Journal of Safety Research, Vol. 18, pp. 179–190, 1987

0022-4375/87/ $3.00 + .00
Printed in the USA

Characteristics of Work-Related Injuries Involving Forklift Trucks

Nancy Stout-Wiegand

Industrial lift trucks or forklift trucks are a common source of occupational injuries. In 1983, over 13,000 workers' compensation claims for lost-workday injuries involving forklift trucks were filed in 30 states. An estimated 24,000 forklift-related injuries were treated in U.S. emergency rooms in 1983, and an estimated 34,000 in 1985. This paper presents the results of an analysis of forklift injuries reported in two occupational injury databases—the National Electronic Injury Surveillance System (NEISS) and the Bureau of Labor Statistics (BLS) Supplementary Data System (SDS). Characteristics of these injuries (e.g., type of injury, diagnosis, body part affected) and of the injury victims (e.g., age, sex, occupation) are described, and scenarios of typical forklift injuries in various occupations are presented. Trends in forklift injuries from 1983–1985 are also discussed.

Industrial lift trucks or forklift trucks are a common source of occupational injuries. In 1985, an estimated 34,000 work-related injuries involving forklift trucks were treated in U.S. emergency rooms. In 1983, over 13,000 workers' compensation claims for lost-workday injuries involving forklifts were filed in 30 states.

The safety literature includes a number of studies of forklift truck accidents. Although most of these studies are dated and limited in scope, they do provide some preliminary indications of the magnitude of the problem. Findings of several previous studies are discussed below.

Nancy Stout-Wiegand, Ed.D., is statistician, Division of Safety Research, National Institute for Occupational Safety and Health, 944 Chestnut Ridge Road, Morgantown, WV 26505

The California Department of Industrial Relations conducted an analysis of disabling work injuries involving forklifts that occurred in California in 1980 (California Department of Industrial Relations, 1982). Of the 3,041 forklift injuries reported, 31% of the accidents were cases in which pedestrians were run over by forklift trucks. Another 23% were cases where the worker was caught in, under, or between a forklift and another object. The most common injuries were contusions and crushing injuries (30%), followed by sprains and strains (21%). Another 21% of the accidents resulted in amputations. Although forklifts accounted for only 0.8% of all work accidents in California in 1980, forklift accidents accounted for 3% of all work-related amputations.

Other studies have reported similar results with regard to types of accidents in-

volving forklifts. An analysis of Wisconsin workers' compensation claims from 1972 to 1975 reported the most frequent forklift accident to be one in which a forklift struck a pedestrian (23%). Other common accident types involved the worker being struck by a moving part of a forklift (16%) or being caught between a moving and stationary object (14%) (Coleman et al., 1978). To gain a better understanding of accidents involving power industrial trucks, these investigators interviewed 146 workers in 12 plants that use forklifts. It was discovered that only 23% of drivers received formal training for their industrial-truck tasks and that 34% had no training at all. Moreover, none of the pedestrian workers had any training for tasks that involve interaction with trucks (Coleman et al., 1978).

Forklift accidents have also been studied in other countries. A Finnish study reported that approximately 1,500 lift truck accidents occur each year in Finland. The most common accident types were described as forklifts running over workers and collisions (Häkkinen, 1978). An analysis of interviews and observations in three food warehouses in Sweden reported the most frequent type of forklift accidents as "truck hits person or other truck" (34%). The most common single accident type was described as "wheel over driver's foot" (Ostberg & Svensson, 1973).

Although these studies are somewhat dated and are based on data from single states or other nations, they all express the common concerns that forklifts are involved in sufficient numbers of work injuries to warrant attention from safety researchers. They also reveal that the most frequently occurring type of accident involving forklifts is one in which a worker is struck by or run over by a forklift.

The Division of Safety Research of the National Institute for Occupational Safety and Health (NIOSH) has recently received numerous requests for information on occupational injuries involving forklift trucks. This widespread interest, in addition to the lack of current, national information, prompted this analysis of work-related injuries involving forklift trucks.

METHOD

Two occupational injury databases were utilized in this analysis: the National Electronic Injury Surveillance System (NEISS) and the Bureau of Labor Statistics (BLS) Supplementary Data System (SDS). The NEISS database is composed of records of injuries treated in a national sample of emergency rooms and burn centers. The data from this sample are weighted to represent the nation in numbers and characteristics of traumatic injuries treated in emergency rooms. A subset of this database—the work-related injuries—is maintained by the National Institute for Occupational Safety and Health (NIOSH) and is analyzed in this study.

The SDS database is composed of workers' compensation claims for injuries involving lost workdays. Only 30 states provide information to the SDS system; however, these data provide valuable information on the characteristics of work-related compensable injuries. SDS data are produced annually with about a 2-year lag in reporting. (1983 is the most recent year currently available.)

Both of these databases provide information on characteristics of injured employees (e.g., age and sex) and characteristics of their injuries (e.g., diagnosis, body part affected, source of injury, and date of occurrence). The SDS database also reports occupation of injured worker and state where the claim was filed.

There are also some important differences between the two databases. NEISS includes only injuries treated in emergency rooms. Thus, traumatic work injuries treated by private practitioners or by industry clinics or personnel are not included in NEISS. Moreover, chronic injuries, such as injuries due to overexertion, are not as likely to be treated in emergency rooms as are acute traumatic injuries. Therefore, chronic occupational injuries are probably underrepresented in the NEISS database.

SDS, on the other hand, includes only compensable injuries. The definition of a compensable injury varies from state to state. All states provide for compensation of

amputations and certain other injuries without requiring any specific number of lost workdays. Most injuries, however, are only compensable if they result in a minimum number of lost workdays, ranging from 1 to 7 days in the participating states (U.S. Chamber of Commerce, 1983). SDS and NEISS may not represent the same injuries because injuries treated in emergency rooms may not always result in lost workdays. At the same time, compensable injuries included in SDS may not have been treated in emergency rooms and thus are not represented in NEISS. Finally, NEISS data are from a sample weighted to represent the nation, while SDS data represent compensable injuries in 30 states. It is important to keep these differences in mind while examining the results of the analysis.

Results are presented as distributions of characteristics of forklift injuries. Injury rates could not be calculated due to the lack of appropriate denominator data (e.g., number of forklifts in operation or number of workers exposed to forklifts). Because the numbers reported in this analysis are not standardized, numbers or proportions of injuries within groups (i.e., age, sex, or occupation groups) may not reflect the relative risk of those groups.

RESULTS AND DISCUSSIONS

Characteristics of Forklift Injuries in 1983

The age and sex of workers who suffered occupational injuries involving forklift trucks, as reported in NEISS and in SDS in 1983, are presented in Tables 1 and 2. An estimated 24,708 injuries involving forklifts were reported in NEISS, and 13,417 were filed in SDS in 1983. More than 90% of the injuries were sustained by younger than by older workers. Workers 35 years of age or younger sustained 71% of the forklift injuries treated in emergency rooms and 64% of those reported to workers' compensation. As Table 3 shows, forklift injuries appear to be somewhat more frequent during summer and autumn months, but there is relatively little variation in injuries by month.

Tables 4 through 6 describe characteristics of the forklift injuries reported in 1983. The most frequent accident type in NEISS was one in which the victim was caught in, under, or between objects (33%), whereas in SDS the most frequent type was one in which the victim was struck by an object (36%) (Table 4). The least frequent accident types were overexertion and falls (including falls from vehicles). The most common diagnosis category of these injuries in both data sets was contusion/abrasion/crushing/bruise (43% in NEISS, 31% in SDS). Other common diagnoses were sprain/strain and fracture/dislocation. In each database, 1% of the reported forklift injuries resulted in an amputation (Table 5).

The part of the body most frequently injured in forklift accidents was the foot; 22%

TABLE 1
PERCENTAGE DISTRIBUTION OF 1983 FORKLIFT INJURIES BY SEX OF INJURED WORKER: COMPARISON OF TWO DATA SOURCES

Sex	NEISS (n = 24,708)	SDS (n = 13,417)
Male	96.6	92.9
Female	3.4	7.1

TABLE 2
PERCENTAGE DISTRIBUTION OF 1983 FORKLIFT INJURIES BY AGE OF INJURED WORKER: COMPARISON OF TWO DATA SOURCES

Age	NEISS (n = 24,708)	SDS (n = 12,519)
Under 21	16.0	10.8
21 - 25	24.4	21.4
26 - 30	17.7	18.4
31 - 35	12.5	13.2
36 - 40	9.0	9.9
41 - 45	7.4	7.5
46 - 50	5.5	6.1
51 - 55	4.0	5.5
Over 55	3.5	7.2

TABLE 3
PERCENTAGE DISTRIBUTION OF 1983 FORKLIFT INJURIES BY MONTH OF OCCURRENCE: COMPARISON OF TWO DATA SOURCES

Month	NEISS (n = 24,709)	SDS (n = 13,417)
January	7.7	6.6
February	5.8	6.2
March	6.2	7.8
April	8.2	7.6
May	7.3	8.0
June	13.8	9.7
July	9.3	9.3
August	8.4	10.4
September	7.0	9.5
October	11.0	9.6
November	7.6	8.1
December	7.7	7.3

TABLE 5
PERCENTAGE DISTRIBUTION OF 1983 FORKLIFT INJURIES BY DIAGNOSIS OF INJURY: COMPARISON OF TWO DATA SOURCES

Diagnosis	NEISS (n = 24,707)	SDS (n = 13,417)
Contusions/abrasions/ crushing/bruise	42.6	31.3
Sprain/strain	17.9	18.7
Fracture/dislocation	17.1	21.9
Laceration	13.0	9.9
Amputation	1.2	1.2
Other	8.2	17.0

of the NEISS cases and 18% of the SDS cases involved foot injuries (Table 6). Another commonly injured body part was the finger (16% in NEISS and 15% in SDS). There was some discrepancy between the two databases regarding body part affected. NEISS reported 12% head/neck injuries compared to 6% in SDS, and SDS reported 14% upper trunk injuries compared to 10% in NEISS. These differences are likely due to differences in definitions and coverage. As previously discussed, chronic injuries such as back injuries are more likely to be reported in the workers' compensation database than in the emergency room reporting system. Similarly, acute traumatic injuries such as head injuries, that may require emergency treatment but may not result in lost work days, would likely be reported in NEISS but not SDS. The frequency with which other body parts were affected in forklift accidents is similar in both data sets (Table 6).

TABLE 4
PERCENTAGE DISTRIBUTION OF 1983 FORKLIFT INJURIES BY TYPE OF ACCIDENT: COMPARISON OF TWO DATA SOURCES

Accident Type	NEISS (n = 24,707)	SDS (n = 13,417)
Struck against an object	20.7	15.4
Struck by an object	22.8	36.2
Fall	8.8	5.3
Caught in, under, or between objects	33.0	28.2
Overexertion	4.3	7.3
Other	10.4	7.5

Forklift-related injuries occurred to employees in a variety of occupations (Table 7). The most frequent occupation of injured workers was forklift and tow motor operatives, although they accounted for only 12% of the reported injuries. Other occupations with relatively high frequencies of forklift injuries were warehousemen (10%), miscellaneous laborers (8%), freight and material handlers (7%), mechanics (7%), and other operatives, except transportation (5%). As Table 7 shows, many forklift accidents occur to employees whose job title would not suggest frequent interaction with forklifts.

These data indicate that in 1983 a scenario of a typical work injury involving a forklift might be one in which a male forklift operator between the ages of 21 and 25 was caught in, under, or between a forklift or

was struck by a forklift, with resulting contusions, abrasions, crushing, or bruises to the foot. Again, note that this scenario is based on frequencies and not rates of worker characteristics (sex, age).

To determine whether workers in different occupations experienced different kinds of forklift injuries, characteristics of forklift injuries were examined by occupation of injured worker (Tables 8–10). Occupational and injury categories that contained few cases were aggregated to maintain meaningful cell sizes in the contingency tables. Lambdas (asymmetric) were calculated for each of the cross tabulations (with occupation as the independent variable) to examine the statistical relationships between occupation and injury characteristics. Lambda was chosen as the appropriate statistic to determine the strength of the association between two nominal level variables with more than two categories each (Andrews, Klem, Davidson, O'Malley, & Rodgers, 1981; Loether & McTavish, 1974).

TABLE 6
PERCENTAGE DISTRIBUTION OF 1983 FORKLIFT INJURIES BY BODY PART AFFECTED: COMPARISON OF TWO DATA SOURCES

Body Part	NEISS (n = 24,706)	SDS (n = 13,417)
Foot	21.6	17.7
Finger	16.3	14.6
Head/neck	12.2	5.9
Leg(s)	10.3	14.1
Toe(s)	8.6	8.0
Ankle	5.7	4.3
Arm(s)	4.9	6.3
Lower trunk	9.6	3.6
Upper trunk (back)	3.7	13.9
Hand	6.2	4.8
Multiple body parts	0.5	6.0
Not specified	0.4	0.8

TABLE 7
PERCENTAGE DISTRIBUTION OF FORKLIFT INJURIES BY OCCUPATION OF INJURED WORKER: 1983 SDS DATA (n = 12,447)

Occupation	%
Professional, technical, and kindred workers	0.3
Managers and administrators (except farm)	2.0
Sales workers	0.8
Clerical and kindred workers	5.0
Craftsmen and kindred workers	
Mechanics	6.5
Foremen	3.0
Other craftsmen and kindred workers	6.0
Operatives (except transportation)	
Assemblers	1.4
Packers/wrappers	1.1
Welders	0.9
Miscellaneous/unspecified operatives	9.2
Other operatives	4.9
Transportation equipment operatives	
Forklift and towmotor operatives	12.3
Truck drivers	5.5
Motormen	1.7
Deliverymen	1.2
Other transportation equipment operatives	0.1
Laborers (except farm)	
Warehousemen	10.4
Freight and material handlers	7.3
Stock handlers	4.4
Construction laborers	2.2
Miscellaneous/unspecified laborers	8.0
Other laborers	1.6
Farmers (laborers and managers)	1.5
Service workers	1.8
Occupation unspecified	1.1

Table 8 shows little variation of injury type by occupation. For every occupational group, the most common injury type was one in which the worker was struck by an object. Among forklift operatives, the largest category of injury type was "other," but a more detailed analysis showed that none of

TABLE 8
PERCENTAGE DISTRIBUTION OF
FORKLIFT INJURY TYPES BY OCCUPATION:
1983 SDS DATA (n = 12,447)

Occupation	Type of Injury			
	Caught in, under, or between	Struck against an object	Struck by an object	Other
Craftsmen and kindred workers				
Mechanics	26.2	22.6	32.0	19.2
Other craftsmen and kindred workers	26.3	16.3	35.9	21.5
Operatives (except transportation)	26.9	16.0	41.2	15.9
Transportation equipment operatives				
Forklift and towmotor operatives	20.2	18.6	24.0	37.2
Other transportation equipment operatives	23.5	17.2	38.2	21.1
Laborers (except farm)				
Warehousemen	30.5	13.7	37.2	18.6
Freight and material handlers	28.3	11.5	44.1	16.0
Other laborers	31.2	12.0	40.1	16.7
Other occupations	26.3	14.1	39.6	20.0
Total	26.8	15.4	37.2	20.1

the injury types included in the "other" category (falls, overexertion, etc.) accounted for a greater proportion of injuries than the category struck by an object. The value of lambda (.03) indicated that predicting injury type could be improved by only 3% by knowing the occupation of the injured worker.

Table 9 shows the distribution of diagnosis of injury by occupation. For all occupations except transportation operatives, the most common injury diagnosis was cut/abrasion/contusion/bruise (27% to 37%). Among forklift operatives, the most frequent diagnosis was sprain/strain (32%). Among other transportation operatives, one fourth of the injuries were cuts/abrasions/contusions/bruises and one fourth were fractures/dislocations. The lambda was again very small (.01) indicating no significant relationship between the variables.

In Table 10, body part affected is distributed by occupation. Body part injured varied slightly by occupation. Among craftsmen and kindred workers (both mechanics and other craftsmen), the most frequently injured body part was the hand or finger. Among forklift operators, the upper trunk (back) was most frequently injured. The foot or toe was the body part most frequently affected by forklift injuries for all other occupations. (Although a greater proportion of injuries was in the category "other part" for forklift operatives, other transportation equipment operatives, and the table total, detailed analysis showed that no individual body part in the "other" category accounted for a greater proportion of injuries than those discussed above.) The lambda statistics for the association between occupation and body part (.04) indicates that the probable improvement in predicting injured

body part by knowing the worker's occupation is only 4%.

Although the associations between occupation and forklift injury characteristics are weak, the scenario of a typical forklift injury does vary somewhat by occupation. For craftsmen – both mechanics and other craftsmen and kindred workers – the typical forklift injury was one in which the worker was struck by an object and received a cut, abrasion, contusion, or bruise to the hand or finger. Among forklift operatives, the most frequent injury was one in which the worker experienced a strain or sprain of the upper trunk. For all other occupations, the most common forklift injury resulted from a worker's being struck by an object and suffering a cut, abrasion, contusion, or bruise of the foot or toe.

1983–1985 Trends in Forklift Injury Characteristics

Because SDS data are available only through 1983, the preceding section discussed 1983 data from SDS and NEISS for the purpose of comparison. In order to examine characteristics, NEISS data from 1983 to 1985 are presented in Tables 11 through 16.

The estimated number of forklift injures treated in emergency rooms increased by 39% from 1983 to 1985. Whether this increase in number of injuries reflects a similar increase in forklift injury rates is unknown. Nevertheless, an increase of nearly 40% in 3 years merits concern.

In general, there were few changes in characteristics of forklift injuries from 1983

TABLE 9
PERCENTAGE DISTRIBUTION OF
FORKLIFT INJURY DIAGNOSES BY OCCUPATION:
1983 SDS DATA (n = 12,447)

Occupation	Diagnosis of Injury					
	Amputation	Cut/ abrasion/ contusion/ bruise	Fracture/ dislocation	Laceration	Sprain/ strain	Other
Craftsmen and kindred workers						
Mechanics	2.5	27.2	21.6	16.4	16.9	13.4
Other craftsmen and kindred workers	1.1	28.2	25.7	12.6	16.5	16.0
Operatives (except transportation)	1.0	36.8	20.8	9.3	16.0	16.1
Transportation equipment operatives						
Forklift and towmotor operatives	1.0	25.7	18.1	7.1	31.6	16.5
Other transportation equipment operatives	1.7	24.3	24.3	9.8	21.6	18.3
Laborers (except farm)						
Warehousemen	1.0	34.5	20.9	9.2	16.2	18.2
Freight and material handlers	1.0	35.2	21.7	7.4	16.7	18.0
Other laborers	1.4	33.6	21.2	9.9	15.1	18.8
Other occupations	1.1	31.0	22.5	11.1	17.6	16.6
Total	1.2	31.4	21.6	10.0	18.8	17.0

TABLE 10
PERCENTAGE DISTRIBUTION OF FORKLIFT INJURIES, BODY PART AFFECTED BY OCCUPATION: 1983 SDS DATA (n = 12,447)

Occupation	Body Part Affected				
	Foot/ toe	Hand/ finger	Legs	Upper trunk	Other[a]
Craftsmen and kindred workers					
Mechanics	16.7	32.8	12.9	12.6	25.1
Other craftsmen and kindred workers	19.3	22.8	14.5	16.1	27.3
Operatives (except transportation)	27.4	17.8	14.7	13.1	27.0
Transportation equipment operatives					
Forklift and towmotor operatives	14.7	17.2	13.7	21.6	32.8
Other transportation equipment operatives	25.6	18.4	11.7	16.7	27.6
Laborers (except farm)					
Warehousemen	32.0	18.2	16.1	10.6	23.1
Freight and material handlers	31.9	16.7	15.5	10.1	25.8
Other laborers	29.9	21.9	12.8	11.6	23.8
Other occupations	28.4	17.6	14.2	12.7	27.1
Total	25.6	19.8	14.0	13.9	26.7

[a]Other body parts include ankle, arms, head, lower trunk, multiple parts, and unspecified body parts.

to 1985. Forklift-related injuries continued to occur to young males during summer and autumn months (Tables 11–13). The most frequent accident types continued to be ones in which the worker was caught in, under, or between objects or was struck by an object (Table 14). There was a slight increase in the diagnoses of contusion/abrasion and sprain/strain in 1985 and a slight decrease in fractures/dislocations, but the rank order of diagnoses frequencies remained constant (Table 15).

TABLE 11
PERCENTAGE DISTRIBUTION OF FORKLIFT INJURIES BY SEX OF INJURED WORKER: NEISS EMERGENCY ROOM DATA, 1983–1985

Sex	1983 (n = 24,708)	1984 (n = 28,979)	1985 (n = 34,397)
Male	96.6	95.2	95.9
Female	3.4	4.8	4.1

The proportion of forklift injuries affecting the foot increased slightly from 1983 to 1985, as did the proportion of injuries to the ankle, arm, and upper trunk. There was a decrease in the proportion of injuries to the finger, lower trunk, and hand. Again, the differences over time were small, and the rank order of body part affected did not change appreciably (Table 16). The scenario of a typical work injury involving a forklift remained the same in 1985 as in 1983.

Forklift-Related Injuries to the Foot

In 1985, nearly one third of all forklift-related injuries reported to emergency rooms were injuries to the foot or toe (31.5%). Be-

TABLE 12
PERCENTAGE DISTRIBUTION OF FORKLIFT INJURIES BY AGE OF INJURED WORKER: NEISS EMERGENCY ROOM DATA, 1983–1985

Age	1983 (n = 24,708)	1984 (n = 28,980)	1985 (n = 34,397)
Under 21	16.0	15.0	14.8
21 - 25	24.4	29.8	24.2
26 - 30	17.7	17.6	18.4
31 - 35	12.5	13.8	13.3
36 - 40	9.0	6.9	8.1
41 - 45	7.4	6.7	6.6
46 - 50	5.5	4.7	5.6
51 - 55	4.0	2.6	3.7
Over 55	3.5	2.9	5.3

TABLE 13
PERCENTAGE DISTRIBUTION OF FORKLIFT INJURIES BY MONTH OF OCCURRENCE: NEISS EMERGENCY ROOM DATA, 1983–1985

Month	1983 (n = 24,709)	1984 (n = 28,980)	1985 (n = 34,397)
January	7.7	6.5	7.6
February	5.8	9.1	4.9
March	6.2	6.2	8.0
April	8.2	7.3	7.8
May	7.3	7.5	7.2
June	13.8	11.0	7.8
July	9.3	7.9	10.8
August	8.4	9.9	9.5
September	7.0	7.6	11.0
October	11.0	10.8	11.7
November	7.6	7.1	7.2
December	7.7	9.1	6.5

cause foot injuries constituted such a large portion of all forklift cases, these specific injuries were examined more closely.

Characteristics of forklift injuries affecting the foot or toe are compared with all forklift injury cases for 1985 in Table 17. Those experiencing foot/toe injuries tended to be young; 48% of those with foot/toe injuries were 25 years old or younger compared to 39% of all forklift injury cases. The typical accident type for foot/toe injuries was one in which the victim was caught in, under, or between objects or was struck by an object (79% for foot/toe injuries versus 56% for all forklift injuries). The diagnosis

TABLE 14
PERCENTAGE DISTRIBUTION OF FORKLIFT INJURIES BY TYPE OF ACCIDENT: NEISS EMERGENCY ROOM DATA, 1983–1985

Accident Type	1983 (n = 24,707)	1984 (n = 28,969)	1985 (n = 34,351)
Struck against stationary object	8.9	9.1	9.7
Struck against moving object	11.8	10.2	10.7
Struck by an object	22.8	22.8	21.1
Fall from vehicles	4.6	4.7	8.4
Other fall	4.2	4.3	1.5
Caught in, under, or between objects	33.0	36.8	34.9
Overexertion	4.3	2.4	3.3
Other	10.4	9.7	10.4

TABLE 15
PERCENTAGE DISTRIBUTION OF FORKLIFT INJURIES BY DIAGNOSIS OF INJURY: NEISS EMERGENCY ROOM DATA, 1983–1985

Diagnosis	1983 (n = 24,707)	1984 (n = 28,979)	1985 (n = 34,397)
Contusions/abrasions	37.1	36.8	40.2
Sprain/strain	17.9	17.1	20.4
Fracture/dislocation	17.1	15.0	13.9
Laceration	13.0	13.8	12.2
Crushing	4.5	5.5	4.8
Amputation	1.2	1.0	1.0
Other	9.2	10.8	7.5

of foot/toe injuries as compared to all forklift injuries was more likely to be an abrasion (54% versus 40%), fracture/dislocation/amputation (23% versus 15%), or crushing (9% versus 5%), and less likely to be a sprain/strain (10% versus 20%) or other diagnosis (3% versus 20%). The most typical forklift injury to the foot/toe was one in which a 21- to 25-year-old male was caught in, under, or between a forklift and another object and received abrasions to the foot.

The NEISS includes a "comments" section for each case. In this section, more specific information about the injury can be described. The comments section for forklift-related injuries to the foot or toe was examined in order to better understand the circumstances of these injuries. Of all the cases in the 1985 NEISS data where the source of injury was a forklift and the body part affected was the foot or toe, 69% of the injury circumstances were described as "foot run over by a forklift." This represents 23% of all forklift injuries treated in emergency rooms in 1985. According to national estimates derived from the NEISS sample, approximately 7,492 occupational injuries in 1985 were caused by forklifts running over workers' feet.

CONCLUSIONS AND RECOMMENDATIONS

Occupational injuries involving forklifts or lift trucks occurred to approximately 34,000 workers in 1985. This analysis indicates that the most common of these injuries involves a forklift running over a worker's foot.

These results are similar to findings of previous research both within and outside the United States. A number of studies have shown that the most frequent accident types reported are ones in which workers are struck by or run over by forklift trucks (California Department of Industrial Relations, 1982; Coleman et al., 1978; Häkkinen, 1978; Ostberg & Svensson, 1973). Although previous analyses have not examined data in such detail as to determine the specific circumstances of frequent accident types, it appears that the general characteristics of injuries involving forklifts have not changed substantially over the past 10 to 15 years. The number of forklift accidents occurring each year, however, appears to be increasing.

There is an obvious need for efforts to prevent occupational injuries associated with forklifts. In order to reduce the greatest portion of such injuries, accident preven-

TABLE 16
PERCENTAGE DISTRIBUTION OF FORKLIFT INJURIES BY BODY PART AFFECTED: NEISS EMERGENCY ROOM DATA, 1983-1985

Body Part	1983 (n = 24,706)	1984 (n = 28,980)	1985 (n = 34,397)
Foot	21.6	22.1	23.7
Finger	16.3	14.9	11.3
Head	11.6	11.6	10.1
Leg(s)	10.3	11.5	9.4
Toe(s)	8.6	8.5	7.9
Ankle	5.7	6.5	7.8
Arm(s)	4.9	4.2	7.8
Lower trunk	9.6	8.8	7.1
Upper trunk	3.7	5.3	6.6
Hand	6.2	5.0	3.8
Neck	0.6	0.7	1.9
25-50% of body	0.1	0.2	1.9
All body	0.4	0.7	0.7
Not specified	0.4		

TABLE 17
CHARACTERISTICS OF FOOT/TOE INJURIES COMPARED TO ALL FORKLIFT INJURIES: NEISS EMERGENCY ROOM DATA, 1985

Characteristic	% Foot/Toe Injuries (n = 10,851)	% All Forklift Injuries (n = 34,397)
Age		
Under 21	20.7	14.8
21 - 25	27.1	24.2
26 - 30	16.2	18.4
31 - 35	13.0	13.3
36 - 40	3.5	8.1
41 - 45	7.4	6.6
46 - 50	5.4	5.6
51 - 55	2.9	3.7
Over 55	3.8	5.3
Accident Type		
Caught in, under, or between objects	48.6	34.8
Struck by an object	30.5	21.1
Struck against moving object	15.1	10.7
Struck against stationary object	1.3	9.7
Fall from vehicle	2.3	9.5
Other	2.2	14.2
Diagnosis		
Abrasion	54.0	40.2
Fracture/dislocation/amputation	23.4	14.9
Sprain/strain	10.2	20.4
Crushing	9.0	4.8
Other	3.4	19.7

tion measures should focus on protecting workers' feet from being run over.

Forklift accident prevention efforts should be directed not only toward forklift operators, but also toward pedestrian workers whose tasks involve interaction with or working in close proximity to forklifts. This analysis indicates that only 12% of compensable forklift injuries occur to forklift and tow motor operatives and that the most common type of injury suffered by forklift operatives differs somewhat from the typical forklift-related injuries of other workers. One third of the injuries reported to SDS in 1983 occurred to laborers (warehousemen, freight and material handlers, etc.), and many forklift accidents reported to workers'

compensation agencies occur to employees whose occupational titles would not suggest frequent interaction with forklifts (e.g., sales workers, professionals, clerical workers). (See Table 7.) It is important that these employees, who interact frequently with lift trucks or who occasionally work in close proximity to forklifts, are also addressed by injury prevention programs.

It is hoped that this analysis will provide the information necessary for safety personnel, as well as employers and workers, to begin seeking solutions to this increasing problem. Eliminating work-related injuries attributed to forklifts could reduce the number of occupational injuries by 34,000 annually. Preventing injuries caused by forklifts running over workers' feet could alone prevent 7,500 work injuries each year.

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