

Abstract

Five-year Industrial Accidents of Ship-building Workers at a Ship-Yard

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Objectives: This study evaluated the status of industrial accidents at a ship-yard in Korea in order to provide the basic materials for preventing further industrial accidents.

Methods: This study reviewed and analyzed the records of 252 industrial accidents that occurred in a ship-yard at Ulsan city from January 1 1997 until December 31st, 2001 according to age, the work career, the job department, the day of the week, the occurrence time, the part of body injured, and the accident type.

Results: There were a total of 252 industrial accidents over the five years. The incidence of industrial accidents per year were 17.38, 26.99, 16.44, 11.35, 14.50 per 1,000 persons from 1997 to 2001, respectively. The frequency of industrial accidents per year were 11.56, 11.23, 6.27, 4.42, 5.79 per one million man hours from 1997 to 2001, respectively. The intensity of industrial accidents per year was 1.67, 0.18, 4.32 per 1,000 man hours from 1999 to 2001, respectively. The highest incidence occurred in the over 50 age group (33.87 per 1,000 persons). Regarding the incidence according to the work career, it was highest in those who had worked for less than 1 year (39.76 per 1,000 persons). The incidence in those working in high places and those using heavy materials were higher than the others. The most frequent day of the week was Monday (19.8%), which was followed by Friday (16.7%) and Saturday (15.9%). The most frequent time of an accident was 15:00-16:59(25.8%), which was followed by 08:00-09:59(24.2%), 10:00-11:59(20.2%). The most frequent part of the body injured was the low back (28.6%), which was followed by the lower extremities (24.2%), and the upper extremities (23.0%). The types of industrial accidents were stenosis (27.0%) to have been happened most and upset (19.8%), fall down (14.7%), hard movement (12.3%), and falling (9.1%).

Conclusions: The above results suggests that a more precise system of reporting industrial accidents will be needed in order to enhance the accuracy and reliability of the industrial accident statistics. In addition, the preventive activities for back injury, stenosis, and fall down are needed in order to prevent industrial accidents at ship-yards in Korea. Furthermore, the strengthening of a continuous health education program will be necessary for beginners, older workers, and those working in high places and using heavy materials.

Key Words: Industrial accidents, Ship-building workers.

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(, 1974), (, 1981),

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tion, ILO) 가 ,
가

(, 1982), (, 1989), (, 1995),

(, 1998; , 2000)

가 ,

(2000)

(Lyndon, 1971),

(2002)

2 1

(, 1997;

가 , , 가 , 2002)가

5

(, 2001; , 2002b).

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2001

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(Heinrich 1980; Peterson,

1983; WHO, 1983;

×
 (2002b) 7,500 , 1997 45 , 1998 72 , 1999 44 , 2000 36 , 2001 55 ,
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 , 33.87, 40 49
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 dard version) Table 3 2000
 2 1 가 ,

Table 1. Index of industrial accidents by year

Year	Number of accidents	Number of workers	Total WT [†] (hours)	Number of workdays lost	IR* [‡]	FR [§]	Intensity rate
1997	45	2,589	3,893,856	-	17.38	11.56	-
1998	72	2,668	6,411,204	-	26.99	11.23	-
1999	44	2,677	7,013,740	11702	16.44	6.27	1.67
2000	36	3,171	8,152,641	1435	11.35	4.42	0.18
2001	55	3,794	9,500,176	41005	14.50	5.79	4.32

* p<0.01 analyzed by ² test.

† WT, working time.

‡ IR, incidence rate=number of accidents / mean number of workers of specific year × 1,000.

§FR, frequency rate=number of accidents / total working time of specific year × 1,000,000.

intensity rate=number of workday lost of specific year / total working time of specific year × 1,000.

(p<0.01).
 1,000 42 (16.7%) 50 (19.8%), 14 (5.5%)
 Table 4 1997 (Erection department) 가 , 1998
 1999 (Hull production department), Table 6 1997 8 10
 2000 2001 (Painting department) , 1998 10 12 15 17
 department) 가 , 1999 12 15 ,
 (Hull outfitting department)가 2000 2001 15 17
 (Hull production department)가 가 15 17
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 (Steel production department)가 Table 7 1997 1999 , 1998
 24.67, (Assembly)가 23.44 2000 가 가 ,
 , 가 (p< 2001 가 가
 0.01). 72 (28.6%), 61
 Table (24.2%), 58 (23.0%)
 5 1997 , 1998 , 1999
 , 2001 가 Table 8 1997 , 1998 , 1999

Table 2. Incidence rate of industrial accidents by age of subjects and year

Unit: Number of accidents/mean number of workers

Age	1997	1998*	1999*	2000	2001*	Total*
29	10.83 (6/554)	8.25 (5/606)	3.41 (2/586)	5.16 (5/968)	4.79 (7/1460)	5.99 (25/4174)
30-39	18.48 (18/974)	30.16 (26/862)	21.99 (17/773)	11.21 (9/803)	14.15 (13/919)	19.16 (83/4331)
40-49	19.90 (19/955)	31.16 (32/1027)	14.06 (15/1067)	14.87 (16/1076)	19.44 (20/1029)	19.79 (102/5154)
50	18.87 (2/106)	52.02 (9/173)	39.84 (10/251)	18.52 (6/324)	38.86 (15/386)	33.87 (42/1240)
Total	17.38 (45/2589)	26.99 (72/2668)	16.44 (44/2677)	11.35 (36/3171)	14.50 (55/3794)	16.91 (252/14899)

* p<0.01 analyzed by χ^2 test.

Table 3. Incidence rate of industrial accidents by the work career of subjects and year

Unit: Number of accidents/mean number of workers

Work career	1997*	1998*	1999*	2000	2001*	Total*
1 yrs.	53.33 (12/225)	125.00 (19/152)	80.65 (5/62)	12.64 (7/554)	35.59 (30/843)	39.76 (73/1836)
2-4	22.00 (9/409)	34.48 (16/464)	26.53 (13/490)	19.28 (8/415)	2.82 (2/708)	19.31 (48/2486)
5-9	20.27 (3/148)	26.43 (6/227)	15.06 (5/332)	11.52 (5/434)	8.93 (5/560)	14.11 (24/1701)
10	11.62 (21/1807)	16.99 (31/1825)	11.71 (21/1793)	9.05 (16/1768)	10.70 (18/1683)	12.05 (107/8876)
Total	17.38 (45/2589)	26.99 (72/2668)	16.44 (44/2677)	11.35 (36/3171)	14.50 (55/3794)	16.91 (252/14899)

* p<0.01 analyzed by χ^2 test.

, 2000 , 2001 가 가
 (27.0%), 가 50 (19.8%), 68
 (14.7%) 37 가
 (Peterson, 1983; WHO, 1983;
 , 2001). 가

Table 4. Incidence rate of industrial accidents by the job department of subjects and year

Unit: Number of accidents/mean number of workers

Job department	1997*	1998*	1999	2000	2001*	Total*
Hull production	21.90 (6/274)	62.50 (16/256)	48.08 (10/208)	26.94 (8/297)	13.79 (2/145)	35.59 (42/1180)
Assembly	36.59 (6/164)	40.23(7/174)	17.24 (3/174)	24.05 (7/291)	18.18 (11/605)	23.44 (33/1408)
Steel production	-	36.08(7/194)	20.73 (4/193)	15.46 (3/194)	0.00 (0/27)	24.67 (15/608)
Pre-outfitting	-	-	-	-	33.56 (5/149)	33.56 (5/149)
Painting	34.63 (8/231)	48.03 (11/229)	18.78 (4/213)	29.85 (2/67)	46.73 (5/107)	35.42 (30/847)
Engine	19.65 (9/458)	19.42 (8/412)	20.41 (8/392)	11.94 (4/335)	30.53 (4/131)	19.10 (33/1728)
Hull outfitting	-	-	-	-	41.10 (9/219)	41.10 (9/219)
Production adm.	25.21 (6/238)	32.79 (8/244)	14.87 (4/269)	7.73 (3/388)	8.70 (4/460)	15.63 (25/1599)
Dock	0.00 (0/ 52)	39.22 (2/51)	23.26 (1/43)	0.00 (0/45)	29.41 (1/34)	17.78 (4/225)
Machine man.	0.00 (0/211)	0.00 (0/195)	5.15 (1/194)	0.00 (0/182)	4.61 (1/217)	2.00 (2/999)
Erection	37.04 (6/162)	49.72(9/181)	24.04 (5/208)	14.01 (5/357)	20.70 (10/483)	25.16 (35/1391)
Machinery out.	6.17 (2/324)	6.06 (1/165)	11.98 (2/167)	9.55 (3/314)	8.33 (2/240)	8.26 (10/1210)
Electric	5.52 (1/181)	4.76 (1/210)	0.00 (0/207)	4.78 (1/209)	5.13 (1/195)	3.99 (4/1002)
Others	3.40 (1/294)	5.60 (2/357)	4.89 (2/409)	0.00 (0/492)	0.00 (0/782)	2.14 (5/2334)
Total	17.38 (45/2589)	26.99 (72/2668)	16.44 (44/2677)	11.35 (36/3171)	14.50 (55/3794)	16.91 (252/14899)

* p<0.01 analyzed by ² test.

Table 5. Distribution of industrial accidents by the day of the week and year

Unit: No.(%)

Day of the week	1997	1998	1999	2000	2001	Total
Sunday	2 (4.4)	2 (2.8)	-	5 (13.8)	5 (9.1)	14 (5.5)
Monday	6 (13.3)	13 (18.1)	9 (20.5)	6 (16.7)	16 (29.1)	50 (19.8)
Tuesday	7 (15.6)	14 (19.4)	5 (11.4)	3 (8.3)	9 (16.4)	38 (15.1)
Wednesday	8 (17.8)	10 (13.9)	6 (13.6)	4 (11.1)	6 (10.9)	34 (13.5)
Thursday	5 (11.1)	10 (13.9)	10 (22.7)	6 (16.7)	3 (5.5)	34 (13.5)
Friday	11 (24.5)	11 (15.3)	6 (13.6)	6 (16.7)	8 (14.5)	42 (16.7)
Saturday	6 (13.3)	12 (16.6)	8 (18.2)	6 (16.7)	8 (14.5)	40 (15.9)
Total	45 (100.0)	72 (100.0)	44 (100.0)	36 (100.0)	55 (100.0)	252 (100.0)

Table 6. Distribution of industrial accidents by the occurrence time and year

Unit: No.(%)

Time	1997	1998	1999	2000	2001	Total
00:00-07:59	-	5 (6.9)	2 (4.6)	3 (8.3)	1 (1.8)	11 (4.4)
08:00-09:59	13 (28.8)	11 (15.3)	7 (15.9)	5 (13.9)	16 (29.2)	52 (20.6)
10:00-11:59	9 (20.0)	16 (22.2)	8 (18.1)	8 (22.2)	10 (18.2)	51 (20.2)
12:00-14:59	8 (17.8)	13 (18.1)	12 (27.3)	2 (5.6)	8 (14.5)	43 (17.1)
15:00-16:59	12 (26.6)	16 (22.2)	10 (22.7)	9 (25.0)	18 (32.7)	65 (25.8)
17:00-18:59	1 (2.3)	4 (5.6)	3 (6.8)	3 (8.3)	1 (1.8)	12 (4.8)
19:00-23:59	2 (4.5)	7 (9.7)	2 (4.6)	6 (16.7)	1 (1.8)	18 (7.1)
Total	45 (100.0)	72 (100.0)	44 (100.0)	36 (100.0)	55(100.0)	252 (100.0)

Table 7. Distribution of industrial accidents by the part of body injured and year

Unit: No.(%)

Part of the body	1997	1998	1999	2000	2001	Total
Head	8 (17.8)	9 (12.5)	5 (11.4)	4 (11.1)	8 (14.5)	24 (9.5)
Eye	-	1 (1.4)	1 (2.3)	-	3 (5.5)	5 (2.0)
Upper extremity	17 (37.8)	17 (23.6)	12 (27.2)	7 (19.5)	5 (9.1)	58 (23.0)
Trunk	1 (2.3)	6 (8.3)	8 (18.2)	3 (8.3)	4 (7.3)	22 (8.7)
Low back	12 (26.6)	18 (25.0)	10 (22.7)	8 (22.2)	24 (43.6)	72 (28.6)
Lower extremity	7 (15.6)	21 (29.2)	8 (18.2)	14 (38.9)	11 (20.0)	61 (24.2)
Total	45 (100.0)	72 (100.0)	44 (100.0)	36 (100.0)	55 (100.0)	252 (100.0)

Table 8. Distribution of industrial accidents by the accident type and year

Unit: No.(%)

Type	1997	1998	1999	2000	2001	Total
Fall down	5 (11.1)	6 (8.3)	6 (13.6)	10 (27.7)	10 (18.2)	37 (14.7)
Upset	9 (20.0)	14 (19.4)	5 (11.4)	8 (22.2)	14 (25.5)	50 (19.8)
Clash	1 (2.2)	1 (1.4)	1 (2.3)	1 (2.8)	2 (3.6)	6 (2.4)
Falling	2 (4.5)	6 (8.3)	7 (15.9)	2 (5.6)	6 (10.9)	23 (9.1)
Stenosis	15 (33.3)	25 (34.7)	15 (34.1)	6 (16.7)	7 (12.7)	68 (27.0)
Electric shock	2 (4.5)	1 (1.4)	-	-	-	3 (1.2)
Explosion	1 (2.2)	1 (1.4)	-	1 (2.8)	-	3 (1.2)
Break	-	1 (1.4)	1 (2.3)	-	-	2 (0.8)
Fire	1 (2.2)	1 (1.4)	1 (2.3)	-	6 (10.9)	9 (3.6)
Hard movement	6 (13.3)	11 (15.3)	5 (11.3)	3 (8.3)	6 (10.9)	31 (12.3)
Others*	3 (6.7)	5 (7.0)	3 (6.8)	5 (13.9)	4 (7.3)	20 (7.9)
Total	45 (100.0)	72 (100.0)	44 (100.0)	36 (100.0)	55 (100.0)	252 (100.0)

* others have occupational diseases and job related disorders.

15 4 2003

2% 98% (Schelp, 가

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 1997;9(1):99-108.
 2002;14(4):468-77.
 2000;12(1):1-11.
 . 1996.
 1998;10(4):562-570.
 . 2001 . 2002a. 1997;9(1):170-7.
 . 2001 . 2002c.
 . 2002b. 1984;17(1):65-74.
 . 2001.
 1981;14(1):89-96.
 :61-8. 1989;1(1) Heinrich HW et al. Industrial Accidents
 Prevention. New York: Mc Graw-Hill, 1980.
 1992;52:4-23. Lyndon GS. Accidents in occupational health and
 safety. Geneva: Intenational Labor Office, ILO,
 , 1993. 1971.
 National Safety Council. Fundamentals of
 Industrial Hygiene, Chicago: NSC, 1988.
 1982. Peterson D. The human error model of accident
 causation. Occupational Hazard 1983:107.
 Schelp L. The role of organizations in communica-
 tion participation. Prevention of accidental
 2002;14(4):408-17. injuries in a rural Swedish municipatity. Soc Sci
 52:75-9. 1998; Med 1988;26(11):1087-93.
 World Health Organization. Psychosocial factors in
 injury prevention. Geneva, WHO, 1983.