Pferdeheilkunde 12 (1996) 4 (Juli August) 582–587

Racing injuries of two year old Thoroughbreds and Quarter Horses

Julia H. Wilson[1], *R. C. Jensen*[2] and *R. A. Robinson*[1]

[1]Department of Clinical & Population Sciences, St. Paul
[2]Illinois Racing Board, Chicago

Summary

Racing injuries of two year old Thoroughbreds and Quarter Horses in the U.S. were characterized using two databases of injury reports from racing regulatory veterinarians. Two year old Thoroughbreds sustained fewer racing injuries on dirt surfaces than older horses on a per start basis, and fewer fatal injuries. The major differences in the types of injuries of two year old Thoroughbreds versus older horses were that two year olds had significantly fewer soft tissue injuries, fewer carpal fractures and more upper limb long bone fractures. Injury rates were not higher earlier in the year, or at longer race distances, dispelling public concerns of relative musculoskeletal immaturity. Fatal fractures predominately were associated with the stretch turn, and non-fast racing surfaces. Colts were overrepresented in comparison to fillies. In Illinois, more training fatalities were reported for two year olds than racing fatalities. Quarter Horse injury patterns were similar as fractures predominated and no soft tissue injuries were reported.

Keywords: horse, racing injury, breed fracture

Verletzungen zweijähriger Vollblüter und Quarter Horses im Rennen

In den Vereinigten Staaten wurden Verletzungen im Rennen bei zweijährigen Vollblütern und Quarter Horses anhand von in zwei Datenbanken erfaßten Berichten von Rennbahntierärzten untersucht. Zweijährige Vollblüter erlitten, bezogen auf die Anzahl der Starts, auf der Sandbahn insgesamt weniger Verletzungen und weniger tödliche Verletzungen als ältere Pferde. Die Hauptunterschiede der Verletzungsarten bei zweijährigen und älteren Pferden bestanden darin, daß Zweijährige seltener Weichteilverletzungen, Frakturen des Karpus und häufiger Frakturen der langen Röhrenknochen im oberen Gliedmaßenbereich erlitten. Die Verletzungsrate war weder in der frühen Saison noch auf langen Renndistanzen erhöht, was die Bedenken der Öffentlichkeit hinsichtlich relativer Unreife von Muskulatur und Skelett zerstreut. Frakturen mit tödlichem Ausgang traten überwiegend im Schlußbogen und auf tieferem Boden auf. Es verunglückten mehr Hengste als Stuten. In Illinois wurden mehr tödliche Trainingsverletzungen der Zweijährigen als Verletzungen im Rennen erfaßt. Das Schema der Verletzungen bei den Quarter Horses war identisch mit dem der Vollblüter. Frakturen überwogen auch hier und es wurden keine Weichteilverletzungen erwähnt.

Schlüsselwörter: Pferd, Verletzung im Rennen, rassespezifische Fraktur

Introduction

In the United States, racing of two year old horses is widespread in contrast to Europe where horses usually make their first start as three year olds. This difference is often suggested as a reason for fewer racing injuries in European race horses (*Duke*). However, more than just the proportion of starts by young horses is different, as more European races are held on turf surfaces versus very few in the U.S., and American race courses are all ovals in contrast to the few oval European courses. The subject of racing of two year old horses is controversial in the U.S. and a focus point for both the Thoroughbred and Quarter Horse racing industries *(Herbert) (Wyant).* The most lucrative and prestigious races for Quarter Horses are for two year olds and most are held in the summer. In Thoroughbreds, three year old races are more prestigious and publicized. Critics of two year old racing argue that the horse's musculoskeletal system is not sufficiently mature to handle the biomechanical stresses of racing and believe that early racing contributes needlessly to excessive morbidity and mortality. It has been difficult to take this discussion beyond the point of subjective opinion without actual documentation of two year old injury rates.

A unique source of racing injury information was established in 1990 by the California Horse Racing Board which instituted the compulsory Necropsy Program that mandated necropsy of all racehorses that died of any cause or were euthanized at any racing or training facility under their jurisdiction. This data source has provided significant insights into the role of preexisting skeletal injury in racehorses (*Stover* et al.) as well as a comparison of fatal musculoskeletal injuries sustained during racing versus training. For two year olds, more fatal musculoskeletal injuries occurred during training than during racing, but no rate determinations were made (*Johnson*). Epidemiologic case control studies based on this data base have shown that an increase in cumulative exercise frequency in the preceding 6 months was associated with a significantly greater risk of fatal musculoskeletal injury for all age groups (odds ratio of 15.5, 95% CI=3.7–64.7) (*Estburg* et al.).

No uniform injury record keeping system is utilized by American racetracks. Many racing commissions and racetracks tally the number of fatal injuries at each racing meet for their own monitoring purposes. This information however, is not available to the

wider racing industry. The need for a nationwide system for documenting racing injuries was recognized. In 1991, members of the American Association of Equine Practitioners' (AAEP) Racing Regulatory Committee devised a pilot project to build a database for all racing injuries. Racing regulatory veterinarians at racetracks were asked to voluntarily record information on a specific form for any horse that was brought to their attention on the racing surface. The project was begun in 1992 with the assistance of the Association of Racing Commissioners International (RCI), and the University of Minnesota. The resultant data provided the first overview of racing injuries across the country as many racetracks were represented (*Wilson* et al.).

The objective of this presentation is to characterize the racing injuries of two year old Thoroughbreds and Quarter Horses utilizing the data from the 1992 AAEP-RCI Racing Injury Reporting Project and the 1987–1992 records of the Illinois Racing Board.

Materials and methods

Two databases on racing injuries were reviewed for injuries to two year old racehorses. The 1992 AAEP-RCI Racing Injury Reporting Project database is comprised of 1255 injury reports from 35 racetracks, and includes both fatal and non-fatal injuries. For Thoroughbreds (TB), only records from the tracks deemed to have complete reporting were utilized (n=27, 1119 injury reports) to permit accurate injury rate determinations. For each of these tracks, the number of two year old starts was known as well as the gender distribution of those horses from a data base contributed by The Jockey Club. The injuries were categorized according to type of injury, outcome (fatal/non-fatal), gender of injured horse, race length, site of injury occurrence on race course, track condition and date of injury. Statistical analyses of the relative risk of injury between groups were calculated using chi square or Fisher's exact tests and a standard statistical software package (Epi Info, version 5.01, 1990 Centers for Disease Control, Atlanta, GA). For Quarter Horses (QH), all two year old injuries were similarly categorized but denominators were not available, beyond the estimate provided by the AQHA of 32% two year old starts of all starts.

The second database comprised the Illinois Racing Board's Thoroughbred fatality records for 1987–1992 at three racetracks. The fatal injuries associated with either racing or training were categorized by type of injury, gender of injured horse, activity when injured, and date of injury. The total number of starts was provided as well.

Results

Thoroughbreds

In the 1992 AAEP-RCI database, 58 Thoroughbred two year old racing injuries were reported. Of these, 57 were from the 27 racetracks deemed to have complete reporting, only one of which had no two year old starts during the 1992 season. The only reported injury from the 491 turf starts represented was a bowed tendon, precluding further analysis of turf injuries. All subsequent results pertain to injuries sustained while racing on dirt surfaces. There were 17,430 dirt starts from March to December for which 56 injuries were reported for an injury rate of 0.321% or one injury reported per 311.3 starts (3.21/1000). (There were 63,241 dirt starts by 3 year olds, and 174,696 dirt starts overall). The injuries of the two year olds are enumerated in Tab. 1. Three were non-musculoskeletal, and all in fillies: sudden death, heat stroke, and collapse followed by recovery. No cases of exercise induced pulmonary hemorrhage were reported in this age group, although this condition has been seen in two year olds.

Musculoskeletal injuries were grouped into four categories: Fractures or hard tissue injury, soft tissue injury, combination of bone and soft tissue injuries, and non-diagnosed lameness. This last group comprises horses that were put on the regulatory veterinarian's unsoundness list but for which a specific diagnosis was not available.

The overall rate of musculoskeletal injury was significantly lower for two year old starts than for starts of older horses: 3.04 injuries / 1,000 starts versus 5.54 / 1,000 starts (Relative risk 0.55, CI=0.42–0.72, Mantel-Haenszel X^2=18.6, p<.0001). Five reports were bucked shins. The only other case of bucked shins reported was in a three year old. Fatal fractures predominated in the distribution of the 35 serious musculoskeletal injuries. Many fractures of the distal cannon bone and sesamoids were accompanied by serious soft tissue injury. This predominance of fractures of the cannon bone and fetlock region was also observed in the older horses. Carpal fractures were rare in two year olds, occurring at a rate of .115/1,000 starts, a rate almost a third that of older horses. Upper limb long bone fractures were relatively more common in two year olds, particularly tibial fractures (n=3). Only two other tibial fractures were reported, in horses ages 3 and 4. Although the frequency of all fractures was slightly lower in two year olds than three year olds or all older horses, this difference was not significant (p>.05).

The frequency of injuries involving a combination of bone and soft tissues was slightly lower for two year old starts than older horses, but not statistically significant (p>.05). The major difference in the pattern of injuries in this group was the absence of suspensory ruptures in combination with sesamoid fractures, a common diagnosis in the older horses.

Soft tissue injuries were significantly less frequent for two year old starts (relative risk = 0.16, CI = 0.06–0.38, Yates corrected X^2 = 21.38, p<.00001). This difference was the major contributor to the overall lower rate of musculoskeletal injury. Three year olds were four times more likely to sustain a reported soft tissue injury than a two year old on a per start basis (CI=1.65–10.1, Yates corrected X^2=10.03, p<.002). The rate of soft tissue injury increased with increasing age after 3.

Two year olds had the lowest fatal racing injury rate (1.49/1,000 dirt starts) of racehorses from ages 2–5, although the difference was slight. The highest rate was for four year olds (1.64) followed by three year olds (1.61). Most of the fatal injuries were fractures or fractures in combination with disarticulation of the fetlock joint.

Gender differences were apparent in the two year old data base. The proportion of starts by gender (colt:filly:gelding) was 1:2.65:1.91 and varied little on a monthly basis. There were no major differences in the overall frequency of starts for all starters of each gender group for each meet. The average of the rates for the 26 tracks was 1.81 (±0.5 SD) starts/colt starter, 1.86 (±0.54 SD) starts/filly starter, 1.95 (±0.56 SD) starts/gelding starter. Colts were over represented among fatal injuries on a per start basis and there were significantly more fatal musculoskeletal injuries of colts than fillies (relative risk = 3.03, CI = 1.1–8.34, Fisher's exact test p<.04). The fatal injury rate for starts by geldings was intermediate between that of colts and fillies (1.67/1,000 starts versus 2.56 and 0.96). The most striking difference in injury rates occurred in September, where injury rates were significantly higher for colts and geldings than fillies (relative risk = 9.6, CI = 1.23–74.8, Yates corrected X^2=5.53, p<.02) (Fig. 1). The other peak of colt

Tab. 1: Injuries sustained during racing on dirt surfaces by two year old Thoroughbreds. The AAEP-RCI database includes fatal and non-fatal injuries reported by racing regulatory veterinarians in 1992. The Illinois Racing Board database includes all fatalities associated with racing or training at 3 racetracks from 1987–1992. (Note: C=colt, F=filly, G=gelding; a, b, c, d: Numbers followed by a letter indicate horses appearing in both databases. * Gender was not recorded for one horse).

Injury	AAEP-RCI Project					II. Racing Fatalities				II. Training Fatalities			
	Total	Fatal	C	F	G	Total	C	F	G	Total	C	F	G
Totals	56	26	14	24	18	12	9	3	0	23*	9	7	6
FRACTURES	29	17	8	13	8	9	6	3	0	20*	8	5	6
Forelimbs													
Third phalanx	1	0	0	1	0	0	0	0	0	0	0	0	0
Proximal sesamoid(s)	4	2	0	1	3	2	2	0	0	5	1	1	3
3rd metacarpus	2	2	0	1a	1	1	0	1a	0	4	3	0	1
3rd matacarpus + splint	1	1	0	1	0	0	0	0	0	0	0	0	0
3rd metacarpus, condylar	4	2	1	2	1	0	0	0	0	1	1	0	0
3rd metacarpus + sesamoids	0	0	0	0	0	1	1	0	0	0	0	0	0
Shin buck	5	0	1	3	1	0	0	0	0	0	0	0	0
Carpus	2	1	1	0	1	1	0	1	0	0	0	0	0
Humerus	0	0	0	0	0	2	2	0	0	2	0	0	2
Olecranon + distal humerus	1	1	0	1b	0	1	0	1b	0	0	0	0	0
Scapula	1	1	1	0	0	0	0	0	0	0	0	0	0
Hindlimbs													
First phalanx	1	1	0	1	0	0	0	0	0	0	0	0	0
3rd metatarsus	0	0	0	0	0	0	0	0	0	4*	0	3	0
3rd metatarsus + sesamoids	1	1	1c	0	0	1	1c	0	0	0	0	0	0
3rd metatarsus + first phalanx	0	0	0	0	0	0	0	0	0	2	2	0	0
Tarsus	1	0	0	1	0	0	0	0	0	0	0	0	0
Tibia	3	3	2	1	0	0	0	0	0	1	1	0	0
Femur	1	1	0	0	1	0	0	0	0	0	0	0	0
Pelvis	1	1	1	0	0	0	0	0	0	1	0	1	0
SOFT TISSUES	5	1	1	2	2	0	0	0	0	1	0	1	0
Forelimbs													
Bowed tendon	3	0	1	1	1	0	0	0	0	0	0	0	0
Suspensory rupture, tendon rupture	1	1	0	0	1	0	0	0	0	0	0	0	0
Laceration	1	0	0	1	0	0	0	0	0	1	0	1	0
COMBINATION	8	7	1	2	4	3	2	0	0	1	1	0	0
Forelimbs													
Fetlock disarticulation, sesamoid fx	1	1	1d	0	0	0	0	0	0	0	0	0	0
Fetlock disarticulation, sesamoid fx and suspensory rupture	1	1	0	0	1	1	1d	0	0	0	0	0	0
Fetlock disarticulation, sesamoid fx and 3rd metacarpus condylar fx	1	1	1	0	0	0	0	0	0	0	0	0	0
Fetlock disarticulation, 3rd metacarpus fx distal sesamoidean ligament rupture	0	0	0	0	0	1	1	0	0	0	0	0	0
Fetlock disarticulation, sesamoid fx, 3rd metacarpus fx, suspensory rupture	0	0	0	0	0	0	0	0	0	1	1	0	0
3rd metacarpus condylar fx, and suspensory rupture	1	1	0	1	0	0	0	0	0	0	0	0	0
3rd metacarpus condylar fx and suspensory rupture	1	1	0	0	1	1	1	0	0	0	0	0	0
3rd metacarpus condylar fx, sesamoid fx, and suspensory rupture	1	1	0	0	1	0	0	0	0	0	0	0	0
Ankle arthritis	1	0	0	1	0	0	0	0	0	0	0	0	0
Hindlimbs													
Fetlock disarticulation, 3rd metatarsus condylar fx	1	1	0	0	1	0	0	0	0	0	0	0	0
NON-DIAGNOSED LAMENESS	11	0	3	4	4	0	0	0	0	0	0	0	0
NON-MUSCULOSKELETAL	3	1	0	3	0	0	0	0	0	1	0	1	0
Heat stroke	1	0	0	1	0	0	0	0	0	0	0	0	0
Collapse	1	0	0	1	0	0	0	0	0	0	0	0	0
Sudden Death	1	1	0	1	0	0	0	0	0	1	0	1	0

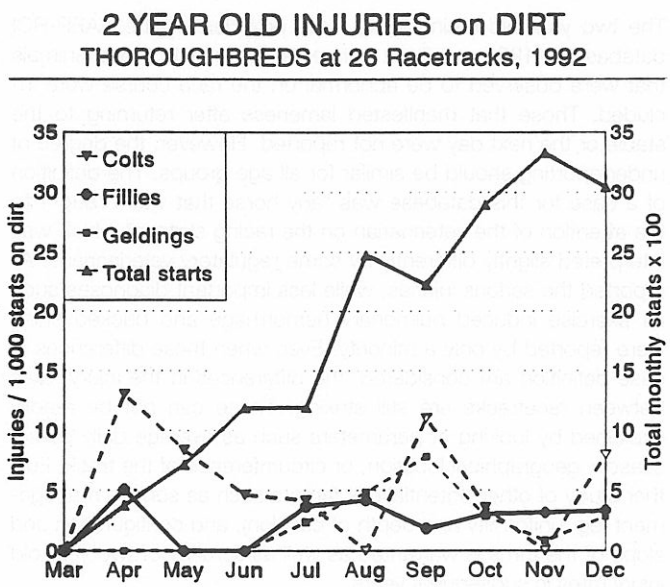

Fig. 1: Monthly racing injury rates for two year old Thoroughbreds at 26 racetracks in 1992, by gender, and total number of starts for each month.

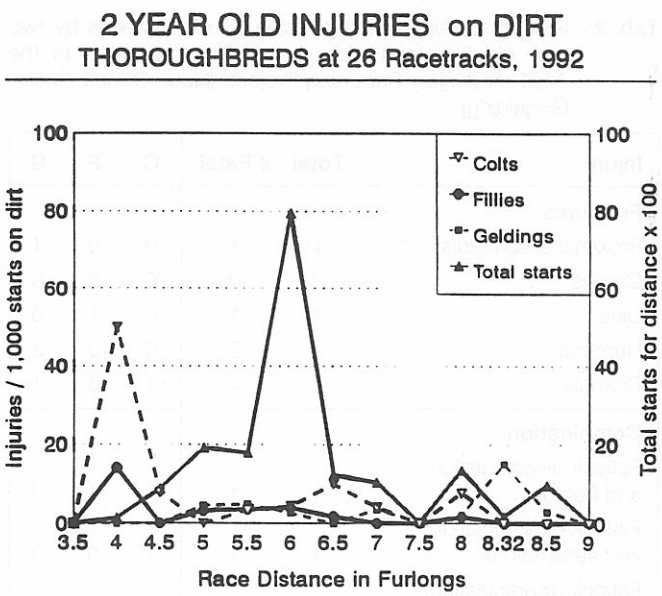

Fig. 2: Racing injury rates for two year old Thoroughbreds in 1992 for each race distance, by gender, and total number of starts at each distance.

injuries in April was not significant due to the small number of starts (1 injury in 75 starts). Fig. 1 also shows that with the exception of April, the injury rates were not higher earlier in the year. The highest monthly injury rate occurred in September (5.41 injuries/1,000 starts) as well as the highest fatal injury rate (3.16/1,000 starts) which was 5 times higher than that for the rest of the year (CI=2.31–10.94, Fisher's exact test p<.00002). The greatest number of two year old starts were in November.

Track surface conditions were not significantly associated with overall injury rates, but the frequency of fractures, excluding bucked shins, was 2.3 times higher on non-fast tracks (good, muddy, slow or sloppy) than on fast tracks (CI=1.01–5.27, Fisher's exact test p<.05). The greatest proportion of starts on non-fast tracks occurred in December, followed by July and November, and the highest frequency of injuries on non-fast tracks occurred in August.

Two year olds raced at a wide range of distances on the dirt: 3.5–9 furlongs, with the most starts at 6 furlongs (1 furlong = 201.16 meters) (Fig. 2). The short sprints predominately took place in the first half of the year, but no significant difference in injury rates were observed for short versus long races.

The site of injury on the racing surface was determined for 38 out of the 56 injuries. Only one fatal injury was reported for which the site was not determined. Most were associated with the stretch turn: 10 on the turn and 6 at the top of the stretch. The majority of these were serious fractures or fetlock disarticulation injuries and 13 were fatal. All the upper limb long bone fractures occurred in association with the turns. (The pelvic fracture was observed on the clubhouse turn). On the backstretch, two fillies were injured coming out of the gate, and 5 geldings were seriously injured, four of which were euthanatized. Eight injuries were observed in the homestretch or near the wire, only two of which were fatal. Two were bowed tendons (the third occurred at the top of the stretch). After the wire, the sudden death and heat stroke were reported as well as four musculoskeletal injuries, two of which were fatal.

The class of race in which an injury was sustained was variable, ranging from maiden claiming races through stake races. All occurred in races restricted to two year old entries. The patterns of injury were similar between classes.

There was a considerable range in two year old injury rates between the 26 tracks with two year old starts (range in starts = 13–1600). Six tracks reported no injuries (starts = 13–852). For tracks with at least 300 starts (n=21), the injury rates ranged from 0 to 17.8/1,000 starts, with a median rate of 2.38 injuries/1,000 starts. If bucked shins are excluded, the range becomes 0 to 11.83. The fatal injury rates were similarly variable, ranging from 0 to 4.14/1,000 starts. A correlation between a track's injury rate and average daily purse was not apparent.

Fractures predominated among the 12 Illinois Thoroughbred fatal racing injuries that occurred over 6 years (Tab. 1). All the two year old racing fatalities resulted from dirt surface races. (Four horses from the AAEP-RCI database in 1992 also appear in this data base.) These comprised 4.2% of all the racing fatalities (n=261) from 145,641 starts. For 1992, two year olds represented 7.42% of all starts for these three tracks. If this proportion of two year old starts was consistent for all six years, a lower fatal racing injury rate for two year old starts is suggested.

Although the gender distribution for two year old starts for these 6 years is not known, for 1992 it was colt:filly:gelding = 1:1.89:1.08. The predominance of colts in two year old racing fatalities (75%) is in sharp contrast to 25% of starts by colts in 1992. No fatal racing injuries occurred in geldings. The types of injuries were similar to the AAEP-RCI database, with the exception of 2 humeral fractures in the Illinois database.

More training injuries were reported for the six year period (n=23). Fractures also predominated in this injury group. A very different gender pattern was observed, although fatal training injuries were also most common in colts (Gender was not listed for one horse). Unique to this database were 4 metatarsal fractures without reported damage to other bones or soft tissue. Overall, metatarsal fractures were proportionately more common during training than racing (6 versus 1). Five of the 6 occurred at the same track, which had summer race meets. Two year olds accounted for 29% of all training fatalities.

Tab. 2: Injuries sustained during racing on dirt surfaces by two year old Quarter Horses in 1992, as reported to the AAEP-RCI Injury Reporting Project. (Note: C=colt, F=filly, G=gelding)

Injury	Total	# Fatal	C	F	G
Fractures					
Proximal sesamoid(s)	1	1	0	0	1
Carpus	2	0	0	2	0
Ulna	1	1	0	1	0
Humerus	2	2	0	0	2
Scapula	2	1	1	0	1
Combination					
Fetlock disarticulation and fracture	1	1	0	1	0
Fetlock disarticulation and sesamoid fx	1	1	1	0	0
Fetlock disarticulation, 3rd metacarpal condylar fx, suspensory rupture	1	1	0	0	1
Fetlock disarticulation, sesamoid fx, superficial flexor rupture, distal sesamoidean ligament rupture	1	1	0	0	1
Non-diagnosed lameness	3	0	0	2	1
Non-musculoskeletal					
Collapse and exercise induced pulmonary hemorrhage	1	0	0	1	0

Quarter Horses

In the AAEP-RCI database, 16 reports were 2 year old Quarter Horses (QH) out of 56 of known age. The injury distribution is shown in Tab. 2. These comprised 28.6% of all the QH reports for all ages, whereas two year old QH's represent 32% of all QH starts. The proportion of two year old fatal injuries among all fatal injuries was similar (25%). Fractures were also most commonly reported, however no simple cannon bone fractures were included. In contrast, the two humeral and one ulnar fracture were unique to this breed for 1992 in this database. No soft tissue injuries were reported, and there were few injuries to colts.

The pattern of site of injury observation on the racetrack was different from that of Thoroughbreds. All of the QH fatal injuries occurred near or after the finish (8).

The distribution of the racing injuries by month was slightly different for QH's, reflecting the lower frequency of two year old QH races during the last quarter of the year. The injuries/month from April to December were 1, 0, 2, 1, 3, 3, 1, 2, 2.

Discussion

The lower racing injury rates in two year old Thoroughbreds in 1992 compared to older horses is welcome news to the racing industry as it fails to support the hypothesis that serious racing injuries occur more frequently in this age group. Indeed, soft tissue injuries were significantly less frequent per start which may reflect less cumulative trauma to the soft tissues, less hyperextension due to racing at lower speeds or more starts at shorter distances.

The two year old racing injury rates provided by the AAEP-RCI database in 1992 are likely conservative as only those animals that were observed to be abnormal on the race course were included. Those that manifested lameness after returning to the stable or the next day were not reported. However, the degree of underreporting should be similar for all age groups. The definition of a case for this database was "any horse that was brought to the attention of the veterinarian on the racing surface" which was interpreted slightly differently by some regulatory veterinarians. All reported the serious injuries, while less important diagnoses such as exercise induced pulmonary hemorrhage and bucked shins were reported by only a minority. Even when these differences in case definition are considered, the differences in the injury rates between racetracks are still striking. These can not be readily explained by looking at parameters such as average daily purse, season, geographical location, or circumference of the track. Further study of other potential risk factors such as surface management (eg. uniformity and depth of cushion), and configuration and slope of the turns is warranted as well as scrutiny of two year old injury rates in subsequent years.

The preponderance of severe fractures, particularly of the upper limbs, in both databases contrasts strongly with the patterns of injury in older horses where soft tissue injuries become proportionally more common as the horse ages (*Wilson*). This observation suggests that there may be an imbalance in the relative strengths of the skeletal versus soft tissue components of the musculoskeletal system in this age group. The remodelling of bone in response to the stress and biomechanical forces associated with racing and training has been well documented. Disruption of this process by stress fractures has been eloquently demonstrated to play a role in subsequent fractures (*Stover* et al.). Their results as well as the data above strongly suggest that training and racing schedules should include time to allow bone to remodel without the severe stress induced by racing at speed that can lead to catastrophic injuries.

The clustering of injuries in the later half of the year reflects the tendency to delay racing for this age group until later in the year, and is not significant when the number of starts is known. Overall, very few starts were made in the first half of the year and none prior to March, when there were only 9. The unusual peak of injuries for colts and geldings in September needs to be further investigated as no explanation is readily apparent to explain the increase in frequency or the gender disparity.

The overrepresentation of Thoroughbred colts in both the AAEP-RCI and Illinois databases is puzzling. Fractures were particularly common in this gender group in comparison to geldings or fillies. Could this suggest a hormonal role in equine bone remodelling? The role of estrogen in the prevention of osteoporosis has been well established in other species, and warrants further investigation in this age group. Should such study be undertaken, the role of exogenous androgenic compounds would also be of great interest. Another potential explanation may be that the colts were more competitive or had a higher pain threshold which compelled them to continue racing after the injury began.

Fracture rates were also related to track surface conditions. Proportionately more fractures occurred on off tracks than on fast ones. Greater leniency in allowing young horses to scratch from races on non-ideal surfaces seems logical.

The stretch turn and top of the stretch were the site of most of the fatal musculoskeletal injuries to two year old Thoroughbreds. The biomechanical forces on the limbs are different on turns than in the straightaways (*Ratzlaff* et al.), and likely play a role in the pa-

thogenesis of the injuries. Should two year olds not race around turns or would they benefit from more training experience working at speed around turns? The alternative of remodeling the configuration of the stretch turn is not economically feasible for existing tracks. Although the stretch turn was the most frequent site of injury, carpal injuries, which most frequently occur on the stretch turn, were comparatively rare in two year olds. This may be partially due to the lower speeds but also to the lower cumulative trauma to these bones. The contrasting cluster of fatal Quarter Horse injuries near or after the wire is intriguing, and in part due to the shorter races run by this breed. Although some of the races do go around the stretch turn, it tends to be earlier in the race when the horse is less likely to be fatigued. This may also explain the absence of cannon bone fractures among the two year old Quarter Horses, as most of the cannon fractures in Thoroughbreds were associated with the stretch turn. The greater proportion of upper forelimb fractures in Quarter Horses is harder to explain, but could be related to a greater intensity of muscular exertion over short distances. When the Quarter Horse industry can provide statistics such as the number of starts, and distances for all participating racetracks, a clearer understanding of these differences may emerge.

Fatal training injuries were more common than fatal racing injuries in Thoroughbreds over a six year period in the Illinois racing jurisdiction. The difference has a number of plausible explanations: greater exposure to speed work during training, more time spent on the track during training, less conditioning and strength of tissues early in training, attrition of horses due to training injuries, precluding racing, and less uniform track surface during training. Although the incidence of fatal injuries could not be determined, the high proportion of two year olds among training fatalities (29%) agrees with similar findings in California (*Johnson*), and the higher incidence of training failure in England (*Rossdale* et al.), and Germany (*Lindner* and *Dingerkus*).

This study adds to the work of other researchers on factors associated with musculoskeletal injuries of race horses. In addition to the aforementioned roles of pre-existing stress fractures, and excessive cumulative exercise density, age, gender, track condition, type of injury and breed have been demonstrated to be significantly associated with differences in injury rates and patterns. Two year old Thoroughbreds were shown to have fewer injuries per start than older horses, particularly of soft tissues. The patterns of injury differed in Quarter Horses, which sustained more upper limb fractures, no cannon fractures, and most fatal injuries near or after the wire.

References

Duke, J. (1994): Head of the class. The Blood-Horse 45, 5346–5349.

Estburg, L., Gardner, I. A., Stover, S. M., Johnson, B. J., Case, J. T., and *Ardans, A.* (1995): Cumulative racing-speed exercise distance cluster as a risk factor for fatal musculoskeletal injury in Thoroughbred racehorses in California. Prev. Vet. Med. 24, 253–263.

Herbert, K. S. (1994): Learning from tragedy. The Blood-Horse 53, 6468–6469.

Lindner, A. and *Dingerkus, A.* (1993): Incidence of training failure among Thoroughbred horses at Cologne, Germany. Prev. Vet. Med. 16,85–94.

Johnson, B. (1993): A look at racetrack breakdowns – 1991. J. Eq. Vet. Sci. 13, 129–132.

Ratzlaff, M., Grant, B., Frame, J. and *Hyde, M.* (1987): Locomotor forces of galloping horses. Equine Exercise Physiology 2, *J. Gillespie* and *N. E. Robinson,* Eds., ICEEP Publications. Davis, CA, 574–586.

Rossdale, P. D., Hopes, R., Wingfield Digby, N. J. and *Offord, K.* (1985): Epidemiological study of wastage among racehorses 1982 and 1983. Vet. Rec. 116, 66–69.

Stover, S. M., Ardans, A. A., Read, D. H., Johnson, B. J., Barr, B. C., Daft, B. M., Kinde, H., Anderson, M. L., Woods, L. W., Moore, J., Stoltz, J. and *Pool, R. R.* (1993): Patterns of stress fractures associated with complete bone fractures in racehorses. Proc. 39th Annu Conv. Am. Assoc. Equine Practnr., 131–132.

Wilson, J. H, Howe, S. B., Jensen, R. C. and *Robinson, R. A.* (1993): Injuries sustained during racing at racetracks in the U.S. in 1992. Proc. 39th Annu. Conv. Am. Assoc. Equine Practnr., 267–268.

Wyant, T. (1994): Two-year-old racing. Quarter Horse Racing J 1994; 9:154

Acknowledgements

This research was made possible by data contributions by dedicated racing regulatory veterinarians and The Jockey Club and financially supported by the Association of Equine Practitioners, Association of Racing Commissioners International, Minnesota Racing Commission, and the University of Minnesota.

Julia H. Wilson, DVM
R. A. Robinson, BVSc, MPH, PhD

Department of Clinical & Population Sciences
1365 Gortner Ave
St. Paul, MN 55108

R. C. Jensen, DVM, MS

Illinois Racing Board
100 W. Randolph St.
Chicago, IL 60601