



# **WASTAGE IN THE AUSTRALIAN THOROUGHBRED RACING INDUSTRY**

**BY  
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## Foreword

From humble beginnings, the Australian Thoroughbred racing industry has developed into a large and important component of the Australian economy. Researchers in other countries have reported that significant wastage is associated with the breeding, training and racing of Thoroughbreds.

Despite the size of the Australian racing industry and some unique features of racing and training in this country, only limited research has been conducted to evaluate the extent and identify the major causes of wastage.

This publication reports the perceptions of trainers on causes of wastage and highlights their priorities for various research topics. Risk factors for serious racing injuries are identified for metropolitan racecourses in Melbourne and career profiles for elite Thoroughbreds are described. The first long-term study of horses in training is described in the final part of this report and the relative importance of various types of injuries and diseases documented.

The information in this report is extremely valuable to the Australian and international racing industries in providing objective information on which to base decisions about future research and development investment. It represents the results of three years of complex investigation and I am particularly delighted that the project has involved international collaboration with Professor Stuart Reid from the Universities of Glasgow and Strathclyde. Finally, valuable information such as this would not have been possible without cooperation of the racing industry: the participating trainers, veterinarians and William Inglis and Son Ltd. This is a model of how researchers and industry personnel should work together in future projects.

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# **Chapter 1**

## **What is Known About the Extent of Wastage?**

## **Introduction**

The term “wastage” has been used to refer to losses that occur at all stages of development of a racehorse, including mares failing to conceive or not carrying the pregnancy to term, illness and death in foals, and injuries associated with training and racing. In the United Kingdom, it was calculated that 72.8% of covered Thoroughbred mares did not produce a foal, or produced a foal that did not race by four-years of age (Jeffcott *et al.*, 1982). The total cost associated with these losses was estimated to be £15.2 million for the 1974 season (Jeffcott *et al.*, 1982). Increasingly, concerns are being raised about the animal welfare implications of injuries sustained by Thoroughbreds, particularly associated with the training and racing of two-year-olds and race-day fatalities. Despite the size of the Thoroughbred industry in Australia and the unique features of stabling, training and racing in this country, there has been limited research on the extent of wastage occurring here.

This review is presented in five main sections. The first section outlines the development of the Thoroughbred racing industry in Australia and provides estimates of the current size and impact of the industry. In section two, training and racing in Australia are compared with the United States and the United Kingdom, highlighting the problems of directly applying results from research in other countries to Australian conditions. The third section examines sources of wastage at the horse studs, from the covering of mares to the sale of yearlings. Although not part of the research of this project, wastage in the breeding sector has been covered in this review because it is an integral part of the racing industry and problems arising at the studs may have a subsequent impact on horses in training. The main emphasis of the review is given to sections four and five, which detail sources of wastage during training and racing, respectively, as this is the focus of the research of the current report. Conclusions are then drawn about the need for research that would be applicable to the Australian Thoroughbred racing industry.

## **1. The racing industry in Australia**

### *1.1 The development of Thoroughbred racing in Australia*

The history of horses in Australia began when the First Fleet landed at Sydney in 1788, arriving with a stallion, three mares and three yearlings that were obtained at the Cape of Good Hope en route from England (Willett, 1970; Pollard, 1981; Hobson, 1986). Seven years later a shipment of good quality breeding mares from the Cape was imported, forming the founding elements of the Australian bloodhorse (Willett, 1970; Pollard, 1981). However, it was not until 1799 that the first notable step to improve the breed of horses in the colony was made with the arrival of the English-bred stallion, Rockingham, from South Africa (Pollard, 1981). In 1802, Northumberland became the first stallion to be imported direct from England (Seth-Smith, 1978). The establishment of the Australian breed of racehorses was also influenced by the importation of a number of Arabian horses from Persia and India (Willett, 1970).

The first official race meeting was held in Hyde Park, Sydney, in October 1810. It was organised by officers of the 73rd Regiment, being conducted over three days and consisting of three heats of two miles each (Willett, 1970; Pollard, 1981). Horse racing gradually became organised and fell under the control of formally established racing clubs, the first of which was the Sydney Turf Club (not the same as the current club of the same name), founded in 1825 (Hobson, 1986).

Captain Henry Rous, an influential figure of the British Turf, visited Australia in 1827 and provided an important stimulus to the establishment of Australian Turf institutions modelled on the English system (Willett, 1970; Seth-Smith, 1978). It was not until 1840 that the Australian Race Committee was formed (Willett, 1970), and by this time the Arabs had lost their dominance to the English bred horses (Pollard, 1981). In 1842, the Australian Race Committee became the Australian Jockey Club, which has remained a powerful club in Australian racing, ensuring uniform rules on the registration of clubs, the licensing of trainers and jockeys, and the appointment of stewards (Pollard, 1981).

### *1.2 Current size of the Australian Thoroughbred racing industry*



From humble beginnings, the racing industry in Australia has developed into a large and important component of the nation's economy. Approximately 120,000 Thoroughbreds were officially registered in 1989 (Pilkington and Wilson, 1993) and Australia produces the second highest number of Thoroughbred foals in the world after North America (ACIL, 1992). In the 1992/93 racing season in Australia, approximately 36,000 horses made over 200,000 starts and raced for nearly \$200,000,000 in prize money (RSB, 1993). Estimates of the economic contribution of Thoroughbred racing to Australia have varied. One of the highest and widely quoted values attributed to racing rates the industry as Australia's third largest, having a turnover of \$20 billion and employing 250,000 people<sup>1</sup>.

A more conservative approach was taken in a comprehensive study on the Australian racing industry for State Racing Ministers (ACIL, 1992) in which the racing industry was divided into nine main activities: administration, breeding, owning, training, riding, veterinary, farriers, clubs and race gambling. It was estimated that racing contributed 0.5% to Australia's Gross Domestic Product (\$2,400 million) and directly employed 132,000 people in 1990/91 (ACIL, 1992). In terms of contribution to Gross Domestic Product, the report found that the racing industry was of similar size to the agricultural output of the high rainfall zone and the iron and steel smelting industry in 1990/91 (ACIL, 1992). However, the above study concedes that by denoting any collection of activities as a single industry, the social impact will be conservatively estimated. Many ancillary activities were not covered by the nine sectors investigated; the important association with racing of pharmaceutical companies, media coverage, transport services, accountants, tourism, catering, and feed companies illustrates the close relationship of racing with the rest of the Australian economy (ACIL, 1992).

Without doubt then the Australian racing industry is an important contributor to Australia's economy. Despite its size, very little research has been conducted to identify areas of wastage.

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<sup>1</sup> Reported in a speech delivered in 1988 by the N.S.W. Minister for Sport, Recreation & Racing (ACIL, 1992).

## **2. Comparisons between racing in Australia, the U.S. and the U.K.**

Despite the Australian racing industry originally being based on the British system of racing and sharing similarities with features of racing in the United Kingdom and the United States, the Australian racing industry has developed some of its own unique features of training and racing. Comparisons will focus on differences between these three major racing countries.

### ***2.1 Training***

Most metropolitan racing stables in Australia are situated at or very near the racecourse. Training tracks are located within the racecourse proper and thus involve straight and curved sections. The main training track surfaces include turf, woodfibre, Equitrack<sup>®</sup>, composite dirt and sand. This is in contrast to the U.K. where training is conducted away from the racecourse and horses are predominantly trained on long straight expanses of turf on a gradual incline. Such differences could influence the impact and types of lameness occurring in the respective countries.

### ***2.2 Stabling***

The housing for horses in the colder northern hemisphere countries is more intensive than in Australia and horses tend to be kept indoors for a much greater proportion of the year. Horses in Australia are usually rested at pasture away from the training stables between preparations or to recover from injuries or disease, even if only for a few weeks. Intensive housing of horses in box stalls for prolonged periods is thought to increase the potential impact of respiratory disease due to the increased exposure to dust and allergens, particularly in the bedding or hay (Robinson, 1997), and due to the increased opportunity for close contact between horses, enhancing the spread of infectious agents. Equine influenza is a respiratory disease that can rapidly spread through populations of horses, particularly if they are closely congregated and have not been exposed to the virus previously (Geering, Forman and Nunn, 1995). The equine influenza virus is exotic to Australia (Geering *et al.*, 1995), distinguishing the racing industry in this country from that of countries such as the United Kingdom, Germany, France, North America, Japan, Hong Kong and South Africa. As a consequence of the above differences, a lower incidence of respiratory disease in Australian racing Thoroughbreds might be expected.

### *2.3 Racing*

In Australia and the U.K., racing is conducted almost exclusively on turf racetracks (Bourke, 1994; McKee, 1995), in contrast to the predominance of racing on oval dirt tracks in the U.S. (Wilson and Robinson, 1996a). Turf races in the U.S. are held only at some tracks and a greater number of these races are allowance or stake races (Wilson and Robinson, 1996a). The shape of the racecourses in Australia vary from oval through to almost triangular but in general have tighter turns than the courses of the U.K..

Horses in Australia generally are raced more frequently than in the U.K.. In the latter country, there is a tendency to retire well performed horses to stud early in their career to protect their racing record, and males are more likely to be kept as entires instead of being gelded. In Australia there is a greater emphasis on the racing of two-year-old horses than in the U.K., with lucrative prize money being offered for juvenile races such as the \$2 million Golden Slipper. Thoroughbred racing on the flat is conducted throughout the year at all racecourses in Australia in contrast to the more limited racing season in the U.K. and the system of race-meets in the U.S. where races are conducted intensively over a limited number of days at one racing centre before moving on to another.

Rules allowing horses to race with detectable concentrations of medication also vary between the countries. The most notable area of difference is the allowance by some states in the U.S. for horses to race with certain concentrations of frusomide and phenylbutazone (Robinson and Gordon, 1988), in contrast to the enforcement of medication-free racing in Australia. Differing racetrack designs and surfaces, varying frequencies of racing, and rules permitting the use of medications could influence the number and type of race-day injuries and fatalities occurring in each country.

Thus, these differences of training, housing and racing could mean that results from studies on causes of wastage in other countries may not be directly applicable to Australia, highlighting the importance of conducting separate studies in Australia to

determine the extent and relative importance of causes of wastage in the Australian Thoroughbred racing industry.

### 3. Wastage in breeding

A large breeding sector is required to supply horses to Australia's domestic racing industry and expanding export markets. The number of broodmares covered by stallions in Australia has decreased in recent years (Pilkington and Wilson, 1993), and if a sufficient supply of horses is to be maintained, the breeding sector also must be an efficient producer of Thoroughbreds. This requires efforts to reduce wastage at all phases of production at the stud farms; from conception, through pregnancy, and subsequent development of foals, weanlings and yearlings.

The annual foaling percentage (foals born/mares registered) for the Australian Thoroughbred breeding industry has been reported to be 56.2% (Pilkington and Wilson, 1993). This compares unfavourably with the United Kingdom and United States, where foaling percentages are over 60% (Pilkington and Wilson, 1993). However, these figures are affected by the number of mares at stud that are not served, and higher agistment fees for northern hemisphere studs may result in a greater effort being made to serve as many mares as possible (Pilkington and Wilson, 1993). The number of live foals born, expressed as a percentage of the number of mares covered, may provide a more comparable figure. Calculated in this way, the live foal percentage in the United Kingdom has been reported as 69.7% (Laing and Leech, 1975) and 67.4% (Jeffcott *et al.*, 1982). The figures for Australian studs are slightly lower (Table 1-1), and have not improved substantially in recent years, despite the advances that have been made in the understanding of reproductive physiology and medicine. Bourke (1990) suggested that the wide range of conditions and management systems under which horses are kept in Australia contribute to the overall relatively poor reproductive performances in this country.

**Table 1-1.** Live foal percentages for Australian Thoroughbred mares, 1992 -1995

	Covering season			
	1992	1993	1994	1995
Mares covered	29,656	28,347	27,827	26,952

Live foals born in following season	18,198	17,946	17,523	17,658
Live foals/mares covered	61.4%	63.3%	63.0%	65.5%

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Source: Australian Stud Book

### 3.1 Failure to conceive

The major reason for the low live foal percentage in Thoroughbreds is a low conception rate (Jeffcott *et al.*, 1982), which can be associated with fertility problems of the mare or stallion (Voss, 1993). A low conception rate may result from fertilisation failure or early embryonic loss, but if breeding management and stallion fertility are optimal, embryonic death constitutes the major cause of reproductive inefficiency in mares (Ball, 1993). The proportion of covered Thoroughbred mares that fail to conceive has been reported as 19.4% (Laing and Leech, 1975) to 22.5% (Jeffcott *et al.*, 1982) in the United Kingdom, and 26.8% to 31.3% in Australia (Bourke, 1990). Possible causes of this low conception rate in Australia include the imposition of an inappropriate breeding season (September-December) instead of the “natural” breeding season (November-February); selection of breeding stock on the basis of racing performance rather than fertility; persevering with breeding from ageing mares and stallions because of the superior racing ability of their offspring; and when yearling prices are high, breeding all mares regardless of reproductive performance (Pilkington and Wilson, 1993). The progressive decrease in the live foal rate associated with increasing age in mares is well documented (Laing and Leech, 1975; Jeffcott *et al.*, 1982).

### 3.2 Abortion, twinning and stillbirths

Abortion results in significant breeding losses, occurring on average in 4.6% of covered mares in England (Jeffcott *et al.*, 1982), excluding twins. There is a wide range of causes of abortion including bacteria, viruses, fungi, twinning and placental abnormalities (Acland, 1993). Equine herpes virus 1 (EHV-1) is the most important infectious cause of abortion in horses, and it has a tendency to occur in outbreaks on particular studs (Acland, 1987). EHV-1 infection generally causes abortion in the last third of pregnancy (Rose and Hodgson, 1993).

Historically, twins have been the single most important cause of abortion in Thoroughbreds (Acland, 1993). The frequency of twins in Thoroughbreds is higher than some other horse breeds, occurring in 15.4% of pregnancies diagnosed early with ultrasound (Bowman, 1986). Only 1.2% of births involve twins (Platt, 1979), which indicates that few twin pregnancies go to full term. Twins in horses originate from multiple ovulations (Ginther, 1987) and older mares have more multiple ovulations than younger mares (Woods and Hallowell, 1993). Modern stud management, through the use of ultrasound, aims to detect twin pregnancies early so that one or both of the embryos can be terminated because of the high incidence of abortion associated with it and the lack of commercial viability of delivered foals (Rose and Hodgson, 1993).

In English Thoroughbreds, stillbirths have been reported to occur in 1.8% (Jeffcott *et al.*, 1982) to 7.1% (Laing and Leech, 1975) of covered mares, and in 2.5% of births (Platt, 1979). In calculating the figure of 1.8%, Jeffcott *et al.* (1982) excluded stillbirths due to twinning, representing a possible explanation for the variation in the results. In Texas, 1.9% of full-term pregnancies in a variety of breeds involved a stillbirth (Cohen, 1994). Twin foals represent the largest category of stillbirths, occurring in 34.7% of twin births compared to 1.7% of single births (Platt, 1979).

### 3.3 Deaths in foals

Estimates of deaths in young foals have varied, partly reflecting the different periods during which deaths were recorded. Reported frequencies of early foal deaths have included 2.93% of covered Thoroughbred mares, in an unspecified time period (Jeffcott *et al.*, 1982); 1.1% of covered Thoroughbred mares, within six weeks of birth (Laing and Leech, 1975); 1.38% of Thoroughbred foals born, within two months of birth (Platt, 1979); and 4.7% of foals of various breeds born, within 180 days of birth (Cohen, 1994).

Daily risk of death in foals is greatest during the first seven days of life (Cohen, 1994) with deaths during the first week of the foal's life accounting for 75% of all deaths up to two months of age (Platt, 1979). This peak within the first week may reflect the elimination of individuals that have failed to develop normally during the pregnancy or that have sustained severe stress during birth (Platt, 1979). The major cause of death in foals up to six months old on Texan farms is pneumonia, followed by septicaemia, although musculoskeletal disorders (problems involving bones, joints, muscles, tendons or ligaments) represent the most common cause of all deaths when considered as a group (Cohen, 1994). Failure of passive transfer of immunity, resulting from inadequate absorption of antibodies in colostrum, is the most important contributory cause of septicaemia in young foals (Platt, 1973).

### 3.4 Developmental diseases

Jeffcott *et al.* (1982) reported that of the 1975 foal crop in the United Kingdom that were eligible for naming, only 49% entered training. Developmental orthopaedic disease (DOD) may be responsible for preventing some of these foals entering training yards. DOD refers to a group of conditions that includes<sup>2</sup> osteochondritis dissecans, subchondral cysts, physitis, angular limb deformities, flexural deformities such as contracted tendons, and cervical vertebral malformation (McIlwraith, 1986). A study of Irish Thoroughbred foals (O'Donohue, Smith and Strickland, 1992) revealed that 67% of animals exhibited some form of DOD and that 11.3% of animals required treatment for DOD. The peak incidence of DOD occurred in weaned foals during the early winter months and the most common form of DOD was angular limb

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<sup>2</sup> See Glossary for explanation of individual terms

deformity, followed by physitis, which together constituted 72.9% of cases treated (O'Donohue *et al.*, 1992). While the majority of treated foals suffered no decrease in sale value by the time of the yearling sales, 18.7% lost much of their sale value, were considered unfit for sale, or were euthanised (humanely put down) (O'Donohue *et al.*, 1992). There is limited information on the incidence of DOD on Australian studs, but it is likely that this group of conditions also causes significant economic loss to the Thoroughbred breeding industry in this country (RIRDC, 1997).

The number of live foals that reach an age for use or sale is the ultimate measure of reproductive efficiency (Voss, 1993). Although investigation of wastage in the breeding sector is beyond the scope of this project, a review of the previous studies reveals that this is an area of significant loss for the racing industry, with resources being wasted on breeding mares that do not produce live or viable foals, and on rearing foals that never enter training.

#### **4. Wastage in training**

The initial training studies (Mason and Bourke, 1973; Jeffcott *et al.*, 1982; Rossdale *et al.*, 1985; Robinson and Gordon, 1988) were descriptive, providing details on the proportion of horses injured and the number of days of training lost because of injury. These early studies have provided valuable information on the relative impact of injuries, highlighting the importance of lameness and respiratory disease as causes of wastage.

##### **4.1 Lameness**

A study of 314 Thoroughbreds in Newmarket, England (Jeffcott *et al.*, 1982) found that lameness was the most important veterinary reason for wastage in young horses in training. Of these horses, 51.9% experienced a period of lameness, and in 20% of cases, the lameness was sufficient to prevent racing during the season (Jeffcott *et al.*, 1982). A further study on English Thoroughbreds in training (Rossdale *et al.*, 1985) confirmed that lameness was the most significant cause of wastage, based on the inability of horses to take part in cantering exercise as a result of injury or disease. Over two seasons, 35.8% of horses were sufficiently lame to prevent training, with



lameness accounting for 67.6% of days lost through injury or disease (Rossdale *et al.*, 1985). In German Thoroughbreds, 57% of training failures, defined as an inability to be trained at a galloping pace, were due to lameness (Lindner and Dingerkus, 1993).

Musculoskeletal (MS) injuries also have a major impact on the training of Thoroughbreds in the United States. Haynes and Robinson (1988) reported that 20% of the horses followed developed MS injuries that did not affect training or racing, 26% developed MS injuries that altered training, and 35% developed MS injuries that prevented training or racing. However, these results were limited by the relatively small sample population (95 horses) that were followed over only 81 days. A more extensive and thorough investigation of the impact of health problems on horses in the state of Michigan, U.S.A. (Kaneene, Ross and Miller, 1997) found that lameness was the most frequently observed health problem, although this study was not restricted to Thoroughbred horses. Lameness also had the second greatest impact, after disease involving the nervous system, in terms of the average duration per case and the average days not performing activities per case (Kaneene *et al.*, 1997).

There are limited published results from Australian studies that measure the impact of injury and disease in horses in training. Mason and Bourke (1973) followed 74 Thoroughbreds during their two-year-old racing season and reported that 40% were unsound at the end of the season, although unsoundness was inadequately defined. The most common cause of unsoundness during the season was sore shins<sup>3</sup> (46%), followed by knee problems (17%), splints (13.5%), sprained fetlock joint (9.5%) and sesamoid problems (5.4%). The distribution of the sites of lameness show a much higher occurrence of sore shins in Australian Thoroughbreds compared to those in England, where approximately 9% of cases of lameness are associated with sore shins (Jeffcott *et al.*, 1982; Rossdale *et al.*, 1985). A survey of veterinarians and trainers estimated that shin soreness affected 80% of two-year-olds in Australia (Buckingham and Jeffcott, 1990) and 70% in the United States (Norwood, 1978). Such differences highlight the need for conducting separate studies in Australia rather than applying results from other countries to Australian populations of horses.

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<sup>3</sup> This condition is also known as dorsal metacarpal disease, “bucked” shins or shin soreness. For the remainder of this report, it will be referred to as sore shins or shin soreness.

The training and racing of two-year-olds is a contentious issue because of welfare concerns about subjecting relatively immature horses to high work demands. In a study of the racing careers of 353 horses sold as yearlings in Australia (Bourke, 1995), it was reported that horses that raced as two-year-olds had a greater number of starts over a lifetime and raced in more seasons than those racing first at three years of age. This appears to indicate that there is no detrimental effect of racing two-year-olds, but while some horses that first raced in later years may have been given time to mature, it is important to consider that others would have entered training as two-year-olds but had their racing debut delayed because of injury or a lack of ability (Physick-Sheard, 1986), and both these factors could subsequently limit the horses' careers. In the United States, a higher proportion of two-year-olds sustain an injury compared to older horses (Robinson and Gordon, 1988), and in Germany, a larger proportion of two-year-olds have training failures compared to older age groups (Lindner and Dingerkus, 1993). A similar situation exists in England, where two-year-olds lose a greater proportion of available training days due to lameness compared to three-year-olds (Rossdale *et al.*, 1985). Despite the emphasis placed on the racing of two-year-olds in Australia, there is no information available on the number of training days lost because of lameness to evaluate objectively the impact of racing young horses.

#### *4.2 Respiratory conditions*

After lameness, respiratory problems associated with respiratory infection or upper respiratory function are the second most important cause of wastage in Thoroughbreds trained in England (Jeffcott *et al.*, 1982; Rossdale *et al.*, 1985). Rossdale *et al.* (1985) reported that respiratory conditions accounted for 20.5% of days lost through injury or disease over two seasons, affecting a high proportion (30.9%) of horses. In a study of 314 English Thoroughbreds, an analysis of the reasons for horses not racing during the 1980 flat racing season showed that 12% were associated with a respiratory problem, although this was of less importance than musculoskeletal conditions (45%) (Jeffcott *et al.*, 1982). In Germany, 12% of training failures are associated with coughing, nasal discharge and fever (Lindner and Dingerkus, 1993). The Michigan Equine Monitoring System ranked respiratory

problems as the third most frequently observed group of health problems (Kaneene *et al.*, 1997). In terms of the average days lost for performance per case, respiratory problems also had the third greatest impact (Kaneene *et al.*, 1997).

Two-year-old horses are more likely to be affected by respiratory problems than older horses, indicated by a higher monthly incidence of training failures (Lindner and Dingerkus, 1993), a greater proportion of horses affected, and a greater proportion of available training days lost (Rossdale *et al.*, 1985). The incidence of respiratory problems appears to be higher at particular times of the year (Lindner and Dingerkus, 1993; Kaneene *et al.*, 1997).

The relative importance of respiratory conditions, in terms of the frequency of disease and number of training days lost, has not been reported for Australian Thoroughbreds. The absence of the equine influenza virus in Australia (Geering *et al.*, 1995) and differences in stabling and climatic conditions may result in respiratory problems having a different impact in Australia compared to other countries.

## **5. Wastage in racing**

### *5.1 Injury and fatality rates*

Two measures have been used to calculate the frequency of injuries and fatalities in horse races: a *starter* refers to any horse that starts in at least one race during a racing season (the racing population); a *start* represents a single horse leaving the starting gate (race entrants) (Estberg *et al.*, 1996b; Wilson and Robinson, 1996b). Injury rates can be expressed as the number of injuries per start/starter, or per 1,000 starts/starters, or as a percentage of total starts/starters. The use of starts is preferable when comparing risk of injury among certain race- and horse-related characteristics because it is more representative of the opportunity for injury (Estberg *et al.*, 1996b).

Variability in the definitions of racing injuries make direct comparisons of injury rates difficult, and veterinarians attending race meetings may differ in their inclination to record less severe cases of injury. At four Kentucky racetracks, the injury rate per start was 0.33%, which included catastrophically and non-catastrophically injured

horses that sustained a musculoskeletal injury that resulted in an obvious change in soundness immediately before, during, or after a race (Peloso, Mundy and Cohen, 1994). During the 1987 racing season at one racetrack in Minnesota there were 3.2 breakdowns per 100 starters, with a breakdown being defined as a severe musculoskeletal racing injury that resulted in the horse being euthanised, retired for breeding, or unlikely to train in the next six months (Haynes and Robinson, 1988). The incidence of all injuries, including conditions such as “bleeding”, at New York Racing Association tracks was reported as 0.7266% of starts (Hill *et al.*, 1986). In Japan, the rate of fractures (broken bones) in races as a percentage of starters is 2.1%, although this figure includes even mild cases that may be diagnosed beyond the immediate post-race period because the Japan Racing Association owns the veterinary clinics that service the horse population (JRA, 1991). Hong Kong racing also involves a high level of regulation of veterinary services, with lameness recorded in 0.7% of starts, including horses found lame up to two days after racing (Watkins, 1985). Bourke (1996) reported the rate of post race lameness to be 0.3% of starts for Thoroughbreds racing on the flat at four Australian racetracks.

Records of fatalities generally are more consistent, although criteria may still vary according to whether or not horses euthanised in the days following the injury are able to be followed up and included. Severe musculoskeletal injuries do not directly result in the death of affected horses, but may necessitate euthanasia on humane grounds. It has become accepted terminology to refer to such cases as “fatal musculoskeletal injuries” (FMI). The reported fatality rates for Thoroughbreds racing on the flat at racetracks in the United States are higher than those for the United Kingdom and Australia (Table 1-2), and risk factors associated with an increased risk of injury or fatality need to be identified.

**Table 1-2.** A review of studies reporting fatality rates for flat racing Thoroughbreds

Study	Location	No. racetracks	Inclusion criteria	Fatality rate per start (%)
Bourke, 1994	Victoria, Australia	67	All fatalities	0.03
McKee, 1995	U.K.	39	All fatalities	0.08
Peloso <i>et al.</i> , 1994	Kentucky, U.S.A.	4	FMI	0.14
Wilson and Robinson, 1996b	U.S.A.	27	Fatal injury	0.159
Dibbern, 1996	West Virginia, U.S.A.	2	Catastrophic injuries	0.12
Estberg <i>et al.</i> , 1996b	California, U.S.A.	15	FMI	0.17

FMI = Fatal Musculoskeletal Injury

### 5.2 Sites of musculoskeletal injuries resulting in fatality

Musculoskeletal conditions sustained during racing or training account for 83% of Thoroughbred post-mortems in California, most frequently involving bone fractures (85%) and ruptured ligaments (10%) (Johnson *et al.*, 1994). The front legs are affected in 90% of cases of leg fractures (Johnson *et al.*, 1994). The leading leg at the time of an accident corresponds to the injured leg in a high percentage of cases of front leg injury (Ueda, Yoshida and Oikawa, 1993). In Californian Thoroughbreds, the most common sites of leg fractures that occur during racing and necessitate euthanasia involve the sesamoid bones (50%), cannon bone (30%), and knee bones (8%) (Johnson *et al.*, 1994). A similar pattern was reported for four racetracks in Kentucky (Peloso *et al.*, 1994; Cohen *et al.*, 1997) and for one racing venue in the northeastern part of the United States (Rooney, 1983). In contrast, cannon bone fractures occur more frequently than fractures of the knee and sesamoid bones in Thoroughbreds racing in the state of New York (Mohammed, Hill and Lowe, 1992).

In the U.K., front leg fractures account for the majority of catastrophic injuries for flat, hurdle and steeplechase races (McKee, 1995). In English flat racing, the most notable difference to the pattern of injuries reported in the U.S. is the lower frequency of sesamoid fractures, which rank behind front leg fractures of the cannon bone, knee, pastern, fetlock, and shoulder region (McKee, 1995). This may have been affected by the relatively large proportion of catastrophic injuries (17.4%) that were recorded as unspecified fractures, highlighting the need for standardised post-mortem programs. In hurdle and steeplechase races, fractures involving bones in the shoulder region are the most common type of forelimb fracture, reflecting the high proportion of fatalities in jumping races that are associated with a fall (McKee, 1995).

The distribution of catastrophic leg injuries in flat racing Australian Thoroughbreds is similar to that in California and Kentucky with sesamoid fracture and fetlock fracture/dislocation being the most common category, followed by fractures of the cannon bone (Suann, 1992; Bourke, 1994).

### *5.3 Risk factors for injuries and fatalities*

#### *5.3.1 Age*

A simple comparison of the injury rates in horses racing on dirt tracks in the U.S. indicated that two-year-olds were significantly less likely to sustain a musculoskeletal injury (3.04 injuries/1,000 starts) compared to older horses (5.54 injuries/1,000 starts) (Wilson, Jensen and Robinson, 1996). Robinson *et al.* (1988) reported that horses four years and older were 5.29 times more likely to suffer a breakdown than two-year-olds. Further studies in the United States have supported these results, demonstrating a positive association between the risk of breakdown (Mohammed, Hill and Lowe, 1991) or the risk of fatal musculoskeletal injury (Estberg *et al.*, 1996b; Cohen *et al.*, 1997) and the age of the horse.

Peloso *et al.* (1994) compared catastrophically injured to non-catastrophically injured racehorses and found no significant difference in the age of the two groups, although Mohammed *et al.* (1992) used similar groups for comparison, but used a more sophisticated form of analysis, reporting that the risk of severe injury decreased with the age of the horse. The use of non-injured horses as a comparison group would have

been preferable in both of these studies. Although Hill *et al.* (1986) concluded that age was not a factor in the occurrence of racing injuries, fracture injuries were found to be more common than other injuries in two-year-olds, whereas at three years of age, other injuries were more common and became progressively more predominant with increasing age.

### 5.3.2 Sex

Rooney (1983) found that there were significantly more breakdowns due to fractures among stallions and colts than expected, and fewer breakdowns in geldings than expected. Using a similar approach for the study of tendon injuries, Rooney and Genovese (1981) reported that the sex frequency for initial tendon strains was no different than the general population, but there was significantly less recurrence in females and more in geldings, than expected. These results were based on a questionnaire sent to trainers, for which no response rate was given.

Colts are over-represented among fatal injuries in two-year-olds on a per start basis and there are significantly more fatal musculoskeletal injuries in colts than fillies in the U.S. (Wilson *et al.*, 1996). The fatal injury rate per start for two-year-old geldings is intermediate between that of colts and fillies (Wilson *et al.*, 1996). Estberg *et al.* (1996b) reported that male horses were twice as likely as females to suffer a fatal musculoskeletal injury, controlling for age. However, sex was not a significant factor in comparing catastrophically injured horses to non-catastrophically injured horses in Kentucky (Peloso *et al.*, 1994).

### 5.3.3 Exercise intensity

Numerous measures of exercise intensity have been used to evaluate the importance of intensive high-speed exercise schedules prior to injury. The most simple measure is the number of days between the race of interest and the previous race. This was not a significant risk factor for catastrophic injury in the study by Peloso *et al.* (1994). In contrast, horses racing at Canterbury Downs, U.S.A., were more likely to suffer a bone injury if they had raced within the previous 12 days (Haynes and Robinson, 1988). A different pattern of racing was identified for horses that sustained complete fractures of the humerus (long-bone of the upper arm) while racing in California:

compared with the average interval between races, there was a longer interval between the last race and complete fracture (Stover *et al.*, 1992). The authors of this study suggested that the horses may have had pre-existing injury that prevented them from racing according to their prior routine. Cohen *et al.* (1997) conducted an analysis of risk factors for Thoroughbreds racing in Kentucky and reported an association of tendon strain in the front leg with an interval of greater than 60 days between the race in which the horse was injured and the previous race. No such association was found for the analysis of catastrophic injuries in the same population of horses (Cohen *et al.*, 1997). Californian Thoroughbred racehorses have been shown to be at greater risk for complete humeral fracture shortly after returning to training from a lay-up of greater than or equal to 60 days (Carrier *et al.*, 1997).

An increasing number of starts per year was associated with a decreased risk of breakdown in horses racing in New York state, possibly reflecting that healthier horses are more likely to race often during a season (Mohammed *et al.*, 1991). Estberg *et al.* (1993) found no difference between cases of catastrophic injury and uninjured horses for the average number of days between race starts. However, lengthy periods of absence from racing will dilute career estimates of racing intensity (Estberg *et al.*, 1996a) and investigation of a horse's recent exposure to intense exercise may be more relevant. In Californian Thoroughbreds, high total and high average daily rates of exercise distance accumulation within a two-month period are associated with higher risk of fatal skeletal injury during racing (Estberg *et al.*, 1996a).

#### **5.3.4 Racetrack**

Considerable attention has been focused on the role of racetracks in the occurrence of racing injuries. The fatality rate per start for 39 flat racing tracks in the U.K. ranges from 0.03% to 0.21% (McKee, 1995), indicating that features of certain tracks may increase the risk of injury. In the United States, there also is variation between racetracks, with the fatality rate for two-year-olds racing on dirt tracks ranging from 0 to 4.14 fatal injuries per 1,000 starts (Wilson *et al.*, 1996). However, the fatality rates at different tracks may be influenced by the age and sex distributions of race entrants at each track (Estberg *et al.*, 1996b) because age and sex have been associated with



racing injuries. Mohammed *et al.* (1991) found that horses racing at one of the study tracks had a lesser risk of breakdown. Restructuring of a racecourse in Japan resulted in fewer severe injuries (Oikawa *et al.*, 1994), supporting the notion that the racetrack design may contribute to racing injuries.

In contrast, Hill *et al.* (1986) concluded that, overall, the frequency of racing injuries is not influenced by the racetrack. The finding of no difference in risk of injury at four Kentucky racetracks (Peloso *et al.*, 1994) was limited by the comparison of the number of injuries per days of racing for each track, rather than the number of starts, which would more accurately reflect the opportunity for injury at each track.

Reports detailing the locations of injuries on the racetrack have been limited to severe injuries or fatalities and generally are descriptive or diagrammatic, highlighting areas where there may be clustering of injuries. Clanton *et al.* (1991) observed that 50% of breakdowns occurred as horses exited the final turn and another 27% as they entered the final turn. The authors noted that at these locations there is compaction around the starting chutes attributable to increased horse and equipment traffic and that the track surface is changing slope. Wilson *et al.* (1996) reported that the stretch (last) turn and top of the stretch were the most common sites for fatal musculoskeletal injuries in two-year-old Thoroughbreds in the United States. In Japan, 63.8% of serious racing injuries occurred on turns, while 36.2% occurred on the straightway (JRA, 1991). Hill *et al.* (1986) concluded that there was no specific location where horses were prone to suffer a fracture injury, based on the statistical analysis of six-furlong races at New York racetracks. However, inspection of their illustration of the sites of injuries indicates that the greatest number of injuries occurred at the pole position corresponding to where horses leave the stretch turn. A study on New York tracks (Mohammed *et al.*, 1992) reported that the risk of severe injuries was high in the early part of the race, but decreased after the horse passed the 6th furlong.

### 5.3.5 Track surface

Racing in Australia is conducted on turf racetracks, whereas in the United States, racing is predominantly on dirt track surfaces. The average fatality or accident rate is lower on turf surfaces than on dirt in the United States (Wilson and Robinson, 1996b)

and in Japan (JRA, 1991). However, this comparison should be qualified by recognising that age and sex distributions of race entrants and the class of races may differ for each type of racing surface. Fracture injuries are significantly more common on dirt tracks than turf tracks in New York (Hill *et al.*, 1986), but this has been attributed to the greater proportion of starts by two-year-olds on dirt tracks compared to turf tracks, and to the opportunity for two-year-olds to start at a younger age on dirt tracks. A study on racing injuries in New York indicated that horses racing on turf tracks had a lower risk of serious musculoskeletal injury compared with horses racing on dirt surfaces (Mohammed *et al.*, 1991). The hardness of a turf surface is similar to or lower than the hardness of a dirt surface (Zebarth and Sheard, 1985). Peloso *et al.* (1994) and Haynes and Robinson (1988) found no association between surface type and injury.

#### *5.3.6 Track condition*

Conflicting results have been presented with regard to the role of track conditions in racing injuries. Cheney *et al.* (1973) reported a positive correlation between horses becoming lame and track hardness, although the occurrence of lameness was determined by a questionnaire sent to trainers, for which no response rate was reported. Rooney and Genovese (1981) found fast tracks to be associated with the occurrence of more cases of bowed tendon than expected. This study also used a questionnaire sent to trainers to determine the frequency of tendon strain relative to track condition. Therefore, the results may be limited by the ability of the trainers to recall the track condition on the day of the injury. In contrast, Wilson *et al.* (1996) reported that the frequency of fractures, excluding sore shins, in two-year-olds racing on dirt tracks was higher on non-fast tracks than fast tracks, although track surface conditions were not significantly associated with overall injury rates. Mohammed *et al.* (1991) and Peloso *et al.* (1994) found no association between track condition and racing injuries. In Japan, accident rates among the turf racecourses are highest on tracks rated as fast, whereas for dirt courses, the highest accident rates are on tracks in heavy condition (JRA, 1991). Therefore, it appears that turf track surfaces may behave differently to dirt tracks when affected by rain.

#### *5.3.7 Other risk factors*

The above variables represent the main horse- and environment-related factors that have been evaluated as risk factors for racing injuries and fatalities. Numerous other risk factors have been investigated for potential association with injuries on the racetrack, in some cases with inconclusive results. In a study of Kentucky racetracks, the race distance was significantly shorter among horses with catastrophic musculoskeletal injuries than among horses with non-catastrophic injuries (Peloso *et al.*, 1994). Rooney (1982a) also found that certain race distances were associated with a higher number of cases of lameness than expected, although this relationship was not constant. Other studies in the U.S. (Hill *et al.*, 1986; Wilson *et al.*, 1996; Cohen *et al.*, 1997) and Japan (JRA, 1991) have found no association between the distance of a race and injury rates. The change in distance between the race in which the horse was injured and the previous race has been investigated as a potential risk factor in a study on racing injuries in Kentucky (Cohen *et al.*, 1997). The authors of this study reported that an increase in distance was associated with a decreased risk of injury to the suspensory apparatus of the front leg, but there was no association when all catastrophic injuries were considered together.

A clear association of season of the year and weather conditions with racing injuries has not emerged despite numerous investigations. The incidence of fractures during races in Japan is highest during early spring, while training accidents are more frequent during winter (JRA, 1991). In the United States, Mohammed *et al.* (1991) found that summer was associated with a higher risk of breakdown than winter or spring, which supports the findings of Rooney (1982b). However, the first phase of the study by Rooney related temperature and humidity to the number of tendon strains per month, and did not consider the number of starts made in each month. The second phase provided stronger evidence of an association by correlating the number of cases of lameness to the number of races per month, although the use of starts would have been preferable. Wilson *et al.* (1996) found that the highest monthly injury and fatality rates for two-year-olds racing in the U.S. occurred in September. In contrast, Hill *et al.* (1986) reported that there was no relationship between season or air temperature and the frequency of fracture injuries or other injuries, and Clanton *et al.* (1991) found no correlation between horse breakdowns and a weather index.

Thoroughbreds racing in a later race on New York Racing Association tracks had a lower risk of injury, possibly because later races were of better quality (Mohammed *et al.*, 1991), but there was no association with race number found in Kentucky when catastrophically injured horses were compared to non-catastrophically injured horses (Peloso *et al.*, 1994). Japanese researchers have reported that injury rates are lower in higher class races (JRA, 1991), which supports results from Minnesota, where significantly more breakdowns occurred in claiming races compared to non-claiming races (Robinson *et al.*, 1988). In contrast, other research in the U.S. has revealed no association between the class of race and injury rates (Peloso *et al.*, 1994; Estberg *et al.*, 1996b; Wilson *et al.*, 1996). Jockey class (apprentice or non-apprentice) was not found to be associated with racing injuries in Kentucky (Peloso *et al.*, 1994; Cohen *et al.*, 1997). However, analyses of patrol videos of racing accidents in Japan revealed that the actions of jockeys and horses may influence the occurrence of injuries (JRA, 1991). A large proportion of the accidents occurred when jockeys used the whip to press their mounts during changes in the leading leg as horses left the final turn to enter the straightaway. Cohen *et al.* (1997) found that the risk of injury was increased if there was a change in the lead leg during the 12-second period prior to the injury, or if a horse stumbled or had physical interaction with another horse during a race. Training regimens may be associated with racing injuries because Thoroughbred racing injury rates in the U.S. are lower for more successful trainers (Wilson, Shaw and King, 1997). Horseshoe characteristics have been identified as another possible risk factor for racing injuries, with toe grabs increasing the risk of fatal musculoskeletal injury, suspensory apparatus failure and cannon bone fracture in Californian Thoroughbreds (Kane *et al.*, 1996).

Results of pre-race inspection by regulatory veterinarians have been shown to be significantly associated with injury (Cohen *et al.*, 1997). For Thoroughbreds racing at four Kentucky tracks, the likelihood of musculoskeletal injury, damage to the suspensory apparatus of the front leg, and tendon strain in the front leg were 5.5 to 13.5 times greater among horses assessed by regulatory veterinarians to be at increased risk of injury (Cohen *et al.*, 1997). The role of pre-existing conditions in the occurrence of racing injuries has been raised by Krook and Maylin (1988) who classified 92% of the 53 fracture cases examined as having involved damage that was

present before the breakdown. In a New York study, 11% of horses injured during racing had a history of previous injury (Mohammed *et al.*, 1992). Peloso *et al.* (1994) reported that a significantly greater number of horses with racing injuries and catastrophic injuries were in the last half of the field at the first quarter fraction than would have been expected by chance alone, and suggested that injuries present prior to the race may have caused horses to settle to the back of the field early in the race. Therefore, thorough pre-race physical inspections may be a relatively simple and cost-effective means of reducing the number of racecourse injuries if regulatory veterinarians can identify and withdraw from races, horses that are at increased risk because of pre-existing injuries.

The increased international recognition of the impact of racing injuries has encouraged in recent years, research into identifying risk factors for such injuries. Differing results from the studies are probably partly attributable to the differences in case definitions, study designs and methodology. Results also may vary because of different features of racing in each country or state, highlighting the need for separate studies to identify risk factors for racing injuries in Australian Thoroughbreds.

## **Conclusion**

This review of previous research highlights the size, importance, and unique features of the Australian Thoroughbred racing industry. It also reveals that, despite this background, only limited research has been conducted in Australia to determine the causes of wastage in the industry, and much of the work has been descriptive. Rigorous and objective scientific research, until recently, has been underutilised in the investigation of training and racing injuries.

Although previous studies have indicated that there is significant wastage in the breeding sector, investigation of losses occurring at horse studs was beyond the scope of this project. Therefore, the present research has been focused on causes of wastage during the training and racing of Thoroughbreds. The information that appears to be of most relevance to the racing industry, yet which is lacking in previous Australian studies, is the identification of risk factors for racing injuries, the determination of variables that may influence the racing career of Australian Thoroughbreds and the documentation of the amount of time lost in training due to specific types of injury and disease. These are the major issues addressed in the studies presented in this report.



## **Chapter 2**

### **The Perceptions of Trainers on Causes of Wastage**



## **Introduction**

Before starting a long-term study on horses in training, a survey of trainers was undertaken to determine their perceptions of the major causes of wastage in Thoroughbred racing. Wastage was defined as any injury or disease that involves an interference with the training schedule of a horse, resulting in lost days in work, a prolonged spell or retirement from racing. Forty trainers, randomly selected from the three major Sydney race centres, were personally interviewed for the survey. The questionnaire contained 69 questions, which covered the following areas: horse population in stables (two questions); time spent in different activities (6 questions); monitoring health (7 questions); frequency of injuries and disease (36 questions); use of medications and treatments (12 questions); major causes of wastage (1 question); and research funding priorities (5 questions). When asked how often conditions occurred or treatments were administered, the categories for response were rarely, occasionally or frequently. Research funding topics were given a low, medium or high priority.

## **Training patterns**

Twenty-one trainers were from Randwick, 11 from Rosehill and eight from Warwick Farm. There was an average<sup>4</sup> of 20 horses housed in each stable and a average of 39 horses under each trainer's care, the latter representing the number of horses registered on his or her books. Of the trainers surveyed, 63% sent at least some of their horses to pretraining for an average of 4 weeks. There was considerable variation in the number of weeks required to get a horse to race fitness, as assessed by the trainers, from the time it entered the stable (average 11 weeks). However, this would be influenced by whether or not the horse was sent to pretraining and most trainers emphasised the difficulty in making generalisations as a horse's training was programmed to suit the individual. Once a horse reached the level of race fitness, 62% of trainers trained the horse at three quarter pace or more three days per week and 20% for two days per week.

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<sup>4</sup> Calculated as the median. For simplicity, both mean and median will be referred to as "average".

### **Health monitoring**

With regard to monitoring the horses' health, 17% of those surveyed took rectal temperatures daily. Most trainers took the temperature when a horse had a decreased appetite or on race day. Twelve percent of trainers routinely submitted blood samples for analyses whereas 70% submitted samples only when they thought it was necessary, such as for horses with elevated temperatures or signs of tying up. Eighty percent of stables did not weigh their horses. Forty percent of trainers quarantined new arrivals to the stable for an average of 7 days whereas 80% attempted to quarantine or spell sick horses, such as those with a nasal discharge or cough, until the signs had resolved.

### **Frequency of injuries and disease**

The responses of the trainers to the perceived frequency of occurrence of various diseases and injuries were ranked according to a frequency score (Table 2-1), calculated by applying a weighting to the response (rare=0, occasional=1, frequent=2). Sixty per cent of trainers observed shin soreness frequently, especially in two-year-olds, and shin soreness was calculated to have the highest frequency score, indicating that this was a major source of wastage. Buckingham and Jeffcott (1990) from a survey of Thoroughbred racehorse trainers and veterinarians in Victoria estimated the incidence of shin soreness in two-year-olds to be around 80%. The prevalence of shin soreness in two-year-old Thoroughbreds in the United States is estimated to be 70% (Norwood, 1978). In contrast, sore shins accounts for 9% of cases of lameness in English Thoroughbreds (Jeffcott *et al.*, 1982; Rosedale *et al.*, 1985), although the latter figure is based on cases that cause lameness or restrict training in horses of various ages. Whilst tendon, ligament and knee problems were mostly thought to occur occasionally or rarely, the consequences for the individual horse's racing career were considered serious by the trainers. There was a range of responses to the frequency of other joint problems such as "joint jarring", usually referring to the fetlock (20% rare, 62% occasional, 17% frequent), and to foot problems (27% rare, 50% occasional, 22% frequent). Sixty percent of trainers indicated that tying up only affected the occasional horse but it could recur as an ongoing problem in those horses so affected, most commonly in fillies.

Seventeen percent of those surveyed had horses with a nasal discharge frequently and 15% with a cough frequently. Colic was regarded as a rare condition by the majority of trainers, probably because the racing industry is composed of a younger population of horses and the risk of surgical colic increases with age (Reeves *et al.*, 1991). “Bleeders” were infrequently observed, although this relates to cases where there was visible external bleeding rather than cases detected by endoscopic examination of the lower airways. Fifty two percent of trainers indicated that horses in the stable had reduced appetite occasionally, most commonly after racing, race trialing or fast exercise. The most common skin condition was greasy heels, but it is unlikely to have a large impact on the training schedule of horses.

**Table 2-1.** Summary of the ranked frequency response scores from 40 Sydney trainers for diseases and conditions of Thoroughbreds. Each column contains conditions in order of decreasing rank

1 (most common)	2	3	4 (rarest)
Shin soreness	The “virus”	Crib biting	Diarrhoea
Coughing	Bleeders	Aggression	Swimming-related colic
Other joint injuries	Tendon/ligament	Rain scald	Queensland itch
Nasal discharge	Knee injuries	Sesamoid problems	Stall walking
Foot problems	Windsuckers	Hindlimb lameness	Teeth problems
Greasy heels	Ring worm	Weavers	Fractured limbs
Tying up	Masturbating	Roarers	Kidney problems
Back problems	“Thick winded”	Colic	“Wobblers”
Reduced appetite	Eye problems	Warts	Biting self

## Use of medications and treatments

With regard to medications and treatments (Table 2-2), antibiotics were mostly used occasionally, usually “when necessary”. Anti-inflammatory drugs (e.g. “bute”) were administered frequently by 30% of trainers, some giving them after every race, which may indicate a relatively high incidence of minor lameness. Salt drenches were given routinely in 57% of the stables surveyed, particularly in hot weather. Ninety five percent of trainers had their horses wormed routinely, which may contribute to the relatively low occurrence of colic. The regular use of vitamin and mineral supplements was widespread, whilst bleeding and pin-firing horses appeared to be losing favour as forms of treatment.

**Table 2-2.** Percentage frequency distribution of treatment administration reported by 40 Sydney trainers

Medications & treatments	Rare (%)	Occasional (%)	Frequent (%)
Antibiotics	25	62	12
Intravenous drips	55	22	22
Salt drenches	7	35	57
Vaccination	75	20	5
Worm drench	0	5	95
Corticosteroids	47	50	2
Anti-inflammatories	7	62	30
Vitamins	12	12	75
Feed supplements	7	10	82
Blood tonics	35	27	37
Bleeding	47	50	2
Pin-firing	80	20	0

### **Causes of wastage**

When asked to list the three most important causes of wastage in the Thoroughbred racing industry, coughs, colds and viral respiratory problems were listed most frequently (31 times), followed by general lameness due to problems such as fetlock and knee injuries, tendon and ligament problems (26 times). Shin soreness was recorded 18 times as being one of the most important causes of wastage, largely being attributed to the emphasis on two-year-old racing in this country. Foot problems such as corns, abscesses and poor shoeing was the next most common category (listed 15 times). Foot problems associated with improper shoeing may be a potential cause of lameness in horses (Stashak, 1987).

In this survey, a number of trainers thought that conditions such as shin soreness were not the most important cause of wastage despite its high frequency score because they accepted it as part of the process of training two-year-olds, which is a similar impression to that reported by Buckingham and Jeffcott (1990). In a study of 74 two-year-old horses in training in Melbourne, Mason and Bourke (1973) reported that 28 (40%) were unsound at the end of their two-year-old season. The major causes of permanent and temporary unsoundness in their study were knee problems and shin soreness, respectively. In our survey, most trainers grouped knee injuries under general lameness rather than specifically stating them as a major cause of wastage. It is interesting that although most trainers reported that nasal discharge and coughs were observed occasionally, overall, coughing and nasal discharge had highly ranked frequency scores and infectious respiratory conditions were perceived as the most significant cause of wastage in training. In England, Rosedale *et al* (1985) concluded that respiratory conditions were not as significant as lameness in causing lost days to training (accounting for 20.5% and 67.6% of days lost respectively) despite a similar percentage of horses being affected. Respiratory problems are perceived to be the third most important equine health problem, after lameness and colic, by horse owners and operators of equine establishments in Michigan, U.S.A. (Kaneene *et al.*, 1997).

## **Research priorities**

Finally the trainers were asked whether they would give high, medium or low priority to various research areas. By far the strongest opinion was expressed about the need for better race and training track design as 87% of trainers gave it a high priority. Investigation of specific causes of lameness was given the second highest priority (60%), followed by training and exercise issues (47%) and nutrition (45%).

Although the present results are derived from a relatively small number of trainers, obtaining the opinions of people who are directly involved in the Thoroughbred racing industry was thought to provide important preliminary information on the occurrence of injuries and disease under Australian conditions. Trainers were interviewed because of their direct involvement with the care of all horses in the stable on a daily basis. In contrast, a survey of veterinarians may have been biased towards more serious conditions, resulting in the under-reporting of low-grade injuries. It is important to consider that the responses of individual trainers on the frequency with which injuries and disease conditions occurred or treatments were administered may have been biased by the number of horses in their stable. Trainers from large stables probably saw more cases of a particular condition on a daily basis simply because of the greater number of horses under their care, and therefore may have been more likely to report conditions as occurring frequently. The present survey was not able to resolve this issue because of the limited sample size.

## **Conclusion**

In contrast to studies conducted in other countries that reported that lameness is the most significant cause of lost training days (Jeffcott *et al.*, 1982; Rosedale *et al.*, 1985), the current survey found that respiratory disease is perceived by the trainers as a more significant cause of wastage. This is surprising considering the more intensive housing and occurrence of equine influenza in England. As a further contrast to results reported from England (Jeffcott *et al.*, 1982; Rosedale *et al.*, 1985), the surveyed trainers indicated that shin soreness, as a specific musculoskeletal condition, is perceived to be a major cause of wastage in Australia. Research into race and

training track design was given a high priority by the vast majority of trainers. It is clear from such a response that the quality and safety of training and racing tracks is seen as a very important issue. Whether this indicates differing injury rates for individual racetracks needs to be determined.

## **Chapter 3**

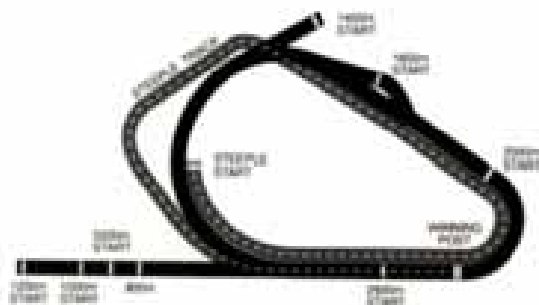
# **Risk Factors for Racing Injuries in Australian Thoroughbreds**



## Introduction

Injuries sustained by horses during racing represent an important source of wastage to the Australian Thoroughbred industry. Some injuries result in lameness, requiring a long spell from training, whilst others such as broken limbs may necessitate the horse being humanely destroyed. The public's perception of racing is also at stake. While a number of studies investigating racetrack injuries have been conducted in countries such as the United Kingdom (McKee, 1995), the United States (Hill *et al.*, 1986; Haynes and Robinson, 1988; Mohammed *et al.*, 1991; Peloso *et al.*, 1994; Estberg *et al.*, 1996a; Estberg *et al.*, 1996b; Wilson *et al.*, 1996; Cohen *et al.*, 1997) and Japan (Ueda *et al.*, 1993; Oikawa *et al.*, 1994), results from these may not be directly applicable to the unique conditions of Australian racing. Consequently, a study was undertaken to identify risk factors for serious racetrack injuries ("breakdowns") in Thoroughbreds racing at the four Melbourne metropolitan racecourses (Figures 3-1 to 3-4) during the period 1st August 1988 - 31st July 1995. The definition of a breakdown was any horse that was recorded in the Veterinary Steward's reports as having sustained a musculoskeletal injury (an injury to the bones, joints, tendons, ligaments or muscles) during a race and that then was either euthanised (put down) at the track or failed to race for 6 months from the date of injury. These horses were compared to an equal number of randomly selected horses that had raced at either of the four tracks without signs of injury.

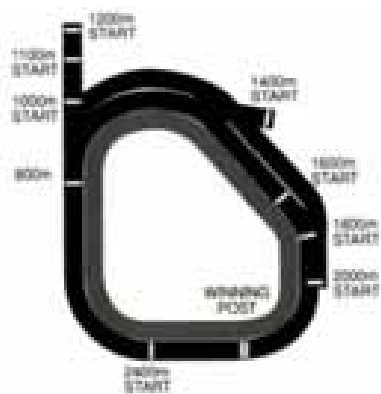
**Figure 3-1.** Flemington racecourse



**Figure 3-2.** Moonee Valley racecourse



**Figure 3-3.** Caulfield racecourse



**Figure 3-4.** Sandown racecourse



Variables that were thought to be potential risk factors associated with breakdown were then investigated. These included: age, sex, total number of race starts, days since previous start, track (Flemington, Moonee Valley, Caulfield, Sandown), track condition (fast, good, dead, slow or heavy), type of race (flat, hurdle or steeple), class of race (stakes race or non-stakes), distance of race, field size, weight carried, barrier position, distance of previous race and change in distance from previous race, season (summer, autumn, winter or spring) and average days between races.

### **Risk factors**

There were 196 cases of serious musculoskeletal injury in flat races, 52 cases in hurdle races and 53 cases in steeplechases over the seven-year period of study. The variables found to be the most significant risk factors for serious injury were age of the horse, track condition, racetrack and race type.

- Age

Increasing age was associated with a progressive increase in risk of breakdown. Horses 4- to 5- years-old were approximately one and a half times more likely to suffer an injury than those aged 2 and 3 years, whilst horses 6 years and older were over two times more likely to sustain an injury. This is not surprising given that older horses are more likely to have been exposed to a greater accumulation of “wear and tear” injuries from a long racing career (Pool and Meagher, 1990). In

addition, the age effect may be a reflection of delayed healing in older horses and the greater likelihood of older horses being retired after a serious injury.

- Track condition

Tracks rated as “fast” were associated with nearly three and a half times the risk of serious injury compared to “heavy” tracks. In other words, harder, drier turf track surfaces were associated with a greater risk than rain-affected softer tracks. This may be due to harder turf tracks having less cushioning effect (Zebarth and Sheard, 1985). Considerable interest has been focused on the role that track conditions play in racing injuries but results from various studies have been conflicting. For turf tracks in Japan, accident rates are highest on tracks that are in fast condition (JRA, 1991). In contrast, Wilson *et al.* (1996) reported that the frequency of fractures in two-year-olds racing on dirt tracks was two to three times higher on non-fast tracks than fast tracks. Studies by Hill *et al.* (1986), Mohammed *et al.* (1991) and Peloso *et al.* (1994) found no association between track condition and racing injuries in the United States. It is important to consider that turf track surfaces when affected by rain probably behave differently to dirt tracks (JRA, 1991).

- Racetrack

Differences were found between the risk of breakdown at some of the Melbourne racecourses. During the period of study, horses racing at Flemington were at an increased risk of injury compared to horses racing at Moonee Valley. This was a surprising result given that Moonee Valley is a smaller course with tighter turns. However, the increased risk of Flemington appeared to be more associated with the steeplechase track. The difference in risk may be due to different track designs or structural features such as the number and positions of crossings that represent areas of increased soil compaction (Clanton *et al.*, 1991). Whilst this is speculative, it does provide an indication that further comparison of these tracks is warranted, particularly since major renovations have been carried out at some of the racetracks after the end of the study period.

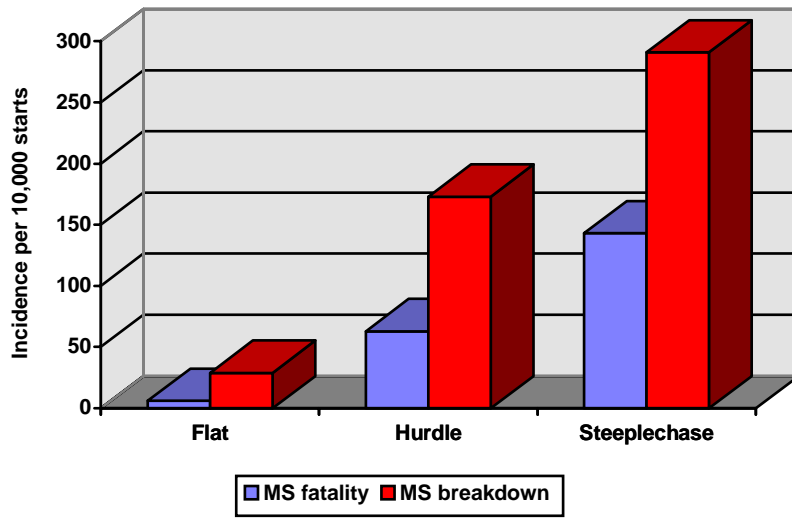
- Race type

The most notable risk factor was the type of race. When compared to flat races, horses in hurdle races were approximately four times as likely to be injured, whilst horses in steeple races had the greatest risk, being nearly eight times more likely to suffer an injury compared to horses racing on the flat. The presence of barriers is the most obvious factor placing horses in jumping races at greater risk and the finding that the majority of jumping fatalities were associated with a fall (Bourke, 1994) supports this. The jumps in steeplechase races are solid structures and are higher than the brush hurdle jumps, contributing to the increased risk of injury in steeplechase races compared to hurdle races.

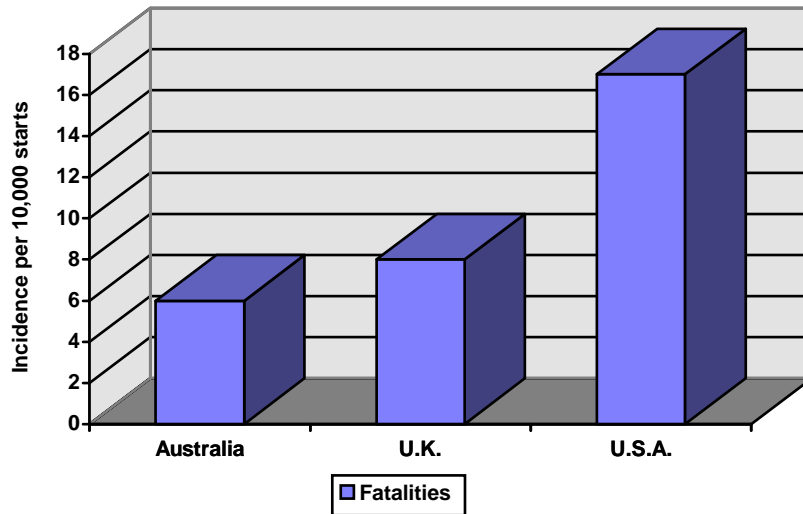
### **Injury and fatality rates**

Severe injuries involving the bones, joints, muscles, tendons or ligaments that necessitate the humane destruction of a horse are referred to as musculoskeletal (MS) fatalities. Figure 3-5 shows the incidence of MS fatalities and MS breakdowns for flat, hurdle and steeplechase races. (As outlined previously, the definition of a breakdown included horses that were put-down and horses that did not race within 6 months of being injured.) The incidence of MS fatalities in flat races for the four Melbourne tracks was 6 deaths per 10,000 starts (a *start* represents a single horse leaving the starting gate). This fatality rate was comparable to figures reported in the United Kingdom (8 deaths/10,000 starts) (McKee, 1995) but considerably lower than the United States, which ranged from 14 (Peloso *et al.*, 1994) to 17 (Estberg *et al.*, 1996b) deaths per 10,000 starts (Figure 3-6). In the United States, racing is predominantly on dirt tracks, in contrast to the turf racecourses of the U.K. and Australia. However, directly inferring that turf tracks are safer may be over-simplistic. Other possible explanations for this difference include variation in the frequency of racing, rules governing the use of medications (e.g. “bute”) before racing, climatic conditions, training regimens and the class of horse, which may be associated with racing on each particular type of track.

**Figure 3-5.** Graph of the rates of musculoskeletal fatalities and breakdowns in flat, hurdle and steeplechase races at four Melbourne racecourses for the period August 1988 - July 1995

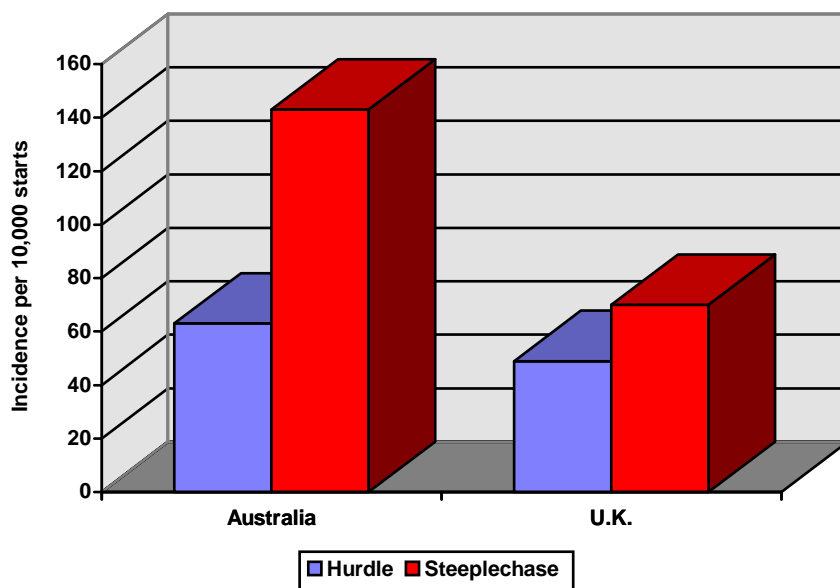


**Figure 3-6.** Graph comparing the rates of flat racing fatalities in Australia, the U.K. and U.S.A.



In contrast, the fatality rates for jumping races were higher for the four Melbourne tracks than that in the U.K. (Figure 3-7). At the Melbourne tracks, there were 63 deaths/10,000 starts in hurdle races and 143 deaths/10,000 starts in steeplechase races, whereas in the U.K., there were 49 deaths/10,000 starts in hurdle races and 70 deaths/10,000 starts in steeplechase races (McKee, 1995). Differences may exist between the type of horse used for jumping races in the two countries. In Australia, geldings that have retired from a career in flat racing form a large proportion of the population of jumping horses, and thus are older and may have predisposing injuries, whereas in England, horses are more likely to be specifically bred and reared for jumping races.

**Figure 3-7.** Graph comparing the incidence of fatalities in hurdle and steeplechase races in Australia and the U.K.



## Conclusion

It may be regarded that horses taking part in athletic competition are inevitably placed at risk of injury. However, there is a responsibility on the veterinary profession and racing industry to address the welfare and public relations issues arising from such injuries. Substantial research is needed if serious injuries are to be prevented or at

least have their incidence reduced. Maintaining accurate and uniform records of track conditions and injuries, during both training and racing, is an important part of this process, which will enable the safety of a track's design and surface to be evaluated. Based on the identified risk factors, strategies of a practical nature that could be implemented to reduce the incidence of injury may include closer monitoring and regulation of track moisture content to avoid excessively hard racing surfaces; more rigorous examination of horses before races for signs of lameness, particularly in older horses; and altering the number and design of jumps in hurdle and steeplechase races. However, although the odds of becoming injured may be quite high for some factors, the incidence of serious injury and death is very low at the tracks studied, and horses racing at them appear to be as safe or safer than horses racing at tracks in the United Kingdom and United States.

## **Chapter 4**

# **Racing Career Profiles of Australian Thoroughbreds**



## **Introduction**

Large sums of money are spent each year on the purchase and preparation of Thoroughbred yearlings. Knowledge of career profiles in Thoroughbreds is important for owners, trainers and racing administrators because it provides an indication of likely performances that can be expected for a population of racehorses. The majority of owners and trainers seek to have their horses racing as early and for as long as possible, both for the enjoyment of watching the horses race and in an attempt to earn a return on their investment through prize money. Therefore, factors that may influence the time until the first race start and the subsequent length of racing careers were evaluated for 553 Thoroughbred horses (259 females; 294 males) catalogued for an Australian yearling sale in 1991. The population of horses in the present study was chosen because it was a well defined group and the horses' racing careers could be followed retrospectively from a common starting point. However, there may be some limitations to inferences made from this group to the general population of Thoroughbreds in Australia because the horses were from a sale of elite yearlings.

From a commercial database that contained racing information on all horses that had made a start in Australia and New Zealand, all racing records up to the end of the group's sixth year (31st July 1996) were examined. The dates of birth were used to group horses into one of three foaling periods: early (August, September), mid (October), or late (November, December). For gender, horses were categorised as male or female because the records did not indicate when colts had been castrated.

Several factors that might have influenced the length of time taken for a horse to make its first race start and the length of the horse's racing career were evaluated. Time until first race start was defined as the number of days from the first possible race start for two-year-olds (21st September 1991) to the horse's first race start in Australia or New Zealand. Career length was defined as the number of days from the first to the last race start in Australia or New Zealand. Graphs were constructed to evaluate the effects of gender and foaling period on the time to first start, and the effects of gender and age at first start (two-, three-, or four-years and older) on career length.

## Overview

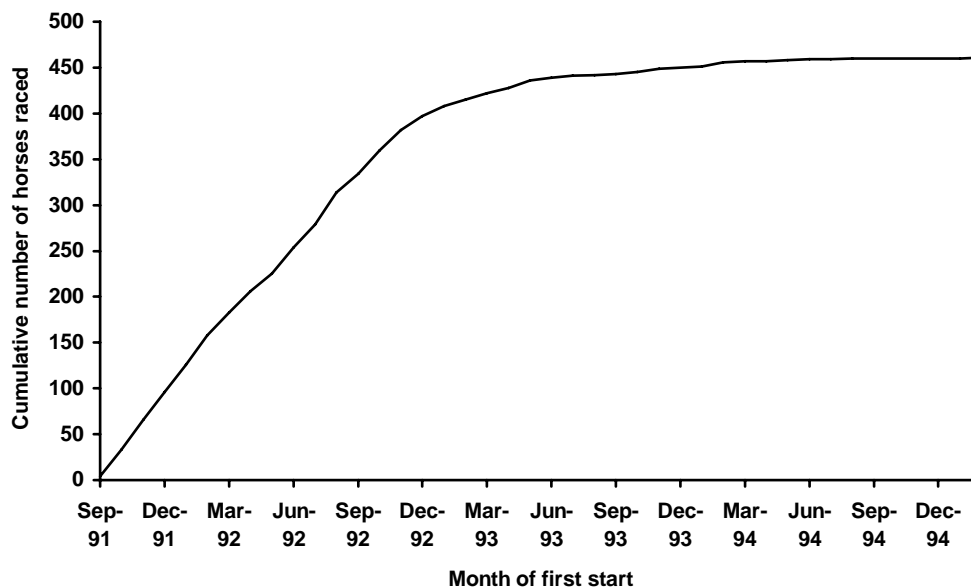
Of the 553 horses catalogued for sale, 81 (14.6%) had not raced by the end of the six-year-old racing season, 438 horses (79.2%) had raced only in Australia or New Zealand, 23 (4.2%) raced first in Australia or New Zealand then in other countries, and 11 (2.0%) had raced only in other countries. A significantly greater proportion of females had not raced (18.9%) compared to males (10.9%). The proportion of unraced horses (14.6%) was slightly lower than that reported in another Australian study of racing Thoroughbreds (Bourke, 1995) in which 20.7% of a group of yearlings sold in 1986 did not race, although the two studies show agreement with regard to the higher proportion of female horses that were unraced compared to males. The gender difference may be explained by the increased breeding opportunities for females, particularly for the current study population that had valuable pedigrees. In the United Kingdom, approximately 50% of Thoroughbred foals that are named and eligible for training do not race as 2-, 3-, or 4-year-olds (Jeffcott *et al.*, 1982). Apart from involving a slightly different denominator, the latter figure may be higher than the Australian results because of the significant number of horses that are kept as “stores” for National Hunt racing in the United Kingdom (Jeffcott *et al.*, 1982). In a study of the career profiles of Canadian Standardbreds (Physick-Sheard, 1986), it was reported that 33.5% of registered Standardbreds did not race. Although not determined in the current study, a large number of unraced horses were likely to have entered training before being retired because of a serious injury or lack of ability. The cost associated with preparing horses that do not race represents a significant economic loss to the industry.

In agreement with the study by Bourke (1995), a greater number of horses had their first race start as two-year-olds than in subsequent seasons (Fig. 4-1 and Table 4-1), reflecting the considerable emphasis placed on the racing of two-year-olds in Australia. Despite this, the finding that approximately 50% of the horses catalogued for sale had not raced as two-year-olds was regarded as significant because of the desire of most owners and trainers to have horses start in the first season of racing. The present study did not investigate reasons for not starting as a two-year-old. Possible explanations may include injury, immaturity or lack of ability. Although greater prize money is offered for some prestigious two-year-old races in Australia

compared to the United Kingdom, the average number of starts for two-year-olds was similar for the two countries (Jeffcott *et al.*, 1982). The average number of starts for three-year-olds was greater for the study population than for horses in the U.K. (Jeffcott *et al.*, 1982).

The average<sup>5</sup> number of race starts in Australia or New Zealand up to and including the six-year-old racing season for horses that had at least one race start in Australia or New Zealand was 15 (range 1 - 82). On average, male horses had a significantly greater number of starts during this period (average 22.0; range 1 - 82) than female horses (average 10.0; range 1 - 64). Table 4-2 details the average number of starts in each racing season. Horses that first raced as two-year-olds had significantly greater number of career starts during the period of study than horses first raced at three or four years of age, and raced for significantly more seasons than horses first raced as three- or four-year-olds (Table 4-3).

**Figure 4-1.** Graph of the cumulative number of horses that had raced in Australia or New Zealand by month



<sup>5</sup> For simplicity, both mean and median will be referred to as “average”.

**Table 4-1.** Age at first race start in Australia or New Zealand for Thoroughbreds sold as yearlings in 1991

Age at first race start	Number of horses	Percent of catalogue	Cumulative percent of catalogue
2-year-old	279	50.5%	50.5%
3-year-old	162	29.3%	79.8%
4-year-old	18	3.3%	83.1%
5-year-old	2	0.4%	83.5%

**Table 4-2.** Average number of race starts in Australia or New Zealand according to age group, in male and female Thoroughbreds sold as yearlings in 1991 having at least one race start at that age

Age	Number of horses	Category	Average starts	Minimum starts	Maximum starts
2-year-old	279	All	3.0	1	14
		Males	3.0	1	14
		Females	3.0	1	9
3-year-old	415	All	7.0	1	24
		Males	7.0	1	21
		Females	6.0	1	24
4-year-old	303	All	7.0	1	26
		Males	8.0	1	26
		Females	6.0	1	20
5-year-old	195	All	8.0	1	22
		Males	8.0	1	22
		Females	5.5	1	18
6-year-old	101	All	7.0	1	25
		Males	8.0	1	25
		Females	3.5	1	12

**Table 4-3.** Career race starts and seasons raced for Thoroughbreds sold as yearlings in 1991 that first raced in Australia or New Zealand as two-, three-, or four-year-olds

Age at first race start	Category	Average career starts (range)	Average seasons raced (range)
2-year-old	All	20.0 (1 - 82)	3.0 (1 - 5)
	Males	25.0 (1 - 82)	4.0 (1 - 5)
	Females	14.0 (1 - 64)	3.0 (1 - 5)
3-year-old	All	11.0 (1 - 60)	2.0 (1 - 4)
	Males	20.0 (1 - 60)	3.0 (1 - 4)
	Females	7.5 (1 - 44)	1.0 (1 - 4)
4-year-old	All	6.0 (1 - 28)	2.0 (1 - 3)
	Males	9.0 (3 - 28)	2.0 (1 - 3)
	Females	2.5 (1 - 6)	1.0 (1 - 2)

### 1. Time to first start

The date of the first race start was available for 461 horses. The time until first race start was not influenced by the gender (male or female) or foaling period (early, mid or late) of the horse. The classification of gender was limited to male or female, restricting our ability to investigate possible differences between colts and geldings. There is no significant difference between colts, geldings and fillies in the year of first race in Canadian Standardbreds (Physick-Sheard, 1986). The lack of effect of foaling period on time to first race start refutes the notion that foals born earlier in the season are more likely to race sooner because of the greater time available for physical development. The lack of significance may be due to the concentration of foaling dates over a relatively short period, or alternatively, compensatory growth in those foals born later in the season. The effect of foaling period on the performance at the first start was not evaluated in this study. Physick-Sheard (1986) suggested that the concept of advantage through early birth date may be an over-simplification that ignores considerations such as the influence of blood-lines upon rate of development, the influence of the environment, and the response to initial training.

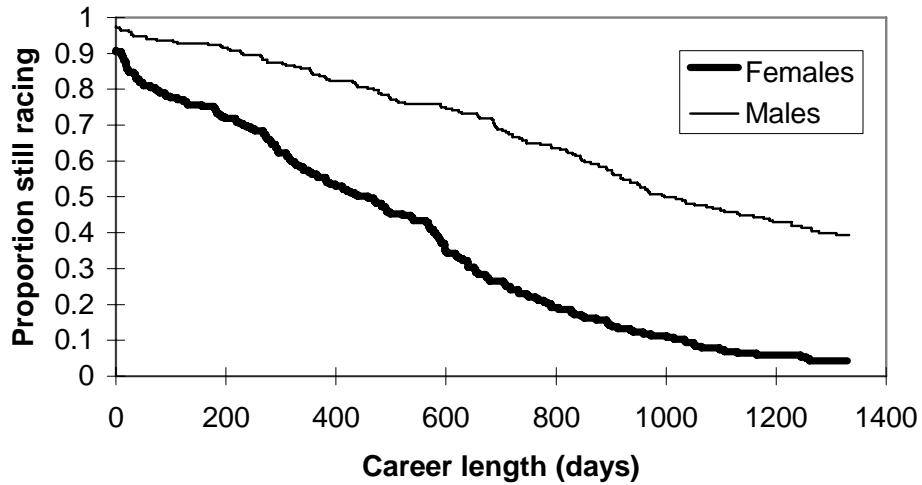
## **2. Career length: 1st start to last start**

Comparison of the graphs for male and female horses revealed a difference in career length between the two genders (Fig. 4-2). As expected, female horses generally had shorter racing careers than males, supporting the results of previous studies of Australian Thoroughbreds (Bourke, 1995) and Canadian Standardbreds (Physick-Sheard, 1986). The average career length was 461 days for females and 1,013 days for males. The potential for females to be used for breeding after racing is much greater than for males, whether they are retired to stud after establishing a successful racing record, sustaining an injury, or displaying a lack of ability. The tendency to retire female horses to stud rather than to continue racing may have been greater in the current group of horses than in the general population of Thoroughbreds because of the superior pedigrees of the study population. If a serious injury is encountered but a return to racing is possible after a long rest, some owners may still elect to retire a female horse to stud rather than forego a breeding season. In contrast, geldings have no value at stud, and only a minority of stallions that have performed well at the racetrack or have fashionable pedigrees, are retired to stud. Therefore, the tendency may be to keep male horses racing for longer, even if prolonged rests are required to recover from injuries. We were not able to compare geldings and stallions separately, but it is likely that combining these two groups into one category resulted in an underestimation of the career length of geldings and an overestimation of the career length of stallions.

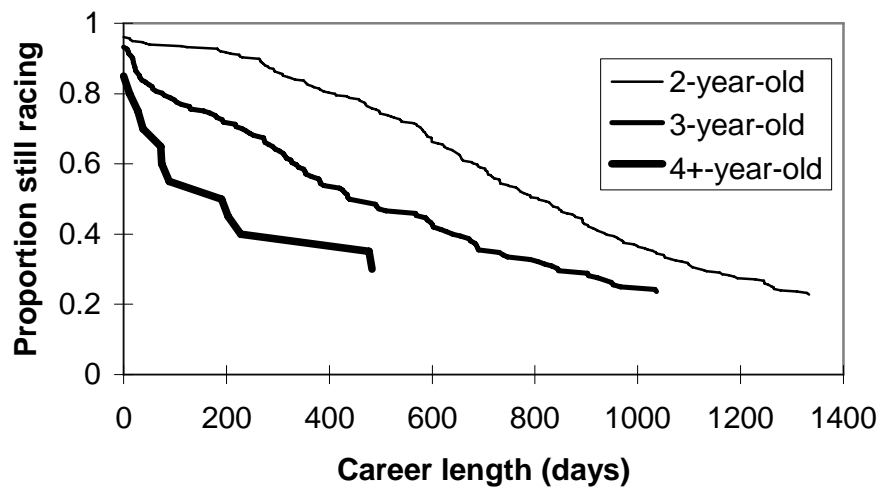
Horses having their first race during the two-year-old season had significantly longer racing careers than horses first racing at three-years or later (Fig. 4-3). Racing horses as two-year-olds is a contentious issue with concern being raised about the possible detrimental long-term effects of racing relatively immature horses. Physick-Sheard (1986) noted that racing horses at a relatively immature age may be offset by the lower frequency of racing in the first year. In the present study, the average number of starts in the two-year-old season was three, whereas in the three-year-old season the average number of starts was seven. Whilst some horses that first raced in later years may have been given time to mature, it is important to consider that others would have entered training as a two-year-old but had their racing debut delayed because of

injury or a lack of ability (Physick-Sheard, 1986), and both these factors could subsequently limit the horses' racing careers.

**Figure 4-2.** Graphs of career length (1st to last start) in male and female Thoroughbreds



**Figure 4-3.** Graphs of career length (1st to last start) in Thoroughbreds having their first race start at two-years of age, three-years of age or four-years of age and older



## **Conclusion**

These results indicated that the timing of the racetrack debut of Thoroughbreds was not influenced by gender or foaling period, such that there was no advantage for foals born early in the season. Male horses demonstrated significantly longer racing careers than females, and racing horses as two-years-olds appeared to have no detrimental effect on career length. However, this study does not provide information on the reasons for horses not racing as two-year-olds and further research is needed to determine whether or not injuries sustained in training are responsible for delaying the time of first race start.





## **Chapter 5**

### **Injuries and Disease in Two- and Three-Year-Old Thoroughbreds in Training**

## Introduction

Injuries and disease sustained in training are less visible to the public than racing injuries, yet they represent an important source of wastage to the industry (Jeffcott *et al.*, 1982) and raise similar concerns for animal welfare. Whilst racing injuries are officially recorded by veterinarians employed by race-clubs in Australia, official records of injuries in training are not maintained in this country. Trainers are not required to report injuries sustained during training and the veterinarians servicing the stables are not compelled to notify the stewards of cases they have treated. In contrast, the regulation of veterinary services by the racing authorities in Japan and Hong Kong makes it possible to maintain central records of injuries sustained in training (Watkins, 1985; JRA, 1991).

Studies in the U.K. and Germany have reported that lameness, followed by respiratory conditions are the most important veterinary causes of wastage in training, in terms of the number of cases and proportion of horses affected (Jeffcott *et al.*, 1982), and the number of days on which horses were unable to take part in cantering exercise (Rossdale *et al.*, 1985) or train at a galloping pace (Lindner and Dingerkus, 1993). In Australia, a study of 74 two-year-old Thoroughbreds indicated that 40% of horses were unsound at the end of the season (Mason and Bourke, 1973). However, this study did not record the time lost in training due to the specific types of injury. Given the unique features of training and racing in Australia (see Chapter 1), it appears that results from other countries may not be directly applicable to the Australian racing industry. Therefore, a long-term study was initiated to investigate causes of wastage in two- and three-year-old Thoroughbreds in training in the Sydney region. The specific aim of this study was to document the time lost in training due to various categories of injuries and disease. This information could then be used to determine the relative importance of lameness and respiratory conditions, thereby assessing the trainers' perceptions on causes of wastage (Chapter 2), and to determine to what extent injuries and disease in training are responsible for the high proportion of elite horses that do not race as two-year-olds (Chapter 4).

From 525 yearlings catalogued at a major yearling sale in 1995, 169 horses placed with 24 participating trainers were enrolled in a long-term study designed to identify

causes of wastage to the Thoroughbred industry. Of the 169 horses enrolled, there were 124 at Randwick stables, 21 at Warwick Farm stables, four at Rosehill stables and 20 at Central Coast stables. Ninety-five horses were male and 74 were female. Horses were followed from the time of sale until the end of the cohort's three-year-old racing season, on 31st July 1997. The one investigator (CJB) personally visited the stables every 14 days and records were maintained on the training, injury and disease status of the horses in the cohort. Information provided by the trainer or trainer's assistant formed the basis of the records. If procedures such as radiography (X-rays) or surgery were performed, details were obtained from the attending veterinarians. Specifically, the following details were recorded for individual horses during each visit: weekly activity status (training in the stable, pretraining, breaking-in, or resting at pasture); presence and character of injury or disease if appropriate; and impact of such disease or injury on training. The impact on training was categorised as:

1. Days of reduced training, in which there was a reduction in training level, but not box rest or walking. For example, cantering, trotting or swimming a horse when it was scheduled to gallop.
2. Days of training prevented, in which there was a reduction in training to the level of box rest or walking.
3. Days where training was modified, the sum of 1 and 2. It is important to note that for days on which the training was modified, the horse remained in the stable and incurred full training costs.
4. Weeks rested at pasture, representing the time between the horse leaving the stable and the horse resuming either pretraining or training.

Cases of injury and disease were recorded only if the training was altered according to one of the above criteria. Therefore, for example, a horse that showed signs of shin soreness but continued training uninterrupted would not be included as a case.

### **1. Time spent in different activity categories**

The horse-week, representing each week a horse was monitored during the period of study, was used as the unit of observation. There were a total of 15,747 horse-weeks of observation during the study period, of which 10,240 weeks were associated with

two-year-olds and 5,507 weeks with three-year-olds. The distribution of observation weeks between the different activity categories is shown in Table 5-1. The finding that this group of horses spent only 42% of the observed weeks in the stable was surprising because this represents time during which the horses were not racing and having the potential to earn prize money, especially as the two- and three-year-old racing seasons offer lucrative prize money. The distribution of time spent in different activity categories according to age group, revealed that two-year-olds spent almost half the time of three-year-olds in the stable. This probably partly reflects the decision of trainers to allow two-year-olds more time to mature without the pressures of training. Of the 525 horses catalogued for sale, 48% had raced by the end of the two-year-old season and 82% had raced by the end of the three-year-old season. Of the 169 horses included in the study, 45% had raced as two-year-olds. The figure for three-year-olds was not calculated because of the high number of horses lost to follow-up by the end of the study.

**Table 5-1.** Distribution of horse-weeks of observation between breaking-in, resting at pasture, pretraining, and training for two-year-olds, three-year-olds and the overall study period

Age group	Breaking-in	Resting at pasture	Pretraining	Training
<b>2-yo</b>				
No. weeks	706	5,392	767	3,375
% 2-yo weeks	6.9%	52.7%	7.5%	33.0%
<b>3-yo</b>				
No. weeks	0	1,916	287	3,304
% 3-yo weeks	0%	34.8%	5.2%	60.0%
<b>2-yo and 3-yo</b>				
No. weeks	706	7,308	1,054	6,679
% total weeks	4.5%	46.4%	6.7%	42.4%

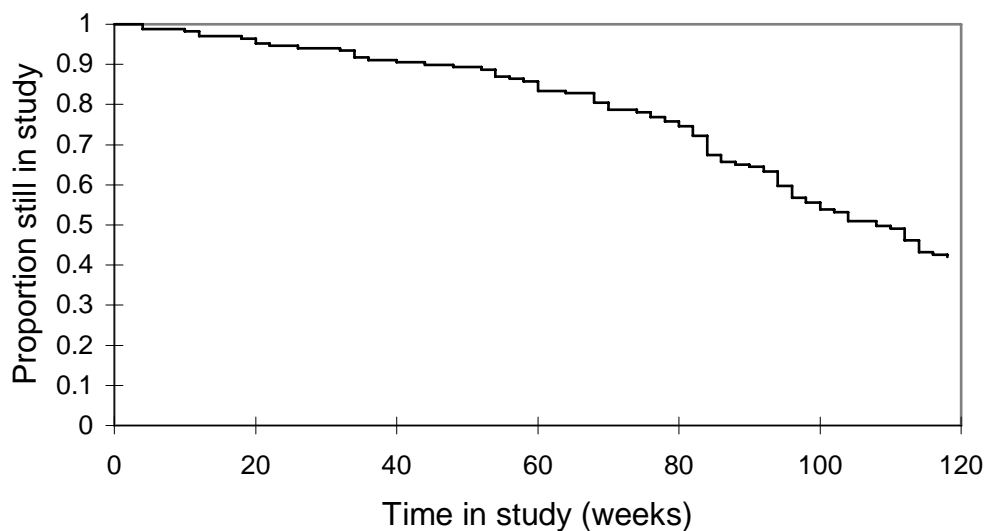
## 2. Reasons for horses leaving the study

Of the 169 horses enrolled in the, 29 were lost to follow-up as two-year-olds and 69 as three-year-olds, representing a drop-out rate of 58%. The time at which horses left the study is shown in Figure 5-1. The higher rate of loss in three-year-olds compared

to two-year-olds may reflect a combination of factors including the greater likelihood of retiring an injured female horse to stud if it is a three-year-old rather than a two-year-old, the retirement of well-performed three-year-olds to stud, and a delay in making a decision on a horse's ability until it had matured. The proportion of horses lost to follow-up over the two seasons compared favourably with the 45% permanent attrition rate reported for Thoroughbreds trained at Canterbury Downs, U.S.A. (Robinson and Gordon, 1988), although the latter study involved only one racing season. None of the enrolled trainers withdrew from the study because of a lack of cooperation.

The most common reasons for a horse leaving the study were owners and trainers electing to sell the horse or send it to another stable (45 horses) and horses being sent to other countries, often Hong Kong, Singapore or Macau (19). It was apparent that for many of these cases the horse was not displaying adequate potential to compete in metropolitan races. However, some of these horses were known to have an injury, which may have contributed to the decision to sell the horse or send it elsewhere. Eight horses were retired from racing because they showed a lack of ability, of which six were females that were sent to stud and two were geldings. Causes of injury and disease that resulted in horses leaving the study, either through retirement, death or euthanasia, included tendon strain (3), sesamoid fracture (2), ligament sprain (3), knee lameness (3), cuts and traumatic injuries (4), fetlock lameness (2), colic (2), severe diarrhoea complicated by founder (1), roarer (1), fractured pelvis (1), fractured cannon bone (1), suspected ingestion of toxin (1), heart flutter (1) and severe internal bleeding (1). From the above list it can be seen that there was no single category of injury or disease that predominated as a reason for horses leaving the study. Female horses, particularly three-year-olds that had sustained a serious injury were likely to be retired to stud even if there was the potential for the horse to return to training after a prolonged rest. Eleven horses died or were euthanised, representing 11% of all horses lost to follow-up. Eight horses were lost to follow-up as two-year-olds because of career-ending injuries or death, and only two of these cases were directly associated with training or racing.

**Figure 5-1.** Graph of the study drop-out rate for 169 Thoroughbreds followed from the time of sale as yearlings in 1995 to July 1997. The end of the two-year-old season corresponded to week 66 of the study



### 3. Injuries and disease occurring in the stable

Of the 169 horses included in the study, 160 (95%) had entered training in the stable by the end of the two-year-old season, whereas only 76 (45%) had raced as two-year-olds. The proportion of two-year-olds that had entered training and were injured in the stable was calculated for the major injury categories. Proportions were not calculated for three-year-olds because of the high number of horses that were lost to follow-up by the end of the study period. Eighty-five per cent of the horses suffered at least one incident of injury or disease whilst in training as a two-year-old. The most common injury in two-year-olds was shin soreness, which affected 42% of the 160 horses, followed by fetlock problems (25%) and coughs and nasal discharges (16%). Thirteen per cent suffered from cuts or traumatic injuries, 9% from foot problems, 7% from knee problems, 6% from tying up, 5% from ligament sprain, 3% from fever of unknown origin, 2% from upper respiratory obstruction (e.g. roarers) and 1% from tendon strain. These findings support the results from the survey of perceptions of Sydney trainers (Chapter 2), in which shin soreness had the highest frequency score, followed by coughing and other joint problems, including fetlock injuries. The proportion of horses that suffered shin soreness in the present group of horses was similar to that found in a study on 74 Australian two-year-olds in which 46% became

unsound due to shin soreness (Mason and Bourke, 1973). Another Australian study estimated that 80% of two-year-olds suffered shin soreness, based on a survey of veterinarians and trainers (Buckingham and Jeffcott, 1990), and a figure of 70% has been reported for Thoroughbreds in the United States (Norwood, 1978), although the latter two studies included cases that did not cause lameness or interrupt training. In contrast, shin soreness accounts for 9% of cases of lameness in English Thoroughbreds (Jeffcott *et al.*, 1982; Rosedale *et al.*, 1985). The higher frequency of shin soreness in Australia compared to the U.K. may be due to the greater emphasis on two-year-old racing in Australia. It also may be associated with the training of horses on tracks involving turns in Australia, unlike many of the straight turf training tracks in England, because strains increase on the cannon bone when horses are exercised around a turn (Davies, 1996). Of the horses that suffered from shin soreness as two-year-olds, 40% developed shin soreness a second or third time as a two- or three-year old. The corresponding figure for recurrences of fetlock problems was 48%, and for coughs and nasal discharges it was 27%.

For this group of horses, the total number of training days in which training was reduced (484) or prevented (591) was 1,075, representing 2.7% of the available training days. The proportion of available training days modified for two-year-olds (3.1%) was higher than for three-year-olds (2.2%). Table 5-2 contains the details of the days lost from training for some of the specific injury and disease categories during the study period, and Table 5-3 compares their impact on two- and three-year olds. Lameness, excluding cuts and traumatic injuries, was the most important veterinary cause of lost training days during the study period (56.2% of total days modified), followed by respiratory conditions (15.8%), supporting results from studies on Thoroughbreds in the U.K. (Jeffcott *et al.*, 1982; Rosedale *et al.*, 1985) and Germany (Lindner and Dingerkus, 1993). This finding was not surprising given that lameness encompasses a wider range of problems and the musculoskeletal system is subjected to frequent stresses from training and racing (Pool and Meagher, 1990).

**Table 5-2.** Impact of injury and disease on training days in 169 Thoroughbreds observed as two- and three-year-olds: days reduced or prevented. Conditions are listed in decreasing order, according to the percentage of total days modified



Injury/disease	Days reduced: % of 484	Days prevented: % of 591	Days modified: % of 1,075	Average days modified per case (range)
Cuts/traumatic injury	6.8%	25.0%	16.8%	4 (1 - 18)
Cough/nasal discharge	5.4%	24.4%	15.8%	5 (1 - 14)
Shin soreness	27.5%	4.4%	14.8%	4 (1 - 20)
Knee problems	12.6%	4.6%	8.2%	3 (1 - 34)
Fetlock problems	9.3%	6.4%	7.7%	3 (1 - 10)
Miscellaneous lameness	3.7%	10.5%	7.4%	8 (3 - 24)
Foot problems	3.1%	8.3%	6.0%	3 (1 - 14)
Fever	0.4%	7.8%	4.5%	3 (2 - 12)
Ligament sprain	7.9%	1.0%	4.1%	5 (2 - 18)
Sesamoid problems	7.9%	0.5%	3.8%	3 (2 - 36)

Of the individual categories of injury or disease, cuts and traumatic injuries, coughs/nasal discharge, shin soreness, knee problems and fetlock problems were the five most important causes of modified training days, but the impact of these on training was very different. Shin soreness, knee problems and fetlock problems caused many days in which training was reduced but few where training was completely prevented. In contrast, coughs/nasal discharge and traumatic injuries, while causing a similar number of days modified to shin soreness, had their major effect by preventing training from occurring at all. This finding may explain the trainers' perception that infectious respiratory disease is the most important cause of wastage in the racing industry (see Chapter 2). Most of the conditions resulted in a similar number of days being modified per incident, possibly reflecting the decision by trainers to keep horses in the stable only if they could resume work after a short rest; otherwise, horses would be rested at pasture. The types of injury and disease impacted differently on two- and three-year-olds: shin soreness, coughs/nasal discharge and sesamoid problems accounted for a greater proportion of total days modified in two-year-olds than in three-year-olds, whereas knee problems appeared to be more important in three-year-olds.

**Table 5-3.** Impact of injury and disease, in terms of training days modified, on 169 Thoroughbreds according to age group

Injury/disease	Days training modified in 2-yo's: % of 632 (rank)	Days training modified in 3-yo's: % of 443 (rank)
Cuts/traumatic injury	9.2% (3)	27.8% (1)
Cough/nasal discharge	19.0% (2)	11.3% (2)
Shin soreness	19.5% (1)	8.1% (4)
Knee problems	6.5% (6)	10.6% (3)
Fetlock problems	8.5% (4)	6.5% (6)
Miscellaneous lameness	7.3% (5)	7.7% (5)
Foot problems	6.5% (7)	5.2% (8)
Fever	3.8% (11)	5.4% (7)
Ligament sprain	4.1% (10)	4.1% (9)
Sesamoid problems	6.2% (8)	0.5% (17)

A total of 3,186 weeks was spent resting at pasture as a result of an injury or disease sustained in the stable, representing 20% of the total number of weeks of observation for this group of horses. Injuries and disease sustained as three-year-olds resulted in proportionally less time resting at pasture (15.2% of three-year-old weeks followed) compared to injuries and disease sustained as two-year-olds (20.0% of two-year-old weeks followed). Table 5-4 contains the details of the number of weeks spent resting at pasture for some of the specific injury and disease categories during the study period, and Table 5-5 compares their impact on two- and three-year olds. Lameness, excluding cuts and traumatic injuries, was the most important veterinary reason for resting horses at pasture during the study period (81.2% of total weeks rested for injury or disease), followed by respiratory conditions (10.9%). The greater impact of lameness compared to respiratory conditions was probably due to a combination of the higher frequency of cases of lameness, the longer time required to recover from serious lameness and consequently, the inclination of trainers to rest lame horses at pasture rather than in the stable. In contrast, many cases of coughs/nasal discharge would recover in a shorter period of time and hence the trainer would be less likely to send the horse away from the stable. This provides an additional reason for the

trainers' perception that infectious respiratory disease is the major cause of wastage because horses sufficiently lame to prevent training are less likely to remain in the stable under the daily observation of the trainer.

The most important individual categories of injury and disease in terms of weeks rested at pasture for the present group of horses were fetlock problems, shin soreness, knee problems and coughs/nasal discharge. The fetlock joint of the front leg is susceptible to injury because it has a relatively small surface area, it has the greatest range of motion of any of the limb joints, and flat racing horses transmit all of their weight through this one joint during one phase of the stride (Pool and Meagher, 1990). Cuts and traumatic injuries were ranked lower for weeks rested compared to their number one ranking as a cause of modified training days. Trainers may prefer to keep horses with cuts in the stable so that they can be treated and have wound dressings changed on a daily basis, rather than sending them to pasture. The various categories of injury and disease resulted in different periods of time being spent at pasture per case. Shin soreness and coughs/nasal discharge were associated with relatively short absences from training, whereas tendon strain could require over six months rest for recovery. Fetlock and knee joint injuries were associated with an intermediary period of rest away from the stable. The practice of completely resting horses with shin soreness appears contrary to recent recommendations for managing such cases, which suggest that the horse should not be galloped but training can be continued at a lower intensity (Larkin, 1995). The finding that shin soreness was responsible for a greater number of reduced training days rather than prevented training days in the stable indicates that this approach is adopted in some cases of shin soreness, but usually only if the horse has an upcoming race or trial, after which the horse is rested at pasture. The application of a radiographic (X-ray) index to monitor the development of shin soreness may be a means of preventing this condition, enabling the identification of horses that are not ready to progress to high intensity training (Larkin and Davies, 1996).

Shin soreness had a much greater impact on two-year-olds than three-year-olds in terms of weeks rested at pasture, whereas knee problems were more important in three-year-olds. Overall, injuries involving bones and joints appeared to have a

greater impact on the training of two- and three-year-olds than injuries that involved ligaments and tendons, possibly reflecting the skeletal immaturity of young horses.

**Table 5-4.** Impact of injury and disease on training in 169 Thoroughbreds observed as two- and three-year-olds: weeks rested at pasture. Conditions are listed in decreasing order, according to the percentage of total weeks rested

Injury/disease	Weeks rested at pasture: % of 3,331 <sup>a</sup>	Average weeks rested at pasture per case spelled (range)
Fetlock problems	23.1%	11 (1 - 44)
Shin soreness	22.5%	7 (2 - 22)
Knee problems	8.4%	16 (2 - 31)
Cough/nasal discharge	7.9%	6.5 (2 - 30)
Miscellaneous lameness	5.6%	13 (5 - 29)
Other joint problems	5.1%	12 (4 - 86)
Cuts/traumatic injury	5.0%	6.5 (2 - 32)
Ligament sprain	4.2%	9.5 (3 - 37)
Tendon strain	3.2%	35 (33 - 38)
Sesamoid problems	2.4%	15 (9 - 24)

<sup>a</sup> The total number of weeks rested at pasture in this table is greater than that listed above (3,186 weeks) because there were nine cases in which a horse was spelled for two reasons, resulting in the number of weeks rested being listed for both injuries

**Table 5-5.** Impact of injury and disease, in terms of weeks rested at pasture, on 169 Thoroughbreds according to age group

Injury/disease	Weeks rested at pasture after injury as a 2-yo: % of 2,471 (rank)	Weeks rested at pasture after injury as a 3-yo: % of 860 (rank)
Fetlock problems	23.7% (2)	21.5% (1)
Shin soreness	27.7% (1)	7.4% (6)
Knee problems	6.7% (4)	13.3% (2)
Cough/nasal discharge	7.0% (3)	10.3% (3)

Miscellaneous lameness	4.6% (6)	8.5% (4)
Other joint problems	5.7% (5)	3.4% (11)
Cuts/traumatic injury	4.0% (8)	7.7% (5)
Ligament sprain	4.1% (7)	4.7% (8)
Tendon strain	2.8% (9)	4.4% (9)
Sesamoid problems	2.2% (11)	3.0% (12)

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2-yo = two-year-old; 3-yo = three-year-old

## Conclusion

This study of horses in training provided objective information on the relative impact of injury and disease in Australian Thoroughbreds. Although there is considerable emphasis on two-year-old racing in Australia, less than 50% of elite horses raced during this year. The principal reason for this low figure was the high number of cases of low-grade injuries and disease that occurred during the training of two-year-olds. These minor incidents often altered training or resulted in the horse being rested at pasture, but did not prevent the horse from racing in subsequent seasons. In contrast, major injury was relatively uncommon in young horses in training. Lameness was a much more significant cause of wastage than respiratory conditions, although when categories of injury and disease were considered separately, respiratory disease was the second most important cause of modified training days and the fourth most important cause of weeks rested at pasture. The most significant causes of lameness were fetlock problems, shin soreness, and knee problems. Therefore, whilst major injury is relatively uncommon in young horses in training, low-grade injury and disease have the potential to disrupt training schedules and cause significant economic loss.



# **Chapter 6**

## **Conclusions**

## Overview

Thoroughbred racing in Australia has developed into a very large industry that now forms an important component of the nation's economy in terms of its contribution to Gross Domestic Product and employment (ACIL, 1992). Successful industries of any size usually devote resources to identifying areas of losses and inefficiencies. This should equally apply to the racing industry, particularly considering that in such a large industry, a small improvement in productivity could result in substantial savings of money and resources. However, previously, because of the expertise available and its focus on administrative issues related to racing, the Australian Thoroughbred industry has not adopted a rigorous approach to identifying causes of wastage that are associated with injuries and disease suffered by horses during racing and training. Such an assessment of losses within the racing industry is a rather dry, economic evaluation. An alternative, but not less important perspective, raises concern for the animal welfare implications of injuries associated with training and racing. The Thoroughbred racing industry has been under increasing scrutiny from animal welfare groups, yet there is limited objective information that can be provided by the industry to either counter claims of unacceptable injury rates or implement policies that address areas of concern.

Researchers in other countries have indicated that there is significant wastage occurring within their racing industries (Jeffcott *et al.*, 1982; Rosedale *et al.*, 1985; Robinson *et al.*, 1988; JRA, 1991; Lindner and Dingerkus, 1993). It appeared likely that a similar level of wastage might have existed within the Australian racing industry but some of the unique features of training and racing in this country (see Chapter 1) could have affected the relative impact of different types of injuries and disease. Therefore, results from other countries might not have been directly applicable to the Australian situation, indicating the need for independent studies. Previously there had been only limited research on identifying causes of wastage in Thoroughbreds in Australia and most of the published material was of a descriptive nature (Bourke, 1990; Bourke, 1994; Bourke, 1995). One of the main impediments to research on injury and disease rates may be the fragmented nature of the racing industry. There often is a minimal exchange of information on the occurrence of injuries: records of race-day injuries and fatalities are not standardised between racing



clubs, and trainers and veterinarians are not required to report injuries sustained during training. In contrast, the regulation of veterinary services by the racing authorities in Japan and Hong Kong facilitates the maintenance of central records of injuries sustained in racing or training (Watkins, 1985; JRA, 1991). There also may be certain reluctance within the industry to investigate causes of wastage through concern that racehorse owners may be discouraged from purchasing and racing Thoroughbreds.

The primary objectives of the current research were to identify the main causes of wastage associated with injuries and disease sustained during the racing and training of Thoroughbreds and to quantify their effect under Australian conditions. Investigation of wastage occurring within the breeding sector was beyond the scope of this research. The investigation was broadly divided into causes of wastage associated with racing (Chapters 2, 3, and 4) and training (Chapters 2 and 5). It was not envisaged that the results would provide information that could be used to directly reduce injury and fatality rates. Instead, the principal aim was to provide objective scientific information so that further research may be directed towards priority areas, based on scientific results rather than anecdotal evidence.

### **Implications and Recommendations**

The implementation of standardised and more detailed reporting of race-day injuries and fatalities at major racetracks would greatly benefit research on racing injuries. The roles of racetracks, racing surfaces and track conditions in racing injuries need further clarification, particularly considering the significant cost of replacing or renovating tracks. This may require the development and evaluation of a uniform system for measuring track characteristics, such as track hardness. The high fatality rates in hurdle and steeplechase races was of concern, and strategies to reduce the incidence of catastrophic injuries in these jumping races need to be investigated. If intervention measures are implemented, such as changing the design and number of jumps, it is important that the impacts of these changes are evaluated.

Research on injuries and disease in training should focus on common causes of low-grade injury and disease. This may include the identification of agents involved in respiratory disease and investigation of risk factors for the occurrence of this condition. Although shin soreness was not a career-ending injury, overall it was a major cause of wastage, and for individual horses, the occurrence of shin soreness at a critical stage of training could result in the withdrawal of the horse from a lucrative race. Methods of monitoring the development of shin soreness in horses may enable training programs to be modified at appropriate times to prevent this condition or at least reduce its severity (Larkin, 1995; Larkin and Davies, 1996). Joint problems, particularly involving the fetlock and knee joints, represent another important source of wastage and area for future research.

## **Conclusion**

Although horses taking part in athletic competition are inevitably placed at some risk of injury, the racing industry needs to be more pro-active in supporting research into reducing wastage associated with injuries and disease sustained in Australian Thoroughbreds. Despite the size, importance and unique features of the Australian racing industry, only limited research has been conducted to determine the causes of wastage in this country. The research presented in this report was successful in highlighting the main causes of wastage sustained during racing and training, using a range of studies. Further research is required to develop strategies to reduce the impact of these conditions. In racing, although serious or fatal musculoskeletal injuries were found to be uncommon events, they represented an important source of wastage because of the severity of the injuries sustained. The roles of tracks and track surface conditions in flat racing injuries, and jump designs in hurdle and steeplechase injuries need to be studied in greater depth because these risk factors have the potential to be modified. The development and implementation of standardised injury reporting forms at metropolitan racetracks would be a necessary component of such an investigation.

In contrast, the main cause of wastage in training was the high number of minor incidents of injury or disease that resulted in lost training days and a delay in the time

to first start. Shin soreness, fetlock and knee joint injuries, and respiratory disease were the most important veterinary causes of lost training days. The identification of risk factors for these conditions and a greater understanding of their development represent important priorities for future research within the Australian Thoroughbred racing industry.

## **Glossary**

Angular limb deformities:	outward or inward deviation of the lower legs.
Antibodies:	part of the immune system that counters bacteria and viruses.
Cervical vertebral malformation:	“wobbler” syndrome due to compression of the spinal cord in the neck.
Colostrum:	the thick, yellow first milk from the dam after birth.
Embryo:	a new organism in the earliest stage of development in the uterus (womb).
Euthanise/euthanasia:	the putting to death of an animal in a humane way.
Fatality:	a death.
Flexural deformities:	tightening or shortening of the flexor tendons at the back of the lower legs.
Fracture:	a broken bone.
Frusomide:	a drug that increases urine production, which is sometimes used in horses known to be “bleeders”.
Intravenous:	given into the bloodstream through a vein.
Musculoskeletal:	involving the muscles, bones, ligaments or tendons.
Osteochondritis dissecans:	thickening, cracking and tearing of the joint cartilage of growing horses.
Ovulation:	the release of eggs (female reproductive cells) from the ovary.
Phenylbutazone (“bute”):	a drug that reduces inflammation and pain.
Physitis:	inflammation, thickening and flaring of the growth plates in bones.
Post-mortem:	examination of an animal after its death to determine the cause of death.
Septicaemia:	the invasion and persistence of harmful bacteria and their toxins in the bloodstream.
Subchondral cysts:	fluid-filled cysts occurring within a bone.

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