

Epidemiology of jockey falls and injuries in flat and jump races in Japan (2003–2017)

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Jockey safety is of paramount importance from the standpoint of welfare and public perception. Thus, an understanding of the epidemiology and associated risk factors is necessary to implement measures to reduce the jockey falls (JFs) and jockey injuries (JIs). This descriptive epidemiological study investigated the occurrence of JFs and JIs in 715,210 and 25,183 rides in flat and jump races, respectively, from 2003 to 2017. In flat races, the incidence rates of JFs and JIs were 1.4 and 0.6 per 1,000 rides, respectively. In jump races, they were 44.4 and 18.1 per 1,000 rides, respectively. In flat races, 56.8% of JFs at corners resulted in JIs. In jump races, the major causes of JFs and JIs were lost balance and hampered by a fallen horse at an obstacle. Our findings provide a basis to design a future study analyzing risk factors for JFs.

Key words: *epidemiology, horse racing, jockey fall, jockey injury*

J. Equine Sci.
Vol. 31, No. 4
pp. 101–104, 2020

Jockey safety is of paramount importance for racing industries from the perspective of welfare and public perception. It is necessary to understand the epidemiology and analyze the risk factors associated with the incidences of jockey falls (JFs) and jockey injuries (JIs) to design and implement appropriate interventions. The incidence rates of JFs and JIs have been studied in several countries, including Australia, France, Great Britain, Ireland, New Zealand, and the United States [1, 3, 4, 13]. The occurrence of JFs can be affected by factors such as racing style, field size, track condition, horse or jockey experience, and the method of data collection [2, 5, 8, 11], warranting an epidemiological study in each racing jurisdiction. The numbers of JFs in thoroughbred races organized by the Japan Racing Association (JRA) between 1998 and 2000 [10] were 211 and 282 in 130,433 and 4,220 rides in flat and jump races, respectively. However, because the rates of JIs were not fully described, the characteristics of JFs that are likely to cause JIs require further elucidation.

The aim of this descriptive epidemiological study was to thoroughly describe the rates, causes, and locations of JFs and JIs in flat and jump races organized by the JRA between 2003 and 2017. Furthermore, despite possible differences in the definition of JFs or JIs among countries and studies, we compared the rates with those reported worldwide with a view to using our findings as the basis of a future study analyzing related risk factors.

Data concerning JFs and JIs associated with JRA races from January 1, 2003, to December 31, 2017, were collated from official accident reports compiled by the race stewards (Stewards' reports). During the study period, 715,210 rides in flat races were recorded at 10 racecourses, and 25,183 rides in jump races were recorded at 8 racecourses. Flat races were held year-round on turf or dirt and ranged between 1,000–3,600 m in length. Jump races were held year-round with hurdles (mobile obstacles with brush placed on top, 120–130 cm in height) and steeplechase fences (immobile obstacles made of hedges, with or without a solid base, 120–160 cm in height) and ranged between 2,750–4,260 m in length. In JRA jump races, a minimum of 8 obstacles (hurdles and/or steeplechase fences) are used depending on the course and distance. A JF was defined as a jockey being dislodged from a horse and was limited to falls occurring from the time of the start of a race until the horse crossed the finish line. JFs occurring before the start of the race or after the horse had crossed the finish line

Received: April 13, 2020

Accepted: October 5, 2020

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were excluded. The incidence rate of JFs was expressed as the number of JFs per 1,000 rides and was calculated as $JF \text{ incidence rate} = \text{number of JFs} / \text{number of rides} \times 1,000$. A JI was defined as an injury where a medical certificate was issued stating that the fallen jockey had developed an orthopedic disorder. The medical certificates were issued by the attending physician at the racecourse clinic or at the hospital where the fallen jockey was admitted. The decision regarding whether a fallen jockey would go to a clinic or a hospital was made by the jockey or the first-aid staff based on the severity of the condition. The medical certificates were easily obtainable because they were stored as attached documents to the official accident reports. The incidence rate of JIs was expressed as the number of JIs per 1,000 rides and was calculated as $JI \text{ incidence rate} = \text{number of JIs} / \text{number of rides} \times 1,000$.

A previous study [6] categorized the causes of JFs and JIs in flat races as stumbled, clipped heels, horse fatality, hampered by fallen horse, shifted ground abruptly, horse behavior, or others. The locations where JFs occurred were classified as shortly after the start, corner, or stretch. In jump races, the causes of JFs and JIs were categorized as lost balance, hampered by fallen horse, clipped heels, horse fatality, stumbled, or other. The locations where the JFs occurred were classified as shortly after the start, corner, stretch, slope, hurdle, or steeplechase fence. For clarification, the stumbled category for falls included such instances as a jockey being thrown from a stumbling horse or falling from the side of a stumbling horse, and the clipped heels category included such instances as a horse running behind another horse and stepping on the hind feet of that horse. Horse fatality was recorded as the cause of a fall only when it was clearly stated in the official accident report that the JF was a direct result of it.

Our study recorded 992 JFs and 399 JIs in flat races, with incidence rates of 1.4 and 0.6 per 1,000 rides, respectively. The locations and causes of JFs and JIs are presented in Table 1. Overall, the percentage of JFs resulting in JIs was 40.2%. At corners, 56.8% of JFs resulted in JIs. The

largest numbers of JFs were caused by stumbling, followed by clipped heels and then horse fatality. Clipped heels and horse fatality were the major cause of JIs, with >50% leading to JIs.

Our study recorded 1,117 JFs and 458 JIs in jump races, with incidence rates of 44.4 and 18.1 per 1,000 rides, respectively. The percentage of JFs that resulted in JIs was 41.0%. The locations and causes of JFs and JIs are presented in Table 2. The major causes of JFs and JIs were lost balance and hampered by a fallen horse at an obstacle. Of the JFs that occurred at hurdles and steeplechase fences, 51.9% and 39.4% resulted in JIs, respectively.

An international comparison of the incidence rate of JFs and JIs in flat and jump races is presented in Table 3. The incidence rates of JFs in flat races in our study were comparable with those reported in Australia and the United States but were lower than those reported in France, Ireland, and Great Britain [4, 6, 8, 9] (Table 3). Of note, the incidence rates in France, Great Britain, and Ireland included JFs occurring on race days from the time when the jockey mounted the horse at a parade ring (mounting yard) to when the jockey dismounted after the race [8, 9]. Due to data availability, only JFs occurring from the start of a race until crossing the finish line were included in our study. This would mean that JFs occurring before the start of a race or after horses crossed the finish line were not included in our study. In addition to the difference in inclusion criteria for JFs, an Australian study suggested that shorter race distance and lower race grade could be associated with the occurrence of JFs [5]. Whether these factors affect the occurrence of JFs in our population is a subject for future study. Our results showed that JIs occurred at a rate of 0.6/1,000 rides, and similar rates were reported in Australia and the United States [4, 6]. However, the rates of JIs were higher in France, Ireland, and Great Britain in comparison with our study [8, 9]. Factors influencing the occurrence of JIs have not been investigated in any of the countries, and therefore reasons for the difference in the incidence rates could not be determined.

Table 1. Locations and causes of jockey falls (JFs) and jockey injuries (JIs) occurring in flat races

	Shortly after start			Corner			Stretch			Total		
	JFs	JIs	JIs/JFs (%)	JFs	JIs	JIs/JFs (%)	JFs	JIs	JIs/JFs (%)	JFs	JIs	JIs/JFs (%)
Stumbled	310	57	18.4	8	7	87.5	6	3	50.0	324	67	20.7
Clipped heels	28	12	42.9	115	72	62.6	61	36	59.0	204	120	58.8
Horse fatality	3	0	0	85	50	58.8	91	45	49.5	179	95	53.1
Hampered by fallen horse	4	2	50.0	103	50	48.5	43	19	44.2	150	71	47.3
Shifted ground abruptly	35	6	17.1	15	8	53.3	24	18	75.0	74	32	43.2
Horse behavior	33	5	15.2	3	1	33.3	2	1	50.0	38	7	18.4
Others	11	2	18.2	4	1	25.0	8	4	50.0	23	7	30.4
Total	424	84	19.8	333	189	56.8	235	126	53.6	992	399	40.2

Studies in France, Great Britain, and Ireland showed that approximately 40% of JFs in flat races resulted in JIs [8, 12], which was similar to our finding of 40.2%. Being a jockey in thoroughbred races is considered a high-risk and dangerous occupation [3]. A single fall can lead to career-ending injuries unless first-aid treatment is immediately administered. Our study, which analyzed the causes and locations of JFs and JIs, will be useful for enabling the appropriate assignment of medical professionals who can administer appropriate first aid to fallen jockeys at the racetrack. In our study, 56.8% of JFs at corners resulted in JIs. Particularly in races with a large number of starters, jockeys may have to race in tighter and closer proximity to each other at corners, and thus, fallen jockeys could be more likely to be struck by the horses they are riding or other horses following them. In the stretch, over half of JFs (53.6%) resulted in JIs. Particularly in the final stretch, horses run at their top speed. Under such circumstances, the impact forces experienced by jockeys after JFs can be greater, which may lead to JIs. The most common cause of JFs was stumbling, followed by clipped heels and horse fatality. Notably, the latter two causes resulted in a higher likelihood of JIs. This was broadly in line with studies in which horse fatality was suggested as a critical target to reduce JIs [7, 14]. Our study found that the majority of JFs with causes classified as stumbled were recorded shortly after the start of a race (310/324). Horses occasionally stumble out of the starting gate. Compared with JFs at other

locations, we speculate that a relatively lower impact force would be generated in the event of a JF occurring shortly after the start of a race because of the slower running speed of the horse, which may account for the limited occurrence of JIs (57/310, 18.4%) in this setting. This agreed with the results of an American study of thoroughbred flat races, in which the occurrence of JIs as a result of JFs caused by stumbling during races was limited (8/45, 17.8%) [6].

The incidence rate of JFs in jump races was similar to those reported in Ireland and Australia [4, 9] but less than those reported in Great Britain and France [8] (Table 3). Studies in Australia and Great Britain indicated that the risk of JFs could be influenced by factors such as race speed, race grade and distance, fence type and location, field size, and experience of the horse or jockey [2, 11]. In Ireland, France, and Great Britain, the distances of some jump races are longer, with the longest being 7,200 m [8, 9]. The location and height of the fences likely differ between countries and between racecourses. Several other factors might be associated with the difference in the incidence rates recorded in each country. The incidence rate of JIs in our study was higher than those reported in Australia, Ireland, France, and Great Britain [4, 8, 9] (Table 3). To date, no analytic epidemiological studies have been conducted to identify risk factors for JIs, and therefore contributing factors for the higher incidence rate of JIs in our study could not be speculated.

The percentage of JFs that resulted in JIs in jump races

Table 2. Locations and causes of jockey falls (JFs) and jockey injuries (JIs) occurring in jump races

	Shortly after start			Corner			Stretch			Slope			Hurdle			Steeplechase fence			Total		
	JFs	JIs	JIs/JFs (%)	JFs	JIs	JIs/JFs (%)	JFs	JIs	JIs/JFs (%)	JFs	JIs	JIs/JFs (%)	JFs	JIs	JIs/JFs (%)	JFs	JIs	JIs/JFs (%)	JFs	JIs	JIs/JFs (%)
Lost balance	1	0	0	8	0	0	0	0	0	9	6	66.7	167	91	54.5	787	319	40.5	972	416	42.8
Hampered by fallen horse	1	0	0	3	1	33.3	1	0	0	1	1	100.0	14	6	42.9	76	24	31.6	96	32	33.3
Clipped heels	0	0	0	4	2	50.0	0	0	0	0	0	0	6	0	0	17	4	23.5	27	6	22.2
Horse fatality	0	0	0	2	0	0	5	1	20.0	1	0	0	0	0	0	2	0	0	10	1	10.0
Stumbled	6	1	16.7	0	0	0	1	0	0	2	1	50.0	0	0	0	0	0	0	9	2	22.2
Others	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	50.0	3	1	33.3
Total	9	1	11.1	17	3	17.6	7	1	14.3	13	8	61.5	187	97	51.9	884	348	39.4	1,117	458	41.0

Table 3. International comparison of incidence rates of jockey falls (JFs) and jockey injuries (JIs) in flat and jump races

	Japan	Australia	France	Great Britain	Ireland	United States
Flat races						
JFs	1.4	1.4	3.1	4.4	3.8	1.6
JIs	0.6	0.7	1.2	1.8	1.4	0.8
Jump races						
JFs	44.4	52.6	91.4	67.7	49.5	-
JIs	18.1	5.1	11.9	12.2	10.1	-

Incidence rates are shown per 1,000 rides. Sources of data: Japan, present study; Australia, Hitchens *et al.* [4]; France and Great Britain, McCrory *et al.* [8]; Ireland, O'Connor *et al.* [9]; United States, Hitchens, Hill *et al.* [6].

was 41.0%, which was higher than in Great Britain (17.7%), Ireland (12.3%), and France (13.0%) [8, 12]. The reason for the differences in the rates remains unclear. In our study, the majorities of JFs and JIs were recorded at an obstacle. An Australian study suggested that most falls in jump races occurred at an obstacle, with 9.7% resulting in a significant injury [4]. Our study recorded a higher rate of JIs (>50%) as a result of JFs at an obstacle. In jump races in Great Britain, >90% of falls were associated with horses colliding with an obstacle [11]. This was in agreement with our findings that >90% of JFs occurred at an obstacle.

In our study, >50% of JFs occurring at hurdles resulted in JIs. In contrast, 39.4% of JFs occurring at steeplechase fences led to JIs. Hurdles are generally lower than steeplechase fences. Thus, we speculated that the jockeys approached the hurdles at a faster speed than when approaching steeplechase fences, which could have contributed to the higher incidence of JIs at hurdles.

Our study was limited in its scope because JFs and JIs were recorded solely during races, and incidents occurring before the start of a race or after horses crossed the finish line were not included. Furthermore, the definition of JI was not strictly equal among countries, and comparisons of the incidence rates should be interpreted with caution.

In conclusion, the incidence rates for JFs and JIs in JRA races were comparable with those reported internationally. Approximately 40% of JFs resulted in JIs in both flat and jump races. In flat races, 56.8% of JFs at corners resulted in JIs. In jump races, the major causes of JFs and JIs were lost balance or hampered by a fallen horse at an obstacle. Prevention strategies aimed at improving factors associated with JFs should be implemented to ensure the welfare and safety of jockeys. Therefore, future studies should examine the risk factors for JFs in JRA races.

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