

# Investigations into Thoroughbred racehorse welfare in Queensland Australia focused on musculoskeletal injuries and retirement

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## Implications

- There are widespread public concerns regarding the ethical operation and the social licence for the Thoroughbred racing industry to continue operating. The primary welfare issues are injuries and fatalities, the racing of 2-yr-old horses and the outcomes for horses after they have retired. Although these issues are relevant to many other jurisdictions, the primary welfare concerns in other jurisdictions may vary to those in Queensland.
- We conducted a 13-mo prospective study to evaluate the welfare of Thoroughbred racehorses in Queensland, Australia.
- The incidence of musculoskeletal injuries was low (0.6% per week) and over the study period there were a total of 14 fatalities out of a median of 544 (IQR 538,547) horses in training every week.
- The hazard of MSI was increased with increasing age that training commenced (Hazard Ratio [HR]: 1.13, 95% CI: 1.06, 1.19,  $P < 0.001$ ) and decreased with increasing high-speed exercise distance (HR: 0.98, 95% CI: 0.97, 0.99,  $P < 0.001$ ). There were no adverse effects for racing two-year-old horses.
- Most of the 110 retired horses (98%) were successfully repurposed into alternative careers after their retirement from racing.

**Key words:** musculoskeletal injury, racehorse, retirement, thoroughbred, two-year-old, wastage

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## Introduction

The longevity of the Thoroughbred racing industry is threatened by public concerns regarding the welfare of horses. The primary issues include the incidence of musculoskeletal injuries (MSI) and fatalities, whether it is appropriate to race 2-yr-old horses and the outcomes for horses after they have retired from racing. As veterinarians are closely involved in the racing industry, our role is to investigate and ensure that the public can be confident in the quality of welfare management. We undertook a 13-mo detailed prospective investigation to understand the welfare of Thoroughbred racehorses in Queensland, Australia.

## Musculoskeletal Injuries and Fatalities

Despite extensive international research, MSI remain a global problem for the Thoroughbred racing industry. Globally, MSI are the most common cause of death in flat-racing horses, comprising over 70% of race day fatalities (Johnson et al., 1994; Wood et al., 2000; Parkin et al., 2004; Perkins et al., 2004; Boden et al., 2006; DeLay, 2017; Physick-Sheard et al., 2017; Rosanowski et al., 2017). In fact, between 7% and 49% of race-day injuries result in death [5, 8, 14, 20–24]. Furthermore, riders are more likely to be seriously injured or killed when their horse is injured. We investigated this problem by inviting trainers based at the three metropolitan racetracks in Brisbane, Australia, to participate in the survey (Crawford et al 2020). These tracks (Eagle Farm, Doomben, and Deagon) comprise the major racetracks in South-East Queensland. Recruitment of horses was performed by recruiting trainers and enrolling all the horses, of all ages, under their care. We invited all licenced trainers at Eagle Farm, Doomben, and Deagon with three or more horses in work at the time of recruitment to participate in the study. A minimum of three horses were selected to ensure efficient data collection and trainer capacity to supply sufficient horses throughout the study. We conducted weekly interviews with trainers to determine the incidence and type of injuries and the fatalities that occurred over the 13-mo period.

Data were analyzed with clustered Poisson regression analysis, adjusted for training track, season, and rainfall. Full details of the statistical methods and results are described elsewhere (Crawford et al., 2020). Briefly, there was a median of 544 (IQR 538,547) horses in training every week. The overall incidence of MSI was low (0.6%). The types of injuries differed between 2-yr-old (up until their third birthday) and older (greater than 3-yr-old) horses, with 2-yr-old horses more likely to have dorsal metacarpal disease (shinsore) and traumatic injuries/lacerations and less likely to have suspensory desmitis, superficial digital flexor tendonitis, proximal sesamoid bone fractures, and fetlock joint injuries than older horses. There were 14 fatalities during the study period, and 12/14 (86%) were due to injuries. These were equally distributed between 2-yr-old and older horses (Crawford et al., 2020).

### The Training and Racing of 2-Yr-Old Horses

The ideal time for Thoroughbred racehorses to commence training is strongly debated, with limited evidence to support that racing 2-yr-old horses is a welfare concern. In contrast, a series of experimental studies found that early race training facilitated superior tissue adaptation and was beneficial (Perkins et al., 2004; Rogers et al., 2005). Furthermore, longevity of racing career and improved performance is associated with starting horses at 2 yr of age (Velie et al., 2013). There are no previous prospective studies evaluating whether early race training is beneficial or harmful.

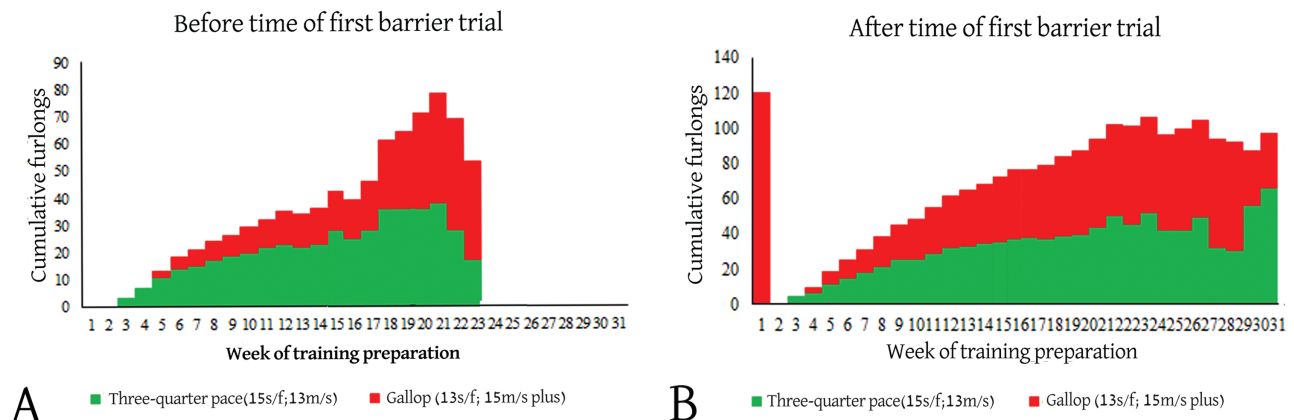
We investigated how training affects MSI in 2-yr-old horses in a detailed analysis of data collected concurrently with the abovementioned study. Briefly, we recruited 535 two-yr-old horses over the 13-mo study period. Together, these 535 horses provided exercise data for 1,258 training preparations over a combined total of 7,512 weeks. Full details of the methodology and data analysis are reported elsewhere (Crawford et al., 2021). In summary, the incidence of MSI in 2-yr-old horses (1.3%) was higher than in older horses (0.3%), but 2-yr-old horses were more likely to race or trial again after injury than

older horses. We investigated risk factors for MSI including high-speed exercise and the age that training commenced.

Survival analysis was performed using multivariable Cox Regression and Weibull Regression models to provide the hazard (which can be thought simply as an estimation of the relative risk) of MSI. Models were developed using a causal approach and adjusted as appropriate for days and distance of high-speed exercise, pre-training before each preparation, the number of training preparations, the age (in months) that training commenced, the rest before each preparation, whether non-ridden training modalities were used, the days of low-speed exercise and sex (Crawford et al., 2021). The hazard of MSI increased with increasing age that training commenced (HR: 1.13, 95% CI: 1.06, 1.19,  $P < 0.001$ ; Crawford et al., 2021). This finding supports the experimental evidence that early training facilitates superior tissue adaptation and the ability to withstand injury (Rogers et al., 2005). This is also biologically plausible because the tendons of young horses can adapt to exercise in response to the mechanical forces imposed; however, the tendon structure is mature by 2 yr of age, after which time there is no further adaptation (Perkins et al., 2004). Thus, horses commencing training at a later age do not experience this beneficial early tissue adaptation. The hazard of MSI was reduced with increased exposure to high-speed exercise (HR: 0.98, 95% CI: 0.97, 0.99,  $P < 0.001$ ). This also supports the need for early loading of tissues to facilitate adaptation and resilience to injury. It should be noted that these findings can only be interpreted within the range of high-speed exercise loads observed within this study, which was between 0 and 112 furlongs of galloping in the 2-yr-old season. The cumulative weekly high-speed exercise volume is illustrated in Figure 1.

### Retirement of Horses and Their Outcomes After Racing

There is public concern regarding retirement of racehorses and the outcome for these horses after racing. There is the belief that horses are unable to be repurposed after racing and



**Figure 1.** The average total weekly cumulative high-speed exercise training volume in 2-yr-old horses (A) before and (B) after their first barrier trial (official timed race trial).

end up in abattoirs rather than in an alternative career. There are no previous prospective studies evaluating these issues surrounding retirement and “wastage” of horses.

Over 13 mo, we followed a median of 544 horses in training every week. There were 110 retirements over the study period, a median of 2 (IQR 1, 3) per week, which equated to 0.4% (IQR 0.2%, 0.6%) of the horses in training (Crawford et al., 2021). Retirement from racing was defined as the owner’s decision to end the horse’s racing career based on the trainer’s recommendation. This definition did not capture injured horses that were intended to return to racing but for various reasons did not. Details for each retired horse were collected, and retirement was confirmed by cross-checking with the Racing Australia (RA) public database (Anon, 2020). Retirement was classified into involuntary and voluntary reasons. Reasons for involuntary retirement included 1) a musculoskeletal injury (MSI) causing an inability to train or race, 2) an upper respiratory condition, 3) a lower respiratory condition, 4) a cardiac problem, or 5) a behavioral problem precluding race training including poor barrier manners. Reasons for voluntary retirement included 1) lack of ability, whereby the horse lacked the ability to continue training and racing successfully; 2) reached their level, whereby the horse had performed well up to the current level but lacked the ability to progress to higher classes of races, or 3) impending MSI, whereby the horse had warning signs of MSI (joint effusion, pain on flexion, etc.) that could progress to a clinical problem with continued training and racing. In this study, involuntary retirements comprised 56/110 (51%) and voluntary retirements comprised 54/110 (49%). The largest number of retirements were due to musculoskeletal injuries, 40/110 (36%).

The outcomes for horses (8–21 mo) after retirement were evaluated. A total of 105 of 110 horses (95%) were alive and under care at the end of the follow-up period. There were five horses (5%) that were dead. Of these five horses, four were euthanased and one was sent to an abattoir due to severe illness or injury. One horse was euthanased after sustaining severe injuries in a paddock accident whereby it galloped through a fence one month after retirement. One horse was euthanased 5 mo after retirement following exacerbating the original injury, a midbody sesamoid fracture. One horse was sent to an abattoir 5 mo after retirement following exacerbating the original injury, a basilar sesamoid fracture. One horse was euthanased following a synovial laceration and infection, 8 mo after retirement. One horse was euthanased 12 mo after retirement due to severe colic. No horses were euthanased or sent to an abattoir by an owner or trainer directly after retirement from racing. One horse was sold to be used as a performance horse but was recognized several months later at a disposal sale and purchased by the jockey who used to ride him. He was subsequently repurposed as a pleasure horse.

Overall, 108/110 horses (98%) were successfully repurposed after retirement from racing, and 2/110 horses (2%) were lost to follow-up. Successful repurposing was defined as remaining in the new career for the follow-up period (8–21 mo after retirement). Most horses (50/110; 46%) were repurposed as performance horses. 12/40 (30%) of the horses that retired due to MSI were successfully repurposed as performance horses.

## About the Authors

**Dr. Kylie Crawford** has recently completed a PhD relating to the investigation of welfare in Thoroughbred racehorses in Queensland Australia. She is a specialist equine surgeon and has a strong interest in the Thoroughbred racehorses. She has extensive experience in the biostatistical investigation and analysis of the impact of factors on racehorse welfare. **Corresponding author:** [k.crawford@uq.edu.au](mailto:k.crawford@uq.edu.au)



**Professor Ahern** is a clinical academic at the University of Queensland with a strong interest in Thoroughbred racehorses. He is double boarded in Equine Surgery and Sports Medicine and Rehabilitation with a PhD related to respiratory function in horses.

Racehorses may be suitable for a performance athletic career despite their injuries having prevented them from racing, due to lower forces encountered in performance disciplines.

## Conclusion

This study supports the ethical management of horses during and after racing in the Queensland Thoroughbred racing industry. The injury and fatality rates were low and there were beneficial rather than adverse effects resulting from training 2-yr-old horses. Furthermore, most horses had alternative careers after retirement from racing. However, it must be noted that findings from this series of investigations may not be generalizable to other racing jurisdictions. Furthermore, post-racing outcomes are only one source of potential wastage across the industry.

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