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Characteristics of Motorcycle Collisions by Work Experience of Delivery Postmen

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Objective: This study is on the characteristics of motorcycle accidents occurring in the mail delivery process by skill level.

Background: The tendency of delivery postmen's driving in a hurry may become the cause of accidents since there is a constraint that delivery should be completed within a limited time.

Method: This study analyzed the traffic accident data of 259 delivery postmen, who had been approved as occupation-related industrial accident victims from 2009 to 2012, by their work experience in view of season, day of the week of an accident occurrence, accident occurrence time, accident cause, collision type, and driving situation.

Results: Accident characteristics of delivery postmen show that the ratio of accidents occurring to those who had less than 10 years of work experience was high. There were many motorcycle collisions in winter and summer by season and an unexpected object, along with road condition, took up 70.7% of the accident sources. There were no differences in accident occurrence time, the day of the week, season, accident source, and collision type between the group of delivery postmen with less than 10 years of work experience and those with 10 years or more of work experience. However, there was a difference in distribution of driving condition.

Conclusion and Applications: The results of this study can be used to present the policies or guidelines for the accident prevention of delivery postmen since the results show the characteristics of the injured and accident occurrence characteristics in relation with the delivery postmen's motorcycle collisions.

Keywords: Postmen, Motorcycle, Mail delivery, Occupational injury

1. Introduction

A delivery postman refers to a person who collects mails from mailboxes installed in each post office district and delivers them to the indicated addresses in the district concerned. They are classified as elementary workers (Major group), transport related elementary occupations (Sub-major group), deliverers (Minor group), and postmen (Occupations) by the Korean Standard Classification of Occupations (Statistics Korea, 2007). Based on 2013 statistics, 15,449 delivery postmen were working at 3,631 post offices: 11,704 at permanent positions (75.8%) and 3,745 at temporary positions (34.2%) (KOSIS, 2013).

The overall handling process of mails in a post office starts from the receipt of mails and ends with delivery to the addresses through the steps of collection, arrangement, postmarking, classification, bundling, binding, transportation, and opening mail pouch. There can be a high probability of traffic accident occurrences due to the job characteristics of a delivery postman who needs to deliver a assigned amount of mails in a hurry while riding a motorcycle in his rounds within a limited time.

Mullin et al. (2000) analyzed the relations among age, driving experience, and accident in relation to general motorcycle accidents, while Na and Park (2012) analyzed the correlations among seasons, when motorcycle collisions occur often, accident severity, time of day, and age. There have also been studies on the factors affecting motorcycle accidents and accident causes (Hurt et al., 1981; Sexton et al., 2004).

Chellini et al. (2013) reported that type of motorcycle, traffic situation and slippery or uneven road are major causes of motorcycle collisions and that injury level can be reduced by wearing a safety jacket through a study on accidents during mail delivery service by motorcycle. Do Nascimento and Bortolotto (2012) revealed that accidents increase, as duty hours became longer, due to long delivery paths.

Searle (1986) analyzed the correlation between a delivery postman's work experience and a sick leave. Jo et al. (2015) developed a postal-motorcycle driver monitoring system (PDMS) analyzing postman's driving habits, and enabling to collect the data to prevent motorcycle accidents.

This study is on the characteristics of motorcycle accidents occurring in the mail delivery process. For an accident prevention measure, the systematic analyses and utilization of the characteristics of accident occurrences according to skill level of mail delivery are needed. This study aims to contribute to accident prevention through an analysis of the characteristics of the injured by skill level in the course of delivering mails using a motorcycle.

2. Methods

2.1 Data collection

This study targeted accidents in which delivery postmen were acknowledged as industrial accident victims during the delivery of mails while riding a motorcycle. While the industrial accident victims are classified as the injury by an accident and occupational disease sufferers, the subjects are only the injured by an accident in this study. This study analyzed the traffic accident data of 259 delivery postmen, who had been approved as occupation-related industrial accident victims from 2009 to 2012. The analyzed data consisted of 4 deaths (1.5%), 24 disabled people (9.3%), and 231 injured people (89.2%).

2.2 Data analysis

This study defined a skilled worker based on 10 years of work experience, and compared differences according to victims' general characteristics (size of employment, age, and work experience) and accident characteristics (season, day of the week of an accident occurrence, accident occurrence time, accident cause, collision type, and driving situation). This study examined accident characteristics and variables using accident data for accident victim approval and accident summary. This study classified accident occurrence time into morning business hours (09:00-12:00), afternoon business hours (12:00-18:00) and after business hours. Season was classified into spring (March-May), summer (June-August), autumn (September-November), and winter (December-February). This study conducted χ^2-test at the significance level of 0.05 to identify differences in the distribution of accident characteristics, based on 10 years of work experience.

3. Results

3.1 Analysis of general characteristics of the injured

3.1.1 Distribution of the injured by age

Table 1 shows the age distribution of the injured. The proportion of the injured was 35.9% in their 30s, 27.0% in their 40s, 20.8% in their 50s and 16.2% in their 20s.

Table 1. Distribution of the injured by age (years)

Frequency	20s	30s	40s	50s	Total
Count	42	93	70	54	259
%	16.2%	35.9%	27.0%	20.8%	100.0%

3.1.2 Distribution of the injured by work experience

Table 2 shows the distribution of the injured by work experience. The injured with less than 1 year of work experience took up 25.1% of the total, while the injured with less than 5 years of work experience took up 50.6% and the injured with less than 10 years and more took up 37.1%.

Table 2. Distribution of the injured by work experience (years)

Frequency	Under 1	1~3	3~5	5~10	10~20	Over 20	Total
Count	65	46	20	32	55	41	259
%	25.1%	17.8%	7.7%	12.4%	21.2%	15.8%	100.0%

3.1.3 Distribution of the injured by size of employment

Table 3 shows the distribution of the injured by size of employment. 62.6% of accidents took place in workplaces with less than 15 employees.

Table 3. Distribution of the injured by size of employment (persons)

Frequency	Under 5	5~9	10~15	16~29	Over 30	Total
Count	46	92	24	29	68	259
%	17.8%	35.5%	9.3%	11.2%	26.3%	100.0%

3.2 Analysis of accident characteristics by skill level

3.2.1 Distribution of the injured by season

Table 4 shows the distribution of the injured by season. Accidents took place in winter, summer, autumn, and spring in order. There was no difference in accident distribution between the skilled workers with less than 10 years of work experience and those with 10 years or more of work experience ($\chi^2=1.493$, $p=0.684$).

Table 4. Distribution of the injured by season

Work experience (years)		Spring	Summer	Autumn	Winter	Total
Under 10	Count	31	41	32	59	163
	%	19.0%	25.2%	19.6%	36.2%	100.0%
10 or more	Count	16	22	25	33	96
	%	16.7%	22.9%	26.0%	34.4%	100.0%
Total	Count	47	63	57	92	259
	%	18.1%	24.3%	22.0%	35.5%	100.0%

3.2.2 Distribution of the injured by day of the week

Table 5 shows the distribution of the injured by the day of the week. Most accidents occurred on Monday, Friday, and Wednesday in order. Accident frequency was especially high on Monday, the next day of holiday. There was no difference in accident distribution between the skilled workers with less than 10 years of work experience and the skilled workers with 10 years or more of work experience ($\chi^2=260$, $p=0.894$).

Table 5. Distribution of the injured persons by day of the week

Work experience (years)		Mon	Tue	Wen	Thu	Fri	Sat	Sun	Total
Under 10	Count	38	27	29	27	29	10	3	163
	%	23.3%	16.6%	17.8%	16.6%	17.8%	6.1%	1.8%	100.0%
10 or more	Count	23	11	18	16	22	5	1	96
	%	24.0%	11.5%	18.8%	16.7%	22.9%	5.2%	1.0%	100.0%
Total	Count	61	38	47	43	51	15	4	259
	%	23.6%	14.7%	18.1%	16.6%	19.7%	5.8%	1.5%	100.0%

3.2.3 Distribution of the injured by hour of day

Table 6 shows the distribution of the injured by hour of the day. 62.9% of all accidents occurred in the afternoon shift, which was relatively longer than the morning shift and the overtime. There was no difference in accident distribution between the skilled

workers with less than 10 years of work experience and those with 10 years or more of work experience (χ^2=0.964, p=0.618).

Table 6. Distribution of the injured by hour of the day

Work experience (years)		AM (9:00-12:00)	PM (12:00-18:00)	Others	Total
Under 10	Count	57	99	7	163
	%	35.0%	60.7%	4.3%	100.0%
10 or more	Count	29	64	3	96
	%	30.2%	66.7%	3.1%	100.0%
Total	Count	86	163	10	259
	%	33.2%	62.9%	3.9%	100.0%

3.2.4 Distribution of the injured by accident source

Table 7 shows the distribution of the injured by accident source, and the primary sources were in the following order: unexpected object (35.9%), road condition (34.75), poor driving (13.9%), and poor maintenance and loading (8.5%). There was no difference in accident distribution between the skilled workers with less than 10 years of work experience and those with 10 years or more of work experience (χ^2=7.677, p=0.104).

Table 7. Distribution of the injured by accident source

Work experience (years)		Road condition	Unexpected object	Poor driving	Poor maintenance and loading	Others	Total
Under 10	Count	50	64	25	16	8	163
	%	30.7%	39.3%	15.3%	9.8%	4.9%	100.0%
10 or more	Count	40	29	11	6	10	96
	%	41.7%	30.2%	11.5%	6.3%	10.4%	100.0%
Total	Count	90	93	36	22	18	259
	%	34.7%	35.9%	13.9%	8.5%	6.9%	100.0%

3.2.5 Distribution of the injured by collision type

Table 8 shows the distribution of the injured by collision type, and the primary types were in the following order: rollover (67.2%), head-on collision (14.3%), and sideswipe (14.3%). There was no difference in accident distribution between the skilled workers with less than 10 years of work experience and those with 10 years or more of work experience (χ^2=4.318, p=0.356).

Table 8. Distribution of injured persons by collision type

Work experience (years)		Rollover	Head-on	Sideswipe	Rear-end	Others	Total
Under 10	Count	107	24	22	4	6	163
	%	65.6%	14.7%	13.5%	2.5%	3.7%	100.0%
10 or more	Count	67	13	15	0	1	96
	%	69.8%	13.5%	15.6%	0%	1.0%	100.0%
Total	Count	174	37	37	4	7	259
	%	67.2%	14.3%	14.3%	1.5%	2.7%	100.0%

3.2.6 Distribution of the injured by driving situation

Table 9 shows the distribution of the injured by driving situation. Most of the accidents occurred in the following situations in particular order: going straight (18.5%), curve driving (18.5%), sudden stop (10.4%), and other situations (changing lanes, going uphill/downhill). There was also a difference in accident distribution between the skilled workers with less than 10 years of work experience and those with 10 years or more of work experience ($\chi^2=8.343$, $p=0.039$). Accident occurrence frequency of the workers with less than 10 years of work experience was high in the following order: going straight (66.9%), sudden stop (14.7%), curve driving (11.7%), and other situations (changing lanes, going uphill/downhill). It was, however, in the following order to the workers with 10 years or more of work experience: going straight (65.6%), curve driving (25.0%), and sudden stop (8.3%). The sudden stop accident ratio was relatively higher among the workers with less than 10 years of work experience, while curve driving accident ratio was high among the workers with 10 years or more of work experience.

Table 9. Distribution of the injured by driving situations

Work experience (years)		Go straight	Sudden stop	Curve driving	Others	Total
Under 10	Count	109	19	24	11	163
	%	66.9%	11.7%	14.7%	6.7%	100.0%
10 or more	Count	63	8	24	1	96
	%	65.6%	8.3%	25.0%	1.0%	100.0%
Total	Count	172	27	48	12	259
	%	66.4%	10.4%	18.5%	4.6%	100.0%

4. Conclusion and Discussion

This study explored characteristics of the motorcycle accident of delivery postmen and analyzed the differences among accident characteristics according to skill level based on 10 years of work experience. Accident characteristics of delivery postmen show that the ratio of accidents occurring to those who had less than 10 years of work experience was 62.9%; therefore, the accident ratio of workers with short work experiences was high. This result is consistent with the result of a study by Searle (1986) reporting that the number of sick leave decreases as work experience gets longer. The result also supports the relation between driving experience and accident in a study of general motorcycle accidents by Mullin et al. (2000).

There were many motorcycle collisions in winter and summer by season, which was consistent with the result concluded by Na and Park (2012), insisting that accident frequency was high in summer. The wet surface of the road in summer and the slippery surface of the road in winter can be the major causes of the accidents. In a study by Chellini et al. (2013), slippery road was presented as a cause of accidents, and also rain was mentioned as a factor of accidents in a study by Do Nascimento and Bortolotto (2012), which analyzed delivery postmen accidents using a motorcycle in the Bahia and Parana regions in Brazil. Relatively higher accident frequency was shown on Monday by the day of the week, suggesting that the volume of delivery increased after holiday may cause the increase in accident frequency. The increase in the volume of delivery increases operation hours and results in making delivery postmen hurry. In a study by Do Nascimento and Bortolotto (2012), exposure to accident risk was reported to be higher if work hours increased.

An unexpected object, along with road condition, took up 70.7% of the accident sources. Meanwhile, rollover (67.2%) and a head-on collision and a sideswipe (28.6%) took up the largest portion of collision types in order. The result is similar to the result by Do Nascimento and Bortolotto (2012) revealing rollover (52.3%) and collision (34.5%) as the primary causes of the accidents. As for driving situation, accidents occurring upon going straight took up 66.4%, whereas curve driving took up 18.5%.

This study analyzed the characteristics of the motorcycle accident of full-time delivery postmen, working until their 50s, based on 10 years of work experience. According to the study results, there were no differences in accident occurrence time, the day of the week, season, accident source, and collision type between the group of delivery postmen with less than 10 years of work experience and those with 10 years or more of work experience. However, there was a difference in distribution of driving condition. Although no difference was shown between the two groups for going straight, the accident ratio for sudden stop was relatively higher among those with less than 10 years of work experience. Curve driving accident ratio was higher among those with 10 years or more of work experience.

The results of this study can be used to present the policies or guidelines for the accident prevention of delivery postmen since the results show the characteristics of the injured and accident occurrence characteristics in relation with the delivery postmen's motorcycle collisions. The tendency of delivery postmen's driving in a hurry may become the cause of accidents since there is a constraint that delivery should be completed within a limited time. An effort to coordinate adequate volume of delivery and schedule is required in consideration of the delivery postmen's physical capability, as well as the road condition of delivery areas. Further study requires a comparative analysis on what differences exist for the accident characteristics of quick delivery servicemen using motorcycles, who are same in occupational classification, working in mainly part-time or contractual basis.

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