven percent were male. Among preschoolers, male injuries were 10 times as many as female. Among agricultural injury. For all ages, male injuries were at least twice as many as female. The age distribution of injuries was typical for occupational injuries in Wisconsin, with 75% of age (Waller, 1985). About 70% of the study occurred to individuals 18-44 years of age. Agricultural injuries occurred to individuals 65 years of age accounted for 54% of the total.

The relationship of the injured person to the farm on which they were injured was also recorded. The greatest number of agricultural injuries occurred on farms themselves. Overall, 88.6% of the injuries were to the owner/operator or mem

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follow-up care for emergency department patients. A joint clinic and hospital medical record system facilitates comprehensive documentation of patient treatments and outcomes.

In November 1986, the staff in the emergency department of the Marshfield Clinic and St. Joseph's Hospital initiated surveillance on all agricultural injury patients seen in the emergency department of the hospital or the urgent care area of the clinic. Agricultural injuries were defined as those injuries associated with machinery, animals, facilities, or the environment at agricultural work sites even if the injured individual was not, strictly speaking, working. Injuries occurring away from the work site while using agricultural equipment were also included. Injuries that might have been employment related, but were due to motor vehicles or were primarily due to recreational activities, were excluded. Data on the circumstances of the accident were collected routinely by emergency department staff at the time of initial care for the injury and recorded on a precoded form. At least three months after the date of the initial injury, the medical record of each injured individual was reviewed to abstract follow-up information on services provided, convalescence, and health outcomes.

The Chi-square test with continuity correction (Armitage, 1971) was used to assess the independence of contingency table data. Edward's test of seasonality was used to assess the periodic nature of the daily and monthly distribution of injuries (Edwards, 1961).

Results

From Nov. 1, 1986, through Oct. 31, 1988, 913 patients with agricultural injuries fulfilling our case definition were seen at St. Joseph's Hospital emergency department. The age and sex distribution of the injured patients is shown in Table 1. Seventy-seven percent of the injured patients were male. Among preschoolers, males and females appeared to be at similar risk of agricultural injury. For all age groups beyond preschool, however, there were at least twice as many male patients with agricultural injuries as females. The age distribution of agricultural injuries also differs from that typical for occupational injuries which are concentrated in workers 18 to 69 years of age (Waller, 1985). About 27 percent of agricultural injuries in our study occurred to individuals 18 years of age or younger, while 5 percent of agricultural injuries occurred to individuals older than 65 years. Men 19 to 65 years of age accounted for 54 percent of the injuries.

The relationship of the injured individuals to the owner/operator of the farm on which they were injured is shown in Table 2. The group with the greatest number of agricultural injuries were the owner/operators of the farms themselves. Overall, 88.6 percent of the agricultural injuries occurred to the owner/operator or members of his or her immediate family. One

Table 1. Age and Sex Distribution of Patients with Agricultural Trauma, Central Wisconsin: November 1986-October 1988.

| Age | Male | % | Female | % | Total | % |
|-------|------|---------|--------|---------|-------|---------|
| 0-5 | 27 | (3.8) | 21 | (10.0) | 48 | (5.3) |
| 6-15 | 90 | (12.8) | 41 | (19.5) | 131 | (14.3) |
| 16-18 | 50 | (7.1) | 17 | (8.1) | 67 | (7.3) |
| 19-25 | 103 | (14.7) | 21 | (10.0) | 124 | (13.6) |
| 26-45 | 263 | (37.4) | 65 | (31.0) | 328 | (35.9) |
| 46-65 | 130 | (18.5) | 43 | (20.5) | 173 | (18.9) |
| >65 | 40 | (5.7) | 2 | (1.0) | 42 | (4.6) |
| Total | 703 | (100.0) | 210 | (100.0) | 913 | (100.0) |

Test of Homogeneity: Chi-square_{6df} = 29.65; p = 0.000046.

quarter of all the injuries occurred to young children of the farm's owner/operator. Less than 12 percent of agricultural injuries occurred to employees or other visitors to the farm.

The number of farm injuries by sex and month of occurrence are shown in Figure 1. The greatest number of agricultural injuries occurred from June to September. The seasonal variability in the number of injuries was highly significant ($\chi^2_{2df} = 88.49$; $p < 1 \times 10^{-12}$). Men had a substantially greater number of injuries than women in each month.

The distribution of farm injuries by sex and day of the week of occurrence is presented in Figure 2. There is some evidence that the greatest risk of injury, particularly for women, occurred on weekends; the difference in the day-of-the-week distribution of the injuries in men and women was statistically significant ($\chi^2_{6df} = 14.002$; $p = 0.0296$).

The type of agent involved in the injuries for males and females is shown in Figure 3. The most common agent of injury was an animal, followed by falling. The distribution of agent of injury differed for males and females ($\chi^2_{8df} = 56.80$; $p < 10^{-8}$). Females accounted for more than 40 percent of all the animal-related injuries, but for less than 15 percent of the injuries due to tractors or farm implements.

Table 2. Relationship of Patient to Farm Owner/Operator, October 1988.

| |
|----------------|
| Owner |
| Spouse |
| Juvenile Child |
| Adult Child |
| Employee |
| Other |
| Total |

The distribution of agent of injury is shown in Table 3. The most common agent of injury in a preschoolers and the elderly.

Discussion

Before discussing the results, some of the limitations of the study are noted. Some of the limitations of the study were the limited information gathered on the detailed circumstances of the injuries, no control or comparison group from which to draw inferences about the characteristics of the injured patients seen at St. Joseph's Hospital in the immediate area and surrounding emergency room, there were no patients who were initially seen elsewhere for specialty care. The mixture

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Table 2. Relationship of Patients with Agricultural Trauma to the Farm Owner/Operator, Central Wisconsin: November 1986-October 1988.

| % | Total | % |
|-------|-------|---------|
| 10.0) | 48 | (5.3) |
| 19.5) | 131 | (14.3) |
| (8.1) | 67 | (7.3) |
| 10.0) | 124 | (13.6) |
| 31.0) | 328 | (35.9) |
| 20.5) | 173 | (18.9) |
| (1.0) | 42 | (4.6) |
| 00.0) | 913 | (100.0) |

| | N | % |
|----------------|-----|---------|
| Owner | 387 | (42.4) |
| Spouse | 96 | (10.5) |
| Juvenile Child | 228 | (25.0) |
| Adult Child | 98 | (10.7) |
| Employee | 66 | (7.2) |
| Other | 38 | (4.2) |
| Total | 913 | (100.0) |

The distribution of agent of injury for people of different ages is shown in Table 3. The most common cause of agricultural injuries in preschoolers and the elderly was falls, while animals were the most common agent of injury in all other age groups.

Discussion

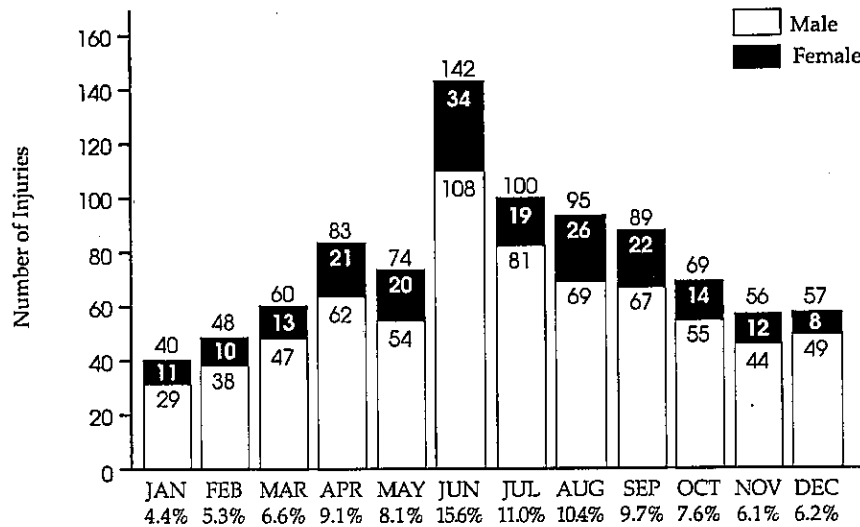
Before discussing the results of this study, it is worth considering some of the limitations of the study data. By the nature of the data collected and the study design, these results are descriptive. There is no detailed information gathered on potential risk factors for injuries or on the detailed circumstances of the injuries. Neither do we have a control or comparison group of uninjured farmers or farm residents from which to draw inferences on the expected frequency of various characteristics of the injured farm residents. Although most patients seen at St. Joseph's Hospital were primary care patients who live in the immediate area and sought initial care at the St. Joseph's Hospital emergency room, there were some secondary or tertiary care patients who were initially seen elsewhere but were then referred to Marshfield for specialty care. The mixture of primary care and referral patients

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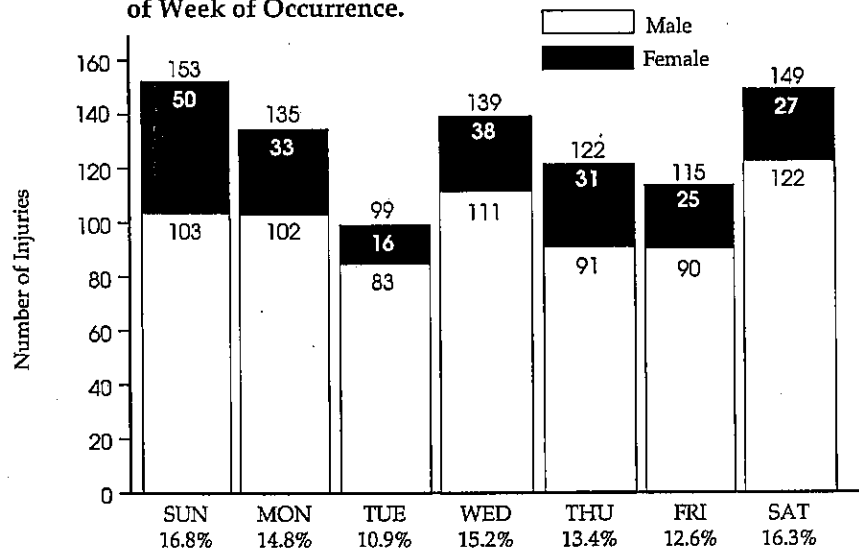
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Figure 1. Number of Farm Injuries in Males and Females by Month of Occurrence.



Information in this figure is for November 1986 through October 1988, and was gathered from St. Joseph's Hospital/Marshfield Clinic, Marshfield, WI, records.

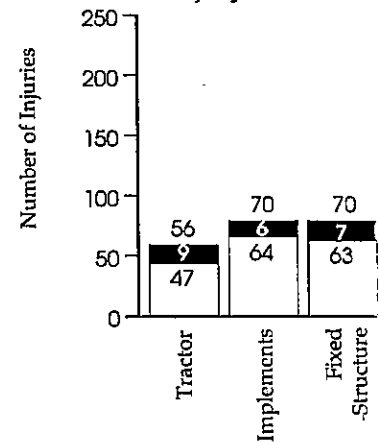
Figure 2. Number of Farm Injuries in Males and Females by Day of Week of Occurrence.



Information in this figure is for November 1986 through October 1988, and was gathered from St. Joseph's Hospital/Marshfield Clinic, Marshfield, WI, records.

$\chi^2_{6df} = 14.00271$ $p = 0.0296$

Figure 3. Number of Farm Injuries by Type of Injury and Sex.

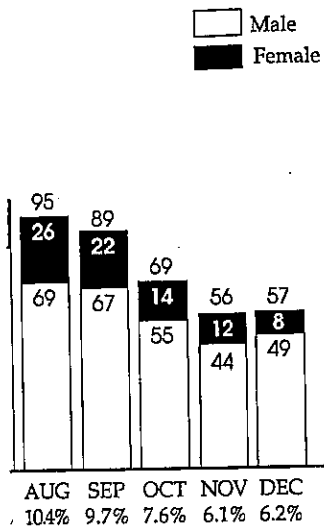


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Table 3. Number of Patients of Injury and Age, October 1988.

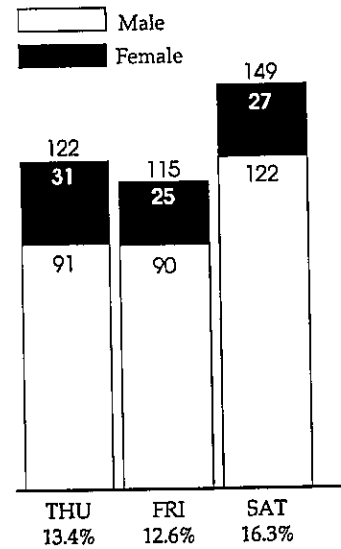
| | 0-5 | 6-15 |
|--------------------|-----|------|
| Tractor | 3 | 11 |
| Implements | 1 | 9 |
| Fixed | 4 | 12 |
| Animals | 5 | 25 |
| Tools | 1 | 20 |
| Other Farm Vehicle | 3 | 5 |
| Fall | 22 | 25 |
| Exposure | 4 | 5 |
| Other | 5 | 19 |
| Total | 48 | 131 |

and Females by Month



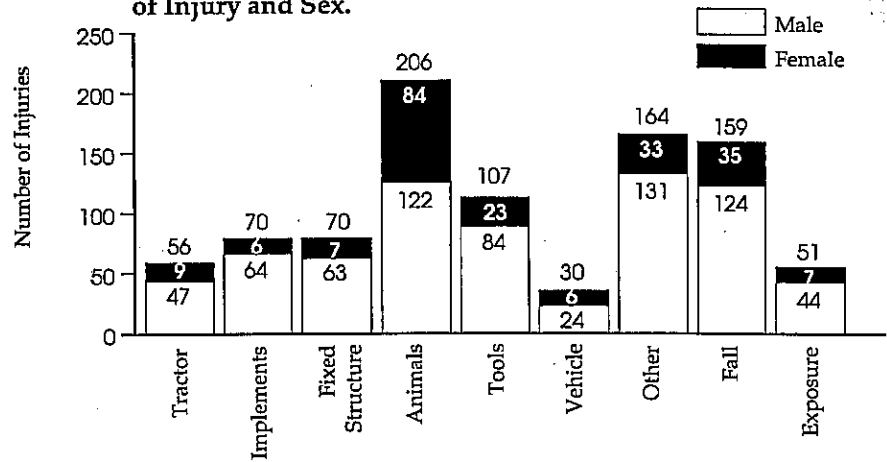
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October 1988, and was gathered from St. Joseph's Hospital/Marshfield Clinic, Marshfield, WI, records.

Figure 3. Number of Farm Injuries in Males and Females by Agent of Injury and Sex.



Information in this figure is for November 1986 through October 1988, and was gathered from St. Joseph's Hospital/Marshfield Clinic, Marshfield, WI, records.

Table 3. Number of Patients with Agricultural Trauma by Agent of Injury and Age, Central Wisconsin: November 1986-October 1988.

| | Age Group | | | | | | | Total |
|--------------------|-----------|------------|-----------|------------|------------|------------|-----------|------------|
| | 0-5 | 6-15 | 16-18 | 19-25 | 26-45 | 46-65 | >65 | |
| Tractor | 3 | 11 | 2 | 7 | 15 | 14 | 4 | 56 |
| Implements | 1 | 9 | 7 | 11 | 22 | 16 | 4 | 70 |
| Fixed | 4 | 12 | 5 | 8 | 27 | 11 | 3 | 70 |
| Animals | 5 | 25 | 17 | 32 | 81 | 41 | 5 | 206 |
| Tools | 1 | 20 | 4 | 19 | 45 | 13 | 5 | 107 |
| Other Farm Vehicle | 3 | 5 | 4 | 3 | 11 | 4 | 0 | 30 |
| Fall | 22 | 25 | 4 | 12 | 49 | 32 | 15 | 159 |
| Exposure | 4 | 5 | 4 | 10 | 23 | 5 | 0 | 51 |
| Other | 5 | 19 | 20 | 22 | 55 | 37 | 6 | 164 |
| Total | 48 | 131 | 67 | 124 | 328 | 173 | 42 | 913 |

will limit the ability to generalize the study results to other trauma centers that have a different mix of primary care and referral patients. Finally, because most of the farming in our area is dairy farming, our study does not provide detailed information about the types or characteristics of injuries occurring in other agricultural settings.

Despite these limitations, several useful inferences can be drawn. The sheer volume of agricultural injuries seen in a single emergency room is noteworthy. There were more than 900 patients whose agricultural injuries were severe enough to seek medical attention during a two-year period at a single hospital. The frequency of farm injuries seen in our emergency department is not surprising, however, in light of the rural setting of Marshfield and of the high frequency of agricultural injuries. The National Safety Council has estimated that 4 to 5 percent of all farmers are injured in an agricultural accident annually (National Safety Council, 1982, 1990). The age and sex distribution of the victims of agricultural injuries is somewhat surprising. Only 54 percent of all the farm injuries occurred to males between 19 and 65 years of age, who correspond most closely to the traditional distribution of "farmers." A higher proportion of injuries in our study were incurred by youngsters 15 years of age and under, compared with the results of a NSC survey that was conducted in 31 states primarily in the 1970s (National Safety Council, 1982). The change in economic conditions and the resulting trend in supplemental off-farm employment by at least one of the adults on the farm may have contributed to the increasing occurrence of farm injuries in young children, because the adult remaining on the farm often has child care responsibilities as well as farm chores.

Compared with studies that deal with the most severe farm injuries that result in hospitalization or death (Cogbill & Busch, 1985; Hansen, 1986; National Safety Council, 1982), our data on the agents involved in agricultural injuries showed a relatively lesser role of tractors and other farm implements and vehicles. Animals were the most common agent of injury and accounted for an appreciable number of injuries in all age groups. Injuries from falls were also a frequent occurrence and were the leading cause of injury in young children and adults older than 65 years.

There was also a marked seasonal pattern in the occurrence of agricultural injuries. The highest number of injuries occurred during the months from June through August, while substantially fewer injuries occurred during the winter months. The seasonal pattern may simply reflect the number of hours worked at different times of the year or may also reflect the concentration of more hazardous farming activities in the fair weather months. The pattern of injuries by day of week indicates that there was no decrease in injuries on the weekends when there is a drop-off in most other occupationally related injuries. In fact, there was a suggestion that the greatest frequency of injuries to women occurred on the weekend days (when they may have been helping out on the farm after having worked a

full week at an off-farm job). Further study of the distribution of weekend injuries, whether the injured person worked on the weekends or if stress, or other factors.

This descriptive report adds to the knowledge of individuals injured in agricultural settings. An emergency room-based survey of agricultural injuries may be a more efficient way to obtain information than farm-based surveillance, as suggested by Jansson (1987). The National Safety Council (National Research Council of the National Academy of Sciences, 1982) has identified a national agenda for injury research, including identification of risk factors and implementation of effective interventions. Further epidemiologic studies will be needed to identify and specific circumstances of injury. Such studies should lead to interventions that have been proven effective, may help to

- Armitage, P. (1971). *Statistical methods in epidemiology*. London: Williams & Wilkins.
- Centers for Disease Control. (1986). *Annual report on surveillance of agricultural injuries*. Atlanta, GA: Centers for Disease Control.
- Cogbill, T.H., & Busch, H.M., Jr. (1985). Agricultural injuries in the emergency department. *Emergency Medicine*, 3, 205-210.
- Cohen, M.L., Moll, M.B., Maley, P.W., et al. (1982). Agricultural injuries in the U.S. In J.A. Dosman (Ed.), *Agricultural injuries in agriculture*, (pp. 311-315). Boca Raton, FL: CRC Press.
- Edwards, J.H. (1961). The recognition and prevention of agricultural injuries. *Journal of the American Medical Association*, 225, 83-87.
- Hansen, R.H. (1986). Major injuries due to farm accidents. *Journal of the American Medical Association*, 255, 59-64.
- Jansson, B.R. (1987). The yield of systematic surveillance of agricultural injuries in emergency care with emphasis on the rural area. *Sociologic Medicine*, 15, 247-252.
- Layde, P.M. (1989). Epidemiology of agricultural injuries. *American Journal of Public Health*, 79, 110-112.
- Layde, P.M. (1990). Beyond surveillance: Agricultural injuries. *American Journal of Public Health*, 80, 110-112.
- National Research Council, & Institute of Medicine. (1982). *Public Health Problem*. Washington, DC: National Academy Press.
- National Safety Council. (1982). *1982 Annual Report on Agricultural Injuries*. Washington, DC: National Safety Council.
- National Safety Council. (1990). *Accidents and Injuries in Agriculture*. Washington, DC: National Safety Council.
- Stueland, D., Zoch, T., Stamas, P., Jr., & Layde, P.M. (1989). The care of agricultural trauma in a rural emergency department. *Journal of Rural Health*, 4, 528-530.
- Waller, J.A. (1985). *Injury control: A guide to the prevention of occupational and agricultural injuries*. Lexington, MA: Lexington Books.

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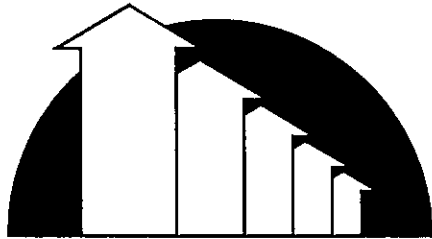
full week at an off-farm job). Further research is needed to determine if the distribution of weekend injuries corresponds to the actual number of hours worked on the weekends or if there is an additional risk due to fatigue, stress, or other factors.

This descriptive report adds to our knowledge of the characteristics of individuals injured in agricultural accidents. This report also describes an emergency room-based surveillance system for agricultural injuries that may be a more efficient way to collect information on agricultural injuries than farm-based surveillance, which has been widely utilized in the past (Jansson, 1987). The National Academy of Sciences report *Injury in America* (National Research Council & Institute of Medicine, 1985) lays out a national agenda for injury research that proceeds from surveillance through identification of risk factors and interventions to the testing and widespread implementation of effective interventions. If progress is to be made in reducing the toll of agricultural injuries, more detailed analytic, and epidemiologic studies will be required to elicit information on risk factors and specific circumstances of injuries along with appropriate control data. Such studies should lead to the development of interventions which, if proven effective, may help to reduce the toll of agricultural injuries.

REFERENCES

- Armitage, P. (1971). *Statistical methods in medical research*. Oxford: Blackwell Scientific Publications.
- Centers for Disease Control. (1986). *Comprehensive plan for epidemiologic surveillance*. Atlanta, GA: Centers for Disease Control.
- Cogbill, T.H., & Busch, H.M., Jr. (1985). The spectrum of agricultural trauma. *Journal of Emergency Medicine*, 3, 205-210.
- Cohen, M.L., Moll, M.B., Maley, P.W., & Linn, H.I. (1989). Statistical description of agricultural injuries in the U.S. In J.A. Dosman, & D.W. Cockcroft (Eds.), *Principles of health and safety in agriculture*, (pp. 311-315). Boca Raton, FL: CRC Press.
- Edwards, J.H. (1961). The recognition and estimation of cyclic trends. *Annals of Human Genetics*, 25, 83-87.
- Hansen, R.H. (1986). Major injuries due to agricultural machinery. *Annals of Plastic Surgery*, 17, 59-64.
- Jansson, B.R. (1987). The yield of systems for continuous and periodic injury surveillance in emergency care with emphasis on farm-work-related accidents. *Scandinavian Journal of Sociologic Medicine*, 15, 247-252.
- Layde, P.M. (1989). Epidemiology of farm injuries. *Marshfield Clinic Bulletin*, 20, 4-12.
- Layde, P.M. (1990). Beyond surveillance: Methodologic considerations in analytic studies of agricultural injuries. *American Journal of Industrial Medicine*, 18, 193-200.
- National Research Council, & Institute of Medicine. (1985). *Injury in America: A Continuing Public Health Problem*. Washington, DC: National Academy Press.
- National Safety Council. (1982). *1982 Farm Accident Survey Report*. Chicago, IL: National Safety Council.
- National Safety Council. (1990). *Accident Facts, 1990 Edition*. Chicago, IL: National Safety Council.
- Stueland, D., Zoch, T., Stamas, P., Jr., Krieg, G., & Boulet, W. (1990). The spectrum of emergency care of agricultural trauma in central Wisconsin. *American Journal of Emergency Medicine*, 8, 528-530.
- Waller, J.A. (1985). *Injury control: A guide to the causes and prevention of trauma*. Lexington, MA: Lexington Books.

RURAL HEALTH:



Harvesting Our Experience

National Rural Health Association
14th Annual National Conference
May 19-22, 1991
Seattle, Washington

Uwe E. Reinhardt, professor of political economy at Princeton University, will present the keynote address at the National Rural Health Association's 14th Annual National Conference. The conference will be held May 19-22, 1991, in Seattle, WA.

Reinhardt's research interests have centered on health economics, with a special focus on health manpower and physician productivity. Having taught at Princeton since 1968, he has consulted with the Department of Health and Human Services and has served on DHHS' National Health Care Technology Council and on former DHHS Secretary Schweiker's Private Sector Task Force on Health Policy. In addition, Reinhardt has been a member of the Institute of Medicine's Committee on the Implications of For-Profit Medicine, and he has been a member of the editorial boards of several policy-oriented journals.

Don't miss your chance to hear this dynamic speaker! Call or write for a conference registration packet. Contact Rosemary McKenzie at the National Rural Health Association, 301 E. Armour Blvd., Suite 420, Kansas City, MO 64111, or call her at (816) 756-3140.

Callahan, Brasted, Myerberg, and Hamilton

Prolonged Travel Time to Intensive Care Unit Does Not Affect Bonding Relationships: A Controlled Prospective Study

Edward J. Callahan, William Brasted, Myerberg, and Sharon Hamilton

ABSTRACT: Decreased local access to intensive care units (ICUs) for rural populations has been associated with increased rates of premature births to rural populations, complicated births in rural populations, and increased rates of child abuse and neglect. This study examined the relationship between travel time to the NICU and bonding relationships between parents and infants hospitalized in the NICU. This possible relationship is critical because bonding relationships of parents were observed visiting their infants in the NICU "house" while the mother was staying in the NICU for an hour or less in travel time; and (2) the length of travel time. Results showed that parents who lived at greater distances stayed with their infants in the NICU for a total visiting time over a two-week period. Mothers and fathers showed no difference in bonding among groups. Thus, visit frequency was not an indicator of failure to bond with their infants in rural populations.

The United States is experiencing a significant impact on the development of rural health care. 24 percent of the U.S. population live in rural areas to have a considerable shortage of health care. Schultz, Williams, & Vandenberg (1988) found that one quarter of the physicians in rural areas will leave in the next five years while a survey of rural physicians found 26 percent of rural physicians will leave in the next five years. Thus, the health care system has a considerable concern given the current situation.

Liability issues have prompted a number of lawsuits against babies (Institute of Medicine, 1988). Access to prenatal care has me-

* Address all correspondence to Edward J. Callahan, University of California, Davis Medical Center, 95616.