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Medical consequences of work-related accidents on 2 454 Swedish farms

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JANSSON BR, JACOBSSON BS. Medical consequences of work-related accidents on 2 454 Swedish farms. *Scand J Work Environ Health* 14 (1988) 21–26. The medical consequences of accidents related to work on 2 454 farms in two Swedish rural municipalities were studied. The objectives were to describe the nature and scope of the injuries incurred, to collect data for the health planning procedure, and to test a local system for continuous injury surveillance in emergency care. All the injuries of 163 patients during the period 1 January — 31 December 1983 were analyzed with regard to diagnosis, severity, medical treatment, hospitalization, and temporary and permanent disability. Wounds, contusions, fractures, foreign bodies, sprains, and strains constituted the main diagnostic groups. Injuries to the fingers, head and face (including the eyes), feet, and legs dominated. Six percent of the patients were admitted to the hospital. Seventy-five patients were put on temporary disability for a total of 2 431 d. For 62 of these patients the injuries were classified as minor. Permanent disability was observed in 4 % of the cases. The study emphasizes the importance of registry criteria when one is comparing different injury surveillance systems. The majority of the injuries could have been prevented by the proper use of appropriate personal safety equipment. The results may serve as a basis for general measures to improve local safety consciousness.

Key terms: countermeasures, injuries, injury surveillance, medical care, severity, trauma.

Farm workers are exposed to a wide variety of hazards in their work. The medical consequences have been described particularly in the United States (2, 12, 13, 24). To aid the improvement of the use of personal safety equipment among agricultural workers, knowledge of the type and location of injuries would be important. In addition activities which cause serious injuries requiring extensive medical treatment can be defined as a basis for local health planning. In Sweden the Health Act of 1983 states that the role of the county councils in this work is to provide data for injury control.

The objectives of the present study were (i) to describe the nature and scope of farm work injuries in two Swedish rural districts, (ii) to collect data for the health planning procedure, and (iii) to test a local system for continuous injury surveillance in emergency care.

Subjects and methods

Study area and population

The study was undertaken in two agricultural districts, Falköping and Lidköping in Skaraborg County, on 2 454 farms, corresponding to 27.8 % of all farms in the county and 2.1 % of all farms in Sweden. The two

districts participating in the study have district hospitals with surgical and medical specialist functions and emergency rooms open 24 h a day. At the hospitals, there are also general emergency clinics, run by the local health centers, which are open between 1700 and 0800 from Monday to Friday and round the clock on weekends and holidays. The health centers also have standby medical services for emergency cases between 0800 and 1700 from Monday to Friday.

The study comprised all individuals living on farms entered for both districts in the Agricultural Register. The patients should have consulted a doctor in the public health service for bodily injury caused by an accident which had occurred on a farm in the area listed in the Agricultural Register during the period 1 January — 31 December 1983. The population amounted to a total of 5 569 individuals, 3 099 in Falköping and 2 470 in Lidköping (26).

Definitions

A *farm* has been defined as a rural property consisting of five acres or more of arable land for the production of agricultural and forestry products and listed in the Agricultural Register by Statistics Sweden (26).

A *farm work injury* is an injury which has occurred on a farm in the area under study and on account of which the injured person has consulted a doctor in a public health facility. The injury should have occurred in connection with the production of agricultural and forestry products and to a person who lived on a farm in the study area and who participated in the work on the farm in a professional capacity.

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Injury surveillance

All emergency cases, including injuries at public health institutions, were registered by the admissions staff on a special form. The form was divided into the four injury categories of home, work, traffic, and other (23). The forms containing a farm address were separated and manually checked against the entries in the Agricultural Register. Injuries which did not occur on a farm were excluded. Private practitioners, dentists, and school and district nurses did not participate in the registration. A special inquiry showed that private practitioners did not handle any accident cases during the study period.

Classification

Information on diagnosis (25), parts of body injured, severity of the injury according to the Abbreviated Injury Scale (AIS) (3), external cause of the injury according to the E series (25), permanent disability, type of medical facility, outpatient treatment, number of consultations (including follow-up visits), hospitalization, and temporary disability was obtained from the patients' records.

Supplementary data collection

In 4.4 % of the emergency cases in the Falköping district the admissions staff neglected to fill out the special form. For this reason, supplementary data collection was undertaken in the Lidköping district by means of telephone interviews with persons on all 1 086 farms, the response rate being 92.6 %. Questionnaires were mailed to the remaining 80 farms, and 56 were filled out and returned. This checking procedure contributed an additional 23 work-related accidents (and eight non-work-related accidents). They have been incorporated into the material.

Recall error

Recall error has been defined as limitations in the memory capacity or experience of time. The postal questionnaire survey was checked through comparison of the reported accidents with the patient records. Two random samples (N=282 and N=200) from the Agricultural Register were used. Another eight work-related accidents (and seven nonwork-related accidents) were found.

Statistical methods

The number of accidents can be considered the sum of the numbers of accidents in a large number of disjoint intervals of time. The probability of more than one accident within an interval tends towards zero when the length of the interval tends towards zero. By this consideration one can realize that the number of accidents of one individual, as well as of many individuals, has a distribution close to a Poisson distribution, although one individual can contribute more than one accident. The hypothesis of no differences in incidence rate between two groups was tested with the optimal test for comparing two Poisson distributions (17).

Each age group (15–24, 25–34, 35–44, 45–54, 55–64, and 65 years or older) was compared to all the others, men and women being combined. There was no significant correlation between age and accident risk.

Results

Injuries

Altogether 163 work accidents causing 167 injuries were registered on 154 (6.3 %) of the 2 454 farms. The 163 accidents involved 142 men and 21 women, and six of these individuals were accident repeaters, three having had two accidents and three having had three accidents. Farm work injuries represented 14.6 % of all the work injuries in the study area. Mechanical im-

Table 1. Injuries by part of body and diagnosis.

Part of body	Diagnosis					Total	Percentage of combined total
	Wounds	Contusions	Fractures	Sprains and strains	Foreign body		
Skull	5	1	1	—	—	7	4
Eyes	2	6	—	—	16	24	14
Face	5	—	1	—	—	6	4
Chest	—	3	1	—	—	4	2
Back	—	1	—	—	—	1	1
Shoulder	1	6	—	3	—	10	6
Forearm	3	1	2	—	—	6	4
Wrist	5	3	2	—	—	10	6
Finger, thumb	30	6	3	1	—	40	24
Thigh, femur	—	1	1	—	—	2	1
Knee	9	6	—	2	—	17	10
Lower leg	6	6	3	2	1	18	11
Foot	6	7	3	6	—	22	13
Total	72 (43 %)	47 (28 %)	17 (10 %)	14 (9 %)	17 (10 %)	167	100

pact due to external trauma dominated (91 %) followed by overexertion of part of the body (7 %) and poisoning and burns (2 %). The five main diagnoses (table 1) were wounds (43 %), contusions (28 %), fractures (10 %), foreign bodies (10 %), and sprains and strains (9 %). Finger (24 %), skull and face including eyes (22 %), and foot and leg (35 %) injuries dominated (figure 1). In 122 cases (73 %) the injured part of the body was not protected by personal protective equipment.

Severity

The severity of the injury was classified according to the Abbreviated Injury Scale, AIS score 1–6 (3). Minor injuries (AIS-1) dominated (90 %) over moderate (AIS-2) (9 %), serious (AIS-3), and severe (AIS-4) (1 %) ones. The most severe injuries occurred in forestry work. Seven of the 16 injuries with an AIS score of 2, 3, or 4 occurred in forestry work. The following case is one example (given an AIS score of 3): A 28-year-old man crushed his left knee between rolling logs and a wagon while unloading logs. His medial ligament was ruptured. An emergency operation

was performed, and the knee was immobilized in plaster. The patient was hospitalized for 9 d and put on full-time sick leave for three months.

Medical treatment

In all, 10 patients (6 %) were admitted to the hospital for a total of 258 (range 1–180) d. One patient was transferred to the Department of Neurosurgery at the University Hospital in Göteborg for specialist treatment after a blow to the skull from a falling tree. A description of the case (given an AIS score of 4) follows: A 37-year-old farmer's wife sustained a blow to the skull from a fallen branch while helping her husband fell trees. She had a large wound on the scalp, a fracture through the arches of the first and second cervical vertebrae and subluxation between the seventh cervical vertebra and the first thoracic one, reduced sensibility below the second thoracic dermatome, complete motor deficit in the lower extremities, bladder paresis, and reduced strength in her right arm. Her functional capacity was permanently impaired.

Seventy-three percent of all patients were brought for medical attention on the day the injury occurred. Out-patient treatment was given to 43 % at a surgical emergency room, to 37 % at a general emergency room, and to 20 % at a health center. More than half (57 %) of the injuries were treated by general practitioners. The type of medical care is specified in table 2. The total number of outpatient consultations was 364

Figure 1. Percentage of injuries to particular parts of the body.

Table 2. Injuries by type of treatment.

Type of treatment	Number ^a	Percentage of total
Dressing of wounds	72	24
Radiographic examination	63	21
Wound revision plus suture	48	16
Tetanus, toxoid or antitoxin	35	11
Eye ointment	18	6
Support bandage/splint	16	5
Plaster without repositioning	16	5
Antibiotics	16	5
Removal of foreign body	14	5
Repositioning plus plaster	6	2
Total	304	100

^a Includes repeated treatments per injury.

Table 3. Injuries (N = 75) by severity degree and temporary disability.

Severity ^a	Temporary disability (d)					Percentage of combined total
	Work with cattle	Cultivation	Construction/repairs	Forestry work	Total	
1	414	378	148	161	1 101	45
2	365	111	90	314	880	36
3	—	—	—	90	90	4
4	—	—	—	360	360	15
Total	779	489	238	925	2 431	100

^a The severity code corresponds to the Abbreviated Injury Scale (AIS) as follows: 1 = minor, 2 = moderate, 3 = serious, 4 = severe, 5 = critical, 6 = maximum injury virtually unsurvivable in AIS-80, and 9 = unknown.

(range 1–20, mean 2.2) consultations. Permanent disability was observed in six cases (4 %).

Temporary disability

Seventy-five patients were put on temporary disability for a total of 2 431 (range 1–360, average 32.5) d. The dominating activities were work with cattle and forestry work. Of the patients with temporary disability 62 out of 75 suffered from minor injuries (table 3). They accounted for 45 % of the total number of days of sick leave (mean 17.8 d per sick-listed patient). The following case illustrates an injury with an AIS score of 1 and sick leave of 75 d: A 38-year-old man twisted his right ankle on the steps of his barn. A radiograph showed a small apophysial fracture of the medial malleolus. He was given a plaster cast with a heel and put on full-time sick leave for 75 d. He had three consultations altogether.

External cause

The six main external causes (table 4) were blows by an object, squeezing or crushing (32 %), cuts or penetrating wounds (26 %), falls (15 %), animals (11 %), and foreign bodies in eyes (10 %).

Discussion

Methodology

The construction of the surveillance system permitted specification of the system coverage. Differences in the

quality of registration between the two study areas were due to several factors. In the Falköping district, the registration system was linked to a local intervention program. The registration was also used for checking that patient fees had been duly paid, two factors which probably increased the motivation for and exactness of registration in that area. More information and better planning of the work in the Lidköping district may have counteracted these differences.

The system did not cover all farm-work injuries in the area. Some were probably dealt with by self-treatment and the district nurses. Pure dental injuries were not registered. Another 56 injuries were found in the Swedish Information System on Occupational Accidents and Diseases (ISA) at the National Board of Occupational Safety and Health (18). Accordingly the total number of reported farm-work injuries in the study area was 219, of which 59 % were reported only to the public health services, 25 % only to the national register, and the remaining 16 % was overlap, ie, found in both systems. At least 1 d of sick leave is required for inclusion in the Swedish national register. The local system in the area studied required at least one visit to an outpatient clinic or general practitioner. Over half of the patients treated by the outpatient health services were not put on sick leave. Cases were thus lost in both systems. Differences in registration criteria may explain these findings. A factor contributing to the differences may be that farm workers are less prone to consult a physician for minor injuries than other occupational groups in the community, because of longer distances to the hospital or a health center.

This study documents, at first sight, a similar farm accident rate for Michigan (22) and Skaraborg (table 5). However, there were differences in the definition of accidental injury, the data collection procedure, and the study periods. Nor was the level of exposure taken into account. The Swedish figures were not randomly selected; instead they represented all farms in the study area. When the incidence rate in Skaraborg is based on data from both the local and the national system, it increases to 89.2 per 1 000 farms. The low rate for all of Sweden is probably a result of the special insurance rules for Swedish farmers, most not being paid for the first 3 d of sick leave. This procedure reduced the reporting levels to the national register (18).

The most severe injuries (AIS scores of 2, 3, or 4) occurred in connection with forestry work. The

Table 4. Injuries in relation to external cause.

External cause ^a	Percentage
Falls on stairs (880.9)	1
Falls from other level (881.9–884.9)	7
Falls from the same level (885.9)	7
Animals (906.9)	11
Foreign body in eye (914.9)	10
Blow by object, squeezing/pinching (916.9–918.9)	32
Overexertion of part of body (919.9)	5
Cuts or penetrating wounds (920.0–920.9)	26
Other (921.0–949.9)	1

^a Code of the eighth revision of the International Classification of Diseases, Injuries and Causes of Death (E code, 807.0–949.9), as adapted for Sweden (25), in parentheses.

Table 5. A comparison of farm work accident rates between the United States and Sweden.

Area ^a	Year of study	Number of farms	Number of accidents	Accidents/1 000 farms
Michigan (22)	1968	2 139	142	66.4
Iowa (28)	1981	2 577	255	99.0
31-state survey (7)	1982	31 398	3 573	113.8
Skaraborg, Sweden	1983	2 454	163	66.4
All Sweden (18)	1983	113 888	3 608	31.7

^a Reference number given in parentheses.

material was too small to permit any generalization of this finding. There may also be large fluctuations from year to year in local farm accident data. However, national statistics show that farmers in Sweden are overrepresented among forestry work fatalities. The majority, 18 of the 19 fatalities in 1983 involved farmers doing logging work. The corresponding figure for the period 1973–1985 was 64 % (18). Our findings, together with the national statistics, support the recommendation that farmer-loggers be thoroughly informed about the importance of using personal safety equipment. It also seems important that farmer-loggers participate in courses designed to teach farmers safe work routines. Compulsory training in forestry work should also be introduced.

The data in the medical records often failed to identify the cause of the accidents, as reported previously by Gallagher et al (6). The external cause described by the E coding system (25) adds little to our understanding of the circumstances under which injuries occur (table 4). The present E coding system has limitations due to taxonomy, ie, an injury could be classified under several headings. In addition, it is not possible to classify the sequence of events and contributory factors related to human, agent, and environmental circumstances. The Committee on Trauma Research has emphasized the need for more adequate data in epidemiologic studies of injuries based on outpatient and inpatient data (4). The Nordic Committee of Statistics (NOMESKO) has recommended a standardized manual for special studies (20).

The Abbreviated Injury Scale is recommended for measuring five separate criteria, ie, energy dissipation, threat to life, permanent impairment, treatment period, and incidence (3). The construct validity of the Scale has been examined. Eastham questioned it as an indicator of the trauma-related recovery period and permanent disability (5). Huang & Marsh concluded that, of the four severity dimensions they reviewed, threat to life was essentially the sole dimension of severity measured by the Scale (10). Our findings indicate that the Scale does not consider long-term effects such as the overall recovery period. This lack is demonstrated by the injuries classified as minor (AIS score 1), which caused 1 101 days (45 %) of temporary disability.

Medical consequences

This study demonstrates the yield of a system for continuous injury surveillance in Swedish emergency care. More than half (57 %) of the injuries were treated by general practitioners. A large number of minor injuries and the increased availability of general practitioners may explain this result. Similar findings as regards type of injuries and treatment have been reported previously (8, 19, 21). The present result emphasizes the need for more intensive training in trauma care for general practitioners who plan to enter rural practice.

Minor injuries are not a great medical problem but are a handicap in agricultural work because of the risk of infection and pain in combination with the heavy nature of the work. These injuries may also indirectly affect the farmer's finances if they occur in connection with spring sowing or harvesting. The pattern of injuries was heterogeneous; it reflected the varying nature and risks of agricultural work. Similar findings have been reported previously (2, 9, 12, 13, 24). As judged by the type and location of the injuries (table 1), appropriate personal protective equipment would probably reduce the number and severity of injuries related to farm work.

In a Finnish study concerning the protective effect of safety equipment, the respondents claimed that loggers work more carefully if personal protective equipment is temporarily out of use (14). Consequently, the use of personal safety equipment could lead to greater risk-taking. This possibility should be taken into account when countermeasures are introduced.

Countermeasures

The injury surveillance system used in this study may serve as a basis for general measures to improve local safety consciousness, eg, information on the nature and scope of the problem. It also provides a basis for planning measures aimed at changing attitudes, eg, increasing the use of personal safety equipment. A third potential use for the system is the selection of priority fields for safety education, eg, forestry work. The system is not suitable as a basis for recommending technical measures such as improvements to safety devices on machines. However, the injury surveillance system used could be complemented by a technical investigation group in order to increase the understanding of the mechanisms behind accidental farm injuries.

We do not believe that farmers are ignorant of farm hazards. But it is difficult to recruit farmers to safety education (11). One problem is that a farmer's mobility is frequently restricted by the needs of their animals and they often live a long way from the towns where the courses are held. Another is that only a minority of agricultural companies belong to the Swedish Farmers' Safety and Preventive Health Association (16). On the other hand much knowledge exists on farm hazards and safety (1, 15). The transfer of this knowledge to the farmers is an important challenge for the future in order to promote health and safety.

A preventive program should be comprised of five sections, ie, mass communication, education, job safety analysis, training, and supervision. An important task before the implementation of such a program would be to identify factors which influence the use of safety measures and factors which limit safety practice or make it impossible (27).

Such a program of active safety measures must be combined with passive safety measures and improved

equipment design. For example, in the forest industry, new timber-harvesting methods have been introduced which replace the manual tree-felling technique. The introduction of roll bars on tractors is an example of a passive safety measure which has decreased fatalities in Sweden during the last two decades (18).

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