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Predictors of race-day jockey falls in flat racing in Australia

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ABSTRACT

Objectives Riding thoroughbred racehorses is a hazardous occupation. In this study, we investigated risk factors associated with falls by licensed thoroughbred racing jockeys participating in flat races conducted in Australia.

Methods Data on race-day falls were extracted from stewards' reports. Denominator data were provided by Racing Information Services Australia on races conducted in Australia from August 2002 until July 2006. Incidence rate ratios (IRRs) were estimated using Poisson regression. Analyses were stratified by race grade (maiden, class, open/restricted).

Results In multivariable analyses, factors associated with falls were female sex of jockey (IRR 1.11; 95% CI 1.00 to 1.23), being an apprentice jockey (IRR 1.51; 95% CI 1.39 to 1.63), being an amateur jockey (IRR 1.44; 95% CI 1.11 to 1.86), drier tracks ($p<0.001$), younger horse age ($p<0.001$), shorter race distance ($p<0.001$), lower field size ($p=0.013$) and lower race grade ($p<0.001$). The IRRs for five factors associated with falls differed by category of race grade: those for apprentice jockey (interaction $p=0.003$), higher prize money (interaction $p<0.001$) and shorter race distance (interaction $p=0.041$) were greater in lower race grades, while those for fewer previous rides this meeting (interaction $p=0.027$) and drier track rating (interaction $p=0.035$) were greater in higher race grades. Female jockeys had a significantly higher incidence of falls when riding horses under 4 years of age in open and restricted races (interaction $p=0.038$), and the effects of lower field size in maiden races, and of shorter races, were more pronounced for falls occurring before the race.

Conclusions We identified a range of factors associated with falls to thoroughbred racing jockeys riding in flat races that adds to the evidence base for formulating strategies to improve occupational health and safety standards in the thoroughbred racing industry.

What this paper adds

- Rates of falls, injuries and fatalities have been investigated but, to date, there has not been a study of factors associated with falls to thoroughbred racing jockeys riding in flat races.
- In multivariable analyses, factors associated with falls were female sex of jockey, being an apprentice jockey, being an amateur jockey, drier track rating, younger horse age, shorter race distance, lower field size and lower race grade.
- The effect of five factors associated with falls differed by category of race grade: those for apprentice jockey, higher prize money and shorter race distance were greater in lower race grades, while those for fewer previous rides this meeting and drier track rating were greater in higher race grades.
- We have identified a range of factors associated with falls that, if confirmed, could be the basis for formulating strategies to improve occupational health and safety standards in the thoroughbred racing industry.

INTRODUCTION

Riding race horses is a hazardous occupation. On average, licensed jockeys in Australia experience a fall at the rate of 1 per 240 rides in flat racing. Any one of those falls could be career ending, 27.0% of these falls result in injury and 0.16%, or 1 in 620 falls, result in death.[1]

Injury and death rates for thoroughbred racing jockeys have been reported previously in studies conducted in Great Britain,[2–7] Ireland,[3 4 6 7] France,[6 7] the United States of America[8 9] and Japan,[10] and by our group in Australia.[1] These studies have consistently found that the majority of injuries are caused by falls.[4 6–10] While the differences in fall rates between amateur and professional racing[7] and different types of track surfaces[4] have been commented on, factors associated with falls to jockeys in the thoroughbred horse-racing industry have yet to be investigated. Designing and implementing appropriate interventions to prevent falls requires an understanding of the numerous factors that are associated with these falls.

Studies of injuries to riders in equestrian and recreational settings have pointed to some of the factors that may be important. They are younger age, height[11] and fractious behaviour[12 13] of the horse, sex and experience of the rider[11–23] and warmer months.[13] However, for the most part, these findings have little relevance to falls and injuries to licensed jockeys in thoroughbred horse-racing. A study of risk factors particular to this occupational group is required.

In this study, we investigated factors associated with higher rates of falls by licensed thoroughbred racing jockeys participating in flat races conducted in Australia during the period August 2002 to July 2006. The falls investigated were those occurring on race days from the time of mounting the horse before the race to the time of dismounting after the race.

MATERIALS AND METHODS

Sources of data

Information on falls of licensed jockeys at race meetings throughout Australia was collated through a search of stewards' reports provided by the Principal Racing Authority (PRA) of each state or territory of Australia. A fall was defined as a rider being dislodged from a horse, regardless of the outcome, and an injury was considered to have occurred if the jockey was declared unfit to ride or was transported to hospital after a fall. This does not include minor injuries that do not preclude the jockey from riding. These data covered 93% of race meetings conducted during those racing seasons. Racing Information Services Australia (RISA), the official repository for all thoroughbred race results across Australia, provided comprehensive data on every race conducted at race meetings run by a PRA from 1 August 2002 to 31 July 2006. These data were merged with the incident falls data by 1:1 matching on race date, race course, race number, jockey name and horse name. Details are provided elsewhere.[1]

Statistical analysis

Poisson regression was used to estimate incidence rate ratios (IRR) with 95% CIs. The Poisson model uses a logarithmic link to model the logarithm of the mean number of falls at each combination of values of the covariates. By including the logarithm of the number of rides as an offset, we are in effect modelling the rate of falls. Multiple observations on the same jockey were condensed into summary data on falls and rides at each level of the covariates with adjustment of standard errors to take account of clustering.

In univariable analyses, study factors were grouped with other like variables (jockey conditions, horse conditions, race conditions, weather and track conditions). For study factors with multiple categories, we included in the model binary (0/1) indicator variables for categories other than the reference category. Tests for linear trend for ordered categorical variables were conducted by replacing the binary indicators with a single predictor taking category rank scores (1=first category, 2=second category, etc) and assessing the statistical significance of its coefficient.

In multivariable analyses, the significant predictors from each group of univariable analyses were entered in a single model and retained in analyses if they were statistically significant, or if they modified the estimated effect of other study factors, or if their inclusion changed the coefficient of covariates for other study factors by more than 10%. Interaction was assessed from the coefficients of product terms (the product of two or more covariates). Effect modification was considered present if the test of the coefficient of a product term yielded a p value less than 0.05.

The effect of race grade varied significantly across other covariates. To report these different effects, the analyses were stratified into three categories of race grade—maiden (horses having not won a race), class (horses classed from A–D in amateur racing or 1–6 in professional racing) and open and restricted conditions (horses racing in open graded races or races with restricted conditions)—and results are reported for each category.

Jockeys are classified by licence (professional or amateur) and by experience (apprentice or full licence). Amateur jockeys do not receive a fee or reward for riding, and professional jockeys are paid a riding fee and receive a percentage of the prize money at stake. Additionally, amateur riders are only licensed to ride at picnic race meetings. Apprentice jockeys typically undergo a 4-year apprenticeship before they can obtain their full licence. Previous race rides at a race meeting was divided into the categories of 0 rides, 1 to 2 rides and 3 or more rides. The Australian and New Zealand classifications of race distance is sprint (<1301 m), middle (1301–1800 m), intermediate (1801–2199 m), long (2200–2700 m) and extended (>2701 m). We combined middle and intermediate ('middle') and long and extended ('staying'). Each level of track rating is based on penetrometer readings of water retention, with heavy indicating the wettest and fast the driest ends of the scale. Club level was divided into metropolitan/provincial race clubs, country clubs and picnic clubs (where non-professional races are held). Field size refers to the number of starters in a race, and was divided into the categories of less than 8 starters, 8–12 starters, and over 12 starters.

All analyses were conducted with Stata 10.0.

RESULTS

There were 836 injuries and 3101 jockey falls from 743 445 flat race rides in 74 873 flat races and 10 373 race meetings. For each race season in the study period, there was an average of 32 096 registered horses, 4184 licensed horse trainers, 394 race clubs and 365 race tracks. The number of jockeys licensed to ride over the study period averaged 1047 per race season, with approximately 24% of these licensed as apprentice jockeys and 7% licensed as amateur jockeys.[24–27]

Univariable analysis

Table 1 presents ratios of incidence of falls per ride for categories of jockey and horse characteristics that may be predictors of falls. Significantly higher fall rates were experienced by female jockeys, apprentice jockeys, amateur jockeys, jockeys having fewer previous rides this meeting, jockeys riding younger horses and jockeys riding fillies or mares. Falls occurred more frequently in lower grade races and races with less prize money at stake.

Table 2 presents the univariable results for weather, track and race conditions. Significant predictors of falls included dryness of the track, races conducted outside the metropolitan or provincial area (club level) and shorter race distances. There was a complex pattern of falls per ride with weather conditions, with the greatest incidence on showery or stormy days, but there were few race meetings conducted in those conditions with a low number of starters (n=728). There was a significant trend of increasing fall rates with fewer starters as a continuous variable (p=0.049), but this is not evident in the way the number of starters has been grouped for the categorical analyses reported in the table. There were no significant differences between field size categories or between turf, dirt/sand and synthetic surface tracks, although only the Acton track at Canberra Race Club was conducting race meetings on a synthetic track during the study period.

Multivariable analysis

In multivariable analyses, factors associated with falls were female sex of jockey (IRR 1.11; 95% CI 1.00 to 1.23), being an apprentice jockey (IRR 1.51; 95% CI 1.39 to 1.63), being an amateur jockey (IRR 1.44; 95% CI 1.11 to 1.86), drier track rating (p<0.001), younger horse age (p<0.001), shorter race distance (p<0.001), lower field size (p=0.013) and lower race grade (p<0.001).

The incidence rate ratio's of five factors associated with falls differed by category of race grade: those for apprentice jockey (interaction p=0.003), higher prize money (interaction p<0.001) and shorter race distance (interaction p=0.041) were greater in lower race grades, while those for fewer previous rides this meeting (interaction p=0.027) and drier track rating (interaction

Table 1 Univariable incidence rate ratios (IRR) for falls in flat racing: jockey and horse characteristics

Variable	Falls	Rides	Univariable IRR (95% CI)
Jockey sex			
Male	2610	654810	1.00
Female	438	88500	1.24 (1.08 to 1.42)
Jockey experience			
Full licence	2160	583700	1.00
Apprentice	874	157857	1.50 (1.35 to 1.66)
Jockey licence			
Professional	3038	732194	1.00
Amateur	63	11251	1.35 (1.04 to 1.75)
Previous rides this meeting			
≥3 rides	665	205318	1.00
1–2 rides	1268	303895	1.29 (1.16 to 1.43)
0 rides	1168	234232	1.54 (1.35 to 1.75)
Trend			p<0.001
Horse sex			
Gelding	1772	453133	1.00
Entire	86	20548	1.07 (0.85 to 1.35)
Filly/mare	1233	268809	1.17 (1.06 to 1.30)
Horse age			
>6 years old	199	68770	1.00
4– 6 years old	1626	447149	1.26 (1.07 to 1.48)
<4 years old	1266	226571	1.93 (1.63 to 2.28)
Trend			p<0.001
Race grade			
Open/restricted	552	189561	1.00
Class	1178	336260	1.20 (1.07 to 1.35)
Maiden	1371	217624	2.16 (1.92 to 2.43)
Trend			p<0.001
Prize money			
>$A25k	305	101825	1.00
$A10–25k	756	211866	1.19 (1.03 to 1.37)
< $A10k	2039	429558	1.58 (1.39 to 1.81)
Trend			p<0.001

p=0.035) were greater in higher race grades. The effect of amateur licence was confined to open and restricted races (interaction p=0.063), and younger horse age became progressively more important in higher grade races (interaction p=0.117), but these trends did not reach statistical significance. Table 3 presents adjusted incidence rate ratios stratified by race grade (maiden, class, and open and restricted).

Fully adjusted for all other factors, including jockey experience and licence type, the effect of female sex of jockey was restricted to open and restricted grade races. We investigated further and found that female jockeys had a significantly higher incidence of falls when riding horses under 4 years of age (interaction p=0.038) (see figure 1).

In univariable analyses, the linear effect of number of previous rides this meeting was attenuated by adjustment for jockey experience (11.7%), race distance (12.7%), horse age (32.2%) and race grade (46.9%). Adjusting for sex of jockey, amateur jockey licence, field size, prize money at stake and track rating made almost no effect. Table 3 shows that the increase in fall rates with fewer previous rides remained significant in open and restricted races after adjustment for all other factors.

The risk-intensifying effect of lower field size in maiden races also prompted further investigation. Figure 2 presents the data stratified by location of the fall and shows that the increase was restricted to falls occurring before the race. In analyses of falls before the race, with falls during and after the race re-classified as non-falls, adjusting for prize money at stake and the horse's age decreased the effect of field size, but the increase was not fully explained by those factors.

Figure 3 depicts fall rates in sprint, middle distance and staying races stratified by location of the fall for all three race grades combined, and shows that the higher incidence of falls in sprint races was mainly confined to falls occurring before the race.

To test the applicability of these finding as a description of factors associated with falls resulting in injury, we fitted the multivariable model to the data after excluding falls that had not resulted in injury. Amateur jockey licence was no longer important as a predictor, but otherwise the estimates were consistent with those in the all falls model. None of the

Table 2 Univariable incidence rate ratios (IRR) for falls in flat racing: weather, track and race conditions

Variable	Falls	Rides	Univariable IRR (95% CI)
Track rating*			
Heavy	140	41520	1.00
Slow	184	52531	1.04 (0.82 to 1.31)
Dead	426	106307	1.19 (0.98 to 1.45)
Good	2088	496436	1.25 (1.05 to 1.49)
Fast	262	46416	1.67 (1.34 to 2.08)
Trend			p<0.001
Track type			
Dirt/sand/synthetic	173	37034	1.00
Turf	2928	706411	1.13 (0.94 to 1.34)
Weather			
Sunny	2491	574932	1.00
Fine	532	143276	0.86 (0.76 to 0.96)
Overcast	69	23779	0.67 (0.53 to 0.85)
Shower/storm	9	728	2.85 (1.52 to 5.37)
Club level			
Metropolitan/provincial	969	259314	1.00
Country	2069	472880	1.17 (1.05 to 1.31)
Picnic	63	11251	1.50 (1.15 to 1.95)
Trend			p=0.001
Field size			
>12 starters	783	196068	1.00
8–12 starters	1907	451081	1.06 (0.96 to 1.17)
<8 starters	411	96296	1.07 (0.93 to 1.23)
Trend			p=0.266
Race distance†			
Staying (≥2200 m)	46	18881	1.00
Middle (1301–2199 m)	1058	315250	1.38 (1.01 to 1.88)
Sprint (≤1300 m)	1997	409314	2.00 (1.47 to 2.72)
Trend			p<0.001

*Each level of track rating is based on penetrometer readings of water retention, with heavy indicating the wettest and fast the driest ends of the scale.
†Race distance uses the Australian and New Zealand classifications for distance parameters, but combines middle (1301–1800 m) and intermediate (1801–2199 m) into one category, namely middle, and long (2200–2700 m) and extended (>2701 m) into one category, namely staying.

Table 3 Multivariable incidence rate ratios (IRR) for falls in flat racing stratified by race grade

	Maiden races			Class races			Open and restricted conditions		
Variable	**Falls**	**Rides**	**IRR (95% CI)**	**Falls**	**Rides**	**IRR (95% CI)**	**Falls**	**Rides**	**IRR (95% CI)**
Jockey sex									
Male	1135	190772	1.00	996	292284	1.00	479	171275	1.00
Female	207	26809	1.12 (0.96 to 1.31)	164	43941	0.99 (0.84 to 1.18)	67	17750	1.33 (1.01 to 1.75)
Jockey experience									
Full licence	931	172408	1.00	811	261121	1.00	418	150171	1.00
Apprentice	406	44671	1.67 (1.48 to 1.88)	342	74132	1.51 (1.33 to 1.72)	126	39054	1.21 (0.98 to 1.48)
Jockey licence									
Professional	1351	215225	1.00	1164	332566	1.00	523	184403	1.00
Amateur	20	2399	1.13 (0.70 to 1.81)	14	3694	0.95 (0.55 to 1.64)	29	5158	2.51 (1.63 to 3.85)
Previous rides this meeting									
≥3 rides	116	18368	1.00	389	118324	1.00	160	68626	1.00
1–2 rides	543	85779	0.94 (0.77 to 1.15)	515	144788	1.06 (0.93 to 1.21)	210	73328	1.10 (0.89 to 1.36)
0 rides	712	113477	0.86 (0.70 to 1.05)	274	73148	1.02 (0.87 to 1.20)	182	47607	1.27 (1.02 to 1.59)
			p=0.072			p=0.622			p=0.010
Track rating									
Heavy	78	14082	1.00	50	18822	1.00	12	8616	1.00
Slow	87	15537	0.99 (0.73 to 1.34)	65	22420	1.10 (0.76 to 1.60)	32	14574	1.54 (0.79 to 2.98)
Dead	198	32436	1.10 (0.84 to 1.43)	141	46106	1.16 (0.84 to 1.61)	87	27765	2.16 (1.18 to 3.96)
Good	910	146113	1.08 (0.85 to 1.36)	814	226746	1.33 (1.00 to 1.78)	364	123577	2.19 (1.23 to 3.90)
Fast	98	9396	1.77 (1.31 to 2.38)	107	22018	1.87 (1.33 to 2.62)	57	15002	2.96 (1.58 to 5.56)
			p=0.030			p<0.001			p<0.001
Horse age									
>6 years old	16	1980	1.00	80	23672	1.00	103	43118	1.00
4–6 years old	543	95149	0.82 (0.48 to 1.40)	844	253129	1.05 (0.82 to 1.33)	239	98871	1.07 (0.84 to 1.37)
<4 years old	803	120012	1.00 (0.59 to 1.69)	253	59181	1.34 (1.03 to 1.75)	210	47378	1.89 (1.44 to 2.50)
			p=0.003			p=0.003			p<0.001
Prize money									
> $A25k	1	544	1.00	34	12244	1.00	270	89036	1.00
$A10k–25k	239	45630		357	108251	1.14 (0.80 to 1.62)	160	57985	0.95 (0.78 to 1.17)
<$A10k	1131	171444	1.17 (1.02 to 1.35)	786	215746	1.21 (0.86 to 1.72)	122	42368	0.88 (0.66 to 1.16)
			p=0.015			p=0.164			p=0.352
Field size									
>12 starters	395	72238	1.00	244	71176	1.00	144	52654	1.00
8–12 starters	855	129964	1.17 (1.04 to 1.32)	733	212317	0.98 (0.85 to 1.14)	319	108800	1.03 (0.84 to 1.26)
<8 starters	121	15422	1.36 (1.10 to 1.68)	201	52767	1.02 (0.84 to 1.25)	89	28107	1.02 (0.75 to 1.37)
			p=0.002			p=0.906			p=0.864
Race distance									
Staying (≥2200 m)	4	1088	1.00	24	8343	1.00	18	9450	1.00
Middle (1301–2199 m)	365	73763	1.25 (0.47 to 3.35)	455	151810	1.08 (0.70 to 1.65)	238	89677	1.33 (0.83 to 2.16)
Sprint (≤1300 m)	1002	142773	1.71 (0.64 to 4.56)	699	176107	1.35 (0.88 to 2.07)	296	90434	1.46 (0.90 to 2.36)
			p<0.001			p<0.001			p=0.070

IRRs are fully adjusted for all other variables in the table.

interactions were statistically significant in the reduced dataset, however. Significant predictors of injurious falls were apprentice jockey (IRR 1.24; 95% CI 1.06 to 1.45), drier track rating (p=0.002), younger horse age (p<0.001), shorter race distance (p=0.024) and lower race grade (p<0.001).

DISCUSSION

This is the first study to investigate predictors of falls by licensed thoroughbred racing jockeys. It adds to studies of injuries in equestrian and recreational horse riding,[11–14 16–23 28] a review of injuries to jockeys in the state of Victoria,[29] and studies reporting fall and injury incidence rates in thoroughbred horse racing.[1–4 6–8 30–34] Factors found to be associated with falls were lower race grades, female sex of jockey, apprentice jockeys, amateur jockeys, fewer previous rides this meeting, lower club level, drier tracks, adverse weather conditions, younger horses, lower prize money at stake, smaller field sizes and shorter distance races. Risk factors for injuries were found to be the same risk factors we identified for falls, with the exception of amateur jockey licence.

We found that female jockeys had a higher fall incidence rate than male jockeys but, on further investigation, this effect of sex of jockey was confined to riding horses younger than 4 years of age in open and restricted races. We suppose that riding younger inexperienced horses in higher pressure open and restricted races causes increased handling problems for all but the strongest, most experienced riders. There were no sex differences in fall rates in the lower race grades. Adjusting for experience and licence type of the jockey decreased but did not explain the elevation in rates for female jockeys in open and restricted races.

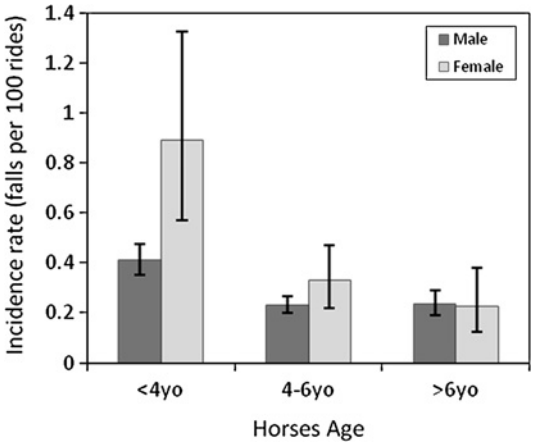

Figure 1 Effects of sex of jockey and horse age in open and restricted races.

Further investigation into why females have a higher fall incidence in races of that category is needed. This may require a study of the physiological and performance attributes of licensed jockeys.

Inexperience of the jockey was a significant risk factor, with apprentice jockeys having a higher fall rate than full licensed jockeys, and this was most pronounced in lower grade races. Consistent with this finding, other studies have found that inexperience of the rider is a risk factor for injury in equestrian and recreational horse riding.[12 16–19] Conversely, some studies have found that more experienced equestrian riders were involved in more incidents and higher incidence rates occur in higher grade of competition,[22] possibly because higher grade competition involves a higher grade of difficulty.[23] Our findings in respect of thoroughbred racing suggest that the experience of the horse is a contributing factor, because the effect was stronger in lower grade races that generally are contested by less experienced horses. That this is the case was further suggested by our results for prize money at stake. In this study, the fall incidence rate was greatest in the lower grade races with least prize money at stake. This suggests the need to investigate the specific skills that experienced riders use when riding inexperienced horses. Conducting a thorough study of the physiological and performance attributes of successful riders, and incorporating the findings in evidence-based apprentice training programs, may assist in reducing the incidence of falls. A further step that could be considered would be to restrict apprentice jockeys in the early stages of their career from riding young and inexperienced or difficult horses.

Amateur jockeys cannot ride at a professional flat race meeting and generally have less race-riding experience than professional jockeys, particularly in higher grade races. This may explain our finding that jockeys licensed as amateur had a significantly higher fall incidence rate than professional jockeys in open and restricted races. Amateur licence was not important in predicting injurious falls, however.

In open and restricted races, higher fall rates were experienced by jockeys who had fewer previous rides this meeting. Lacking the information to do so, we were unable to investigate whether jockey factors such as mental alertness, adequacy of warm-up and familiarity with the track were contributing factors.

There was an increasing trend in the incidence of falls to jockeys riding younger horses with regard to race grade. We think younger horses are likely to contribute to a higher fall incidence due to their inexperience and fractious behaviour. Factors such as younger age, and more fractious character of the horse, have been associated with injury occurrence in equestrian and recreational riding.[11–13] Together, these results suggest that more thorough education of horses in race-day conditions may be required prior to them commencing a racing career.

Two race conditions we identified as predictors, namely track condition and race distance, suggest that faster speeds and tighter racing contribute to an increase in the incidence of falls. There was an increasing incidence of falls on drier tracks, with markedly greater fall rates on fast tracks, and this effect progressively increased with higher race grades and was particularly pronounced in open and restricted grades. This suggests the need for further studies of falls to jockeys riding thoroughbred horses racing on fast tracks, with objective information on the state of the track (using penetrometer readings of moisture content, taken at the time of each race for example). We had penetrometer data for 1411 race meetings, but these readings were often taken in the early morning and did not always reflect the reported track conditions at the time the race was run. In respect of race distance, jockeys riding in sprint races (1300 m or under) had a higher fall incidence rate than those riding in staying races (2200 m and over) across all race grades, but this effect was most pronounced in maiden races. This is consistent with our findings in respect of track conditions because sprint races are generally run at faster speeds, with jockeys bustling for position and giving fellow jockeys less room to manoeuvre. On the other hand, most of the falls in sprint races occurred before

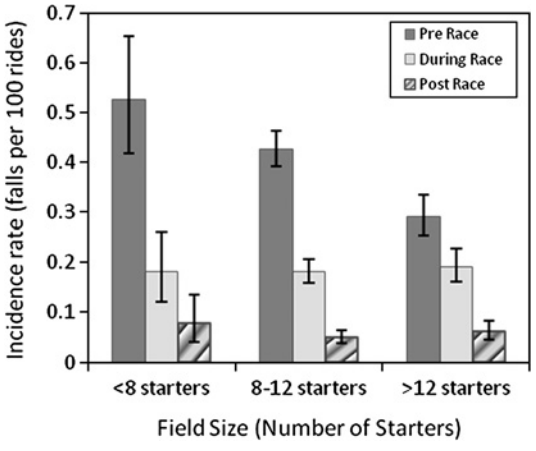

Figure 2 Effects of field size and location of fall in maiden races.

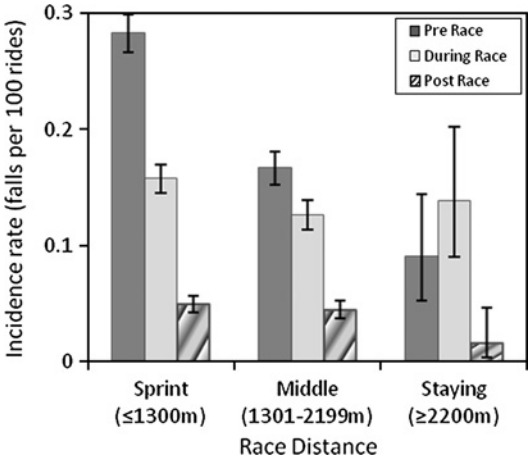

Figure 3 Effects of race distance and location of fall.

the race, suggesting that other factors—such as the behaviour of the horse—must play a part.

An unusual finding was that falls were more common in smaller field sizes in maiden races and this effect was confined to falls occurring before the race. We do not have an explanation for this. Horses are social animals,[35] with a herd instinct, and one possibility is that inexperienced horses may be more relaxed and less fractious in larger groups. Another possibility is that there is something different about the pre-race procedures when field sizes are smaller.

The strengths of this study were complete ascertainment of race information and high ascertainment of falls from the 93% of stewards reports we were able to obtain,[1] its large size that permitted close investigation of risk factors within strata of other factors, the confined nature of the study period that reduced heterogeneity due to changes in regulations and practices, the objective nature of most of the measurements and the wide range of study factors able to be investigated in their own right and as confounders or effect modifiers.

Some limitations of these analyses need to be considered, however. The observational design allows conclusions about associations but not about causation. Further, while we do not suspect bias in the information we obtained, we cannot discount the possibility of random error in the measurements of outcome and study factors. In addition, we had imperfect indicators of jockey experience, horse experience and weather and track conditions. Our indicator of jockey experience, for example, was whether they were apprentice or full-licensed jockeys and this does not provide information on training, years of experience, riding records in races of different conditions or sanctions for careless riding. We had no information on physical or performance attributes of the jockeys—such as age, muscular strength and endurance, balance, previous falls or injuries, nutritional status, fatigue or alertness—and no direct information on extraneous factors, for example crowd size and noise level, that could be important risk factors, confounders or effect modifiers.

Conclusion

This is the first epidemiological study of risk factors for falls to jockeys employed in thoroughbred racing. We have identified a range of factors associated with falls that, if confirmed, could be the basis for formulating strategies to improve occupational health and safety standards in the thoroughbred racing industry, thereby addressing the critical lack of information in this regard.

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