



Editorial

A sustainable structure for jockey injury data management for the North American horse racing industry



ARTICLE INFO

ABSTRACT

Summary: Jockey injuries in North American racing are not well understood. The types and severity of injuries as well as exposure need to be better characterized in order to reduce risk. We consider existing data sources and the opportunity to combine this data with a new data collection effort to better understand and potentially reduce risk to riders. Using a two-phase approach, data appears to be available which would allow useful information on jockey injuries that could inform efforts for risk reduction quickly and with modest resources. Initial successes can help to develop support for a more comprehensive data collection and risk reduction program.

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Background

North American flat racing lacks comprehensive collection, collation, and analysis of jockey fall and injury data. Almost three decades ago the National Jockey Injury Study recommended development of a centralized national jockey injury database. This initial study, using a self-reported retrospective survey, highlighted the under-reporting of low severity injuries considered to be “occupational hazards of riding”, and lacked denominator data and risk factor information (particularly track and regional differences) [1]. Soon after another retrospective study used insurance data to better detail causes of jockey injuries, reiterating the need for enhanced reporting [2]. In 2005, Congressional hearings prompted a request that the National Institute for Occupational Safety and Health (NIOSH) investigate safety and health hazards in the horse racing industry. Two relevant NIOSH recommendations were (1) to develop track-, state-, and organisation-level injury and illness data collection systems as a model for a national surveillance system; and (2) support scientific inquiry into the health status of racing industry participants [3]. To date, some jurisdictions have their own means of monitoring injury, but none are standardised and there has been little progress implementing a national system.

On average two jockeys die each year of injuries sustained during racing in North America (1940–2018, N = 146 jockey deaths; Jockeys' Guild). The incidence rates of jockey falls and injuries across North America are unknown, although there has been one study reporting the incidence in the state of California from 2007 to 2012 – with two jockey falls per 1000 race rides in Thoroughbred flat racing and three falls per 1000 race rides in Quarter Horse racing. Injuries occurred in 52% and 60% of associated falls, respectively [4]. Globally, the incidence of jockey falls and injuries ranges from 2 to 4 falls and 1 to 2 injuries per 1000 race rides in flat racing (Table 1), and 48 to 91 falls and 5 to 12 injuries per 1000 race

rides in jumps racing (Table 2). Due to differences in reporting, definitions of incidents, and epidemiological study methodologies it is difficult to compare these rates across countries.

Efforts to improve safety for jockeys in North America are recognised at the biennial Welfare and Safety of the Racehorse Summit, coordinated and underwritten by the Grayson-Jockey Club Research Foundation and The Jockey Club. The first of such Summits was held in 2006, and since have generally recurred every two years. The Summit brings together the breeding, racing, veterinary, scientific, and regulatory sectors with the aim of improving the safety and welfare of the Thoroughbred racehorse. During the original summit, committees were established and work began on various aspects of Thoroughbred welfare and safety. Among those new initiatives was the Health and Medical Records Committee and the On-Track Injury Reporting Committee. These initiatives were critical to the formation of a comprehensive equine injury tracking system for North American racing – the Equine Injury Database (EID). Efforts continue which will expand infrastructure to support standardised veterinary records for veterinarians working in racing. However, due to privacy concerns and varying medical personnel at the racetracks, the documentation of medical and emergency treatment of the human participants is less well developed.

One oft-cited obstacle for data acquisition and management in North American racing is the decentralized regulatory model with 38 stand-alone jurisdictions, and an even larger number of individual racetrack operators. These industry structural challenges have been substantively addressed by the EID. While specific regulations may vary between jurisdictions, regulatory veterinarians are present in all major jurisdictions and have similar roles.

At the eighth Summit in June of 2018, a panel titled ‘Safety Initiatives and the Jockey’ included presentations from Dr Petra

Table 1
Global incidence of jockey falls and injuries in Thoroughbred flat racing.

Country	Reference	Years	Data source	Falls per 1000 race rides	Injuries per 1000 race rides
Australia	Hitchens, Blizzard [5]	2002–2006	Stewards' reports	4.2	1.1
New Zealand ^a	Bolwell, Rogers [6]	2008–2013	Stewards' reports	2.2	0.5
California, USA	Hitchens, Hill [4]	2007–2012	Stewards' reports	2.1	1.1
Japan ^b	Oikawa [7]	1998–2000	Not reported	1.6	–
Ireland	McCrorry, Turner [8]	1991–2001	Medical officer	3.7	1.5
United Kingdom	McCrorry, Turner [8]	1991–2001	Medical officer	4.4	1.8
France	McCrorry, Turner [8]	1991–2001	Medical officer	3.1	1.2

^a Excludes jockeys that fell from horses that were scratched pre-race; ^b falls and injuries that occurred during races only.

Table 2
Global incidence of jockey falls and injuries in Thoroughbred jumps racing.

Country	Reference	Years	Data source	Falls per 1000 race rides	Injuries per 1000 race rides
Australia	Hitchens, Blizzard [5]	2002–2006	Stewards' reports	52.6	5.1
New Zealand ^a	Bolwell, Rogers [6]	2008–2013	Stewards' reports	84.7	14.7
Japan ^b	Oikawa [7]	1998–2000	Not reported	66.8	–
Ireland	McCrorry, Turner [8]	1991–2001	Medical officer	47.4	6.1
United Kingdom	McCrorry, Turner [8]	1991–2001	Medical officer	67.7	12.2
France	McCrorry, Turner [8]	1991–2001	Medical officer	91.4	11.9

^a Excludes jockeys that fell from horses that were scratched pre-race.

^b falls and injuries that occurred during races only.

Hitchens (Equine Veterinary Epidemiologist, University of Melbourne), Dr Kelly Ryan (Primary Care Sports Medicine Physician, MedStar Health), and Dr Carl Mattacola (Associate Dean of Academic and Faculty Affairs, University of Kentucky). The panel concluded that much work remains in terms of human injury reporting. In conjunction with the 2018 Summit, the inaugural Racing Safety Data Workshop convened at Spindletop Hall on 28 June 2018 to discuss the way forward for the implementation of a jockey injury data management system. Thus, the Workshop outcomes form this proposed sustainable structure for North American jockey injury data management.

Haddon matrix and countermeasures

Risk factors identified to date are contained within the framework of the Haddon matrix for the pre-event and event phases of jockey falls and injuries [9,10]. The Haddon matrix is commonly used to describe sports injury risk [11]. Studies of risk for jockey falls and injuries have identified a number of modifiable and non-modifiable factors related to one of the four matrix components of the first dimension: (1) the host or person at risk of injury (jockey), (2) the agent or vehicle that transmits the agent of injury (horse), (3) the physical environment (race conditions), and (4) the social environment (e.g. rules and regulations). In the second dimension, we have pre-, during-, and post-fall or injury

phases which are the points in time at which each countermeasure would be affected (Table 3) [9,10]. Preventative measures are most effective in the early phases, i.e. prevention is better than cure. Numerous risk factors for jockey falls and injuries have been identified in studies from Australia. At the jockey-level (host), those at increased risk of falling in flat races include female jockeys, apprentice jockeys, amateur jockeys, jockeys who were older at the commencement of their race riding career, and jockeys with fewer previous rides on the current race-day [12,13]. Jockeys with lower aerobic and anaerobic fitness, greater muscular strength and power (possibly due to stronger riders being placed on more difficult horses), and riding with the full foot in the stirrup irons compared with riding on the ball of the foot have also been found to have greater risk of falls, albeit in a pilot study [14]. At the horse-level (vehicle), jockeys riding horses younger in age were at higher risk. At the race-level (environment), jockeys riding on drier, faster tracks, over shorter race distances, in races that were lower in grade, and with fewer starters had a higher risk of falling [12]. Many of the host-vehicle-environment conditions interact with each other, exacerbating risk. For example, combining less-experienced jockeys with less accomplished horses (lower race grade, fewer previous race starts, lower prize money) and/or under certain race-level conditions (drier or faster tracks, shorter race distance) increases the risk of falls such that the risk is greater than the sum of each individual risk factor [13].

Table 3
The Haddon matrix and example countermeasures applied to the reduction of falls and injuries to jockeys in horse racing.

	Jockey	Horse	Race conditions	Rules and regulations
Pre-fall or injury Prevent or reduce	Education and training; Physical assessments; Increase jockey minimum weights	Education and training; Safety equipment; Pre-race horse examinations	Produce safe track conditions in which to race (e.g. track surface); Train starting gate crew	Cancel or postpone races if track surface is deemed to be unsafe; monitoring of alcohol/drug use for both jockeys and horses; weather protocols; outriders
During the fall or injury event Minimise, control, and protect	Fall training; Strength and conditioning; Helmet use	Ensure equipment on horse is maintained	Starting gate padding; Safety rails	Minimum helmet and vest standards
Post-fall or injury Rapid response, treatment and rehabilitation	Understanding of protocols (e.g. lying still in case of back injury); Easy access to services	Veterinarian or other to attend to horse; Veterinarian to monitor horse post fall if necessary	Ambulance and veterinarian follows race field from mounting to dismounting	Minimum 2 ambulances on course; Reporting to insurance agency; EMS preferred over paramedic

Although there are relatively few jumps racing starts in North America, it is likely that the frequency of jumps-jockey injuries is not trivial based on observations in other countries [5]. As a result, jump racing injuries should also be considered. Key predictors associated with both types of jumps racing (hurdle and steeplechase) in Australia were: provisionally licenced jockeys, fence design, and a greater number of starters in the race. In hurdle racing; older jockeys (host), the fence design, metropolitan tracks, greater prize money, and maiden races over long distances (environment) were associated with higher risk. In steeplechase racing, jockeys having had previous rides at a meeting were at higher risk. Plus, there were significant interactions between vehicle-environment conditions, notably, horses with fewer than five starts competing in races with a greater number of starters [15].

Comparisons between countries may be of particular value for addressing operational issues. A priority would be to look at a range of controllable and modifiable factors which exist in different countries and which may be protective or increase risk. Some factors that differ between countries include: movement of jockeys between tracks, jockey training, and racing-related factors such as the racing surface materials. Possible risk factors particular to North America may be race conditions such as claiming races, the length of the race meet, presence of assistant starters in the starting gate, the prevalence of lead ponies from paddock to post, and on-track stabling and training methods [16,17].

Translating research into injury prevention practice

Industry modification begins with identified risk factors, but only sustains through implementation. The critical translation of research findings into industry practice is often met with resistance or incomplete implementation. A change to the rules and regulations requires acceptance and adoption from diverse racing authorities, followed with compliance by industry participants. Rule changes are unlikely to be implemented if they don't concretely affect the occurrence of falls or injuries, if they conflict with current racing culture, or if they affect participation or (often most importantly) racing performance of the horse or jockey [18].

The Translating Research into Injury Prevention Practice (TRIPP) framework developed by Finch [18] as an extension of the framework introduced by Van Mechelen, Hlobil [19], covers this next process in building the evidence-base for prevention of injury. We have some understanding of the aetiology of falls and injuries to jockeys in North America, specifically when they are associated with horse fatality. However, more information related to other causes of injury are required. Once each causal link is established, interventions can be developed that directly address the identified mechanisms of injury and then be monitored over time to assess their effectiveness [18]. Though recommended, it is often not practical to test interventions under controlled conditions due to the high costs normally involved and practicality of testing under race-day conditions.

Racing safety data workshop goals

The inaugural Racing Safety Data Workshop built on the objectives of the original work and implementation plan that were developed in the Welfare and Safety of the Racehorse Summit by focusing on the operational implementation of jockey fall and injury data collection, collation, and analysis. The primary workshop goals were to (1) outline current standards for jockey injury data; (2) describe required data types – including racehorse injury, jockey injury, jockey health, and race field data – and identify existing gaps in that data; and (3) discuss a path forward for actionable jockey injury data in North America.

Current standards for jockey injury data

Our goal is to collate the best available racing safety data under practical conditions. We must ensure the uniformity of data collected, so that we may accurately compare incidence of injuries across jurisdictions and countries. Over time this uniform data can produce the high-quality evidence-based research required to propose and then monitor policies or practices aimed at improving safety.

Particular threats to data uniformity include onerous data reporting requirements and current racetrack medical staffing constraints. First, extensive and detailed injury reports can result in reduced participation and incomplete data. Next, decentralized regulation of North American horse racing results in significant medical staffing, training, and protocol inconsistencies across numerous racetracks or regulatory jurisdictions.

The current gold standard is that defined under the European Consensus Statement [20]. The consensus statement was developed following a meeting of experts from the four leading horse racing countries in Europe, facilitated by the British Horseracing Authority. Each statement within the consensus came about as a result of formal voting. The statement provides a framework for the minimum reporting requirements of horse-related injuries. This framework includes defining recurrent, acute or gradual onset injuries; injury severity; body region and substructures affected; type of injury (e.g. fracture); activity conducted that resulted in the injury (racing, training, non-riding); location that the injury occurred (e.g. race course); cause of the injury (e.g. fall, kick); personal protective equipment (PPE) worn by the rider injured; and information on exposure (e.g. number of starts, hours) [20]. An injury report form, modelled on the European Consensus Statement, has been developed to better collect consistent and necessary data across North American tracks (see Supplementary File 1).

Data types and linkage of racehorse and jockey injury, jockey health, and race field data

The proposed architecture for collection, collation, and analysis of jockey injury data in North America using existing infrastructure is presented in Fig. 1. The complex structure of the North American racing industry has also created the need to obtain research data from a number of sources. The Jockey Health Information System (JHIS) and the Equine Injury Database (EID), both introduced in 2008, are components within the InCompass Race Track Operations (RTO) software. This facilitates data linkage of injury data with race information from Equibase. Equibase is the official industry database of racing information and statistics for North American racing – a partnership between The Jockey Club and the Thoroughbred Racing Associations of North America. Equibase provides numerical exposure data plus race notes provided by the chart caller that may hold potential for flagging incidents and/or injured riders. Data linkage of horse and pedigree information is possible via The Jockey Club's breed registry. The JHIS has the capability to store jockeys' personal, private medical information so that they are available to medical personnel at racetracks and, in turn, receiving emergency rooms. This database was developed through a collaborative effort between InCompass, The Jockey Club Technology Services, Jockeys' Guild, Keeneland Association, and Dr. Barry Schumer (Keeneland's Medical Director). Rider participation is voluntary and the data is typically entered by the rider or with the help of a designated racetrack resource or local jockeys' representative. This approach attempts to address medical privacy concerns as a part of the provision of data. While the availability of current information for jockeys' attending medical personnel is an important tool, the system suffers from weak central support and

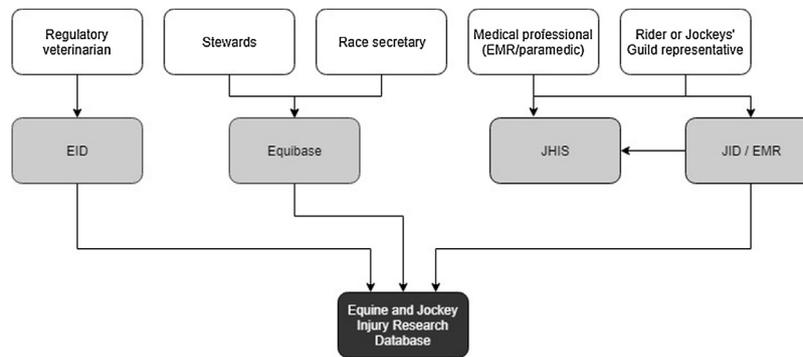


Fig. 1. Proposed structure for the collection (white), collation and storage (light grey), and analysis (dark grey) of jockey injury data in North American racing, current and required infrastructure and resources.

untested legal constraints. As a result the JHIS is implemented at a relatively small number of racetracks, and the feasibility remains to be determined since data input relies on the athlete or a representative rather than a medical professional.

In spite of the extensive data infrastructure, the history and structure of the current system does not currently provide a consistent system at tracks to record incident (i.e. fall and injury) data related to jockeys. However an EID field is available to record jockey incidents that occur when the information is related to racehorse injuries sustained on race-days. The EID identifies the frequency, types, and outcomes of racehorse injuries. The EID is ideally suited to identifying indicators for horses at increased risk of injury, and serves as a data source for research directed at improving racehorse safety and welfare, for example recent studies by Georgopoulos and Parkin [16], [17]. Since the EID is completed by the regulatory veterinarian who is responsible for the horses, and not the riders, information related to incidents which involve potential jockey injuries is not accessible in the EID data. As a result a linkage between the EID and JHIS becomes important. Since the relationship between racehorse and jockey safety is well established [4,21,22], the potential for the EID to trigger inquiries is quite good. The limitation to the EID, a focus on the horse, is less of a concern with jockey incidents because of the association with the risk factors for the horse. This limitation becomes more problematic with exercise riders where the EID data is less complete and a rider injury would be unlikely to be noted if the horse was not impacted. The utility of the data is thus a result of the focus of the regulatory veterinarians.

The alternative approach, which is a less well-developed system, is the Jockey Injury Database (JID). At this time the JID is a log of events with redacted, de-identified jockey information. This is primarily due to the reluctance to mandate what is perceived as a personal privacy issue. Privacy in the United States is related to HIPAA (Health Insurance Portability and Accountability Act of 1996) – legislation in the United States that provides data privacy and security provisions for safeguarding medical information. Though HIPAA compliance will also ensure high security standards that protect access to this health data. From an epidemiological perspective this data is insufficient since it cannot be linked to race information and, in the absence of sufficient trained medical personnel at each track, data reporting is inconsistent. The arrangement of the emergency medical personnel on the tracks also present obstacles where these are operating contracts with public or private ambulance and medical care companies that operate within the varying local regulations and structures of the respective medical community. What is needed is a regulatory mandate for collection and secure electronic access to this jockey injury data.

A path forward for actionable jockey injury data in North America

The path forward for the jockey injury data tracking is reasonable and more likely to succeed if it does not require added track-level personnel or resources. However, to be consistent with the European Consensus Statement specified data surrounding every incident is needed. The guiding philosophy of this approach is that high quality and more complete data can be used to assess areas of risk for the riders which can then in turn be used to focus on areas in the pre-event phase of the Haddon matrix (i.e. higher in the hierarchy of controls, prior to the fall or injury occurring). The approach of including more information on risk factors for preventing the falls or injuries and less of a focus on medical and equipment usage is more consistent with industrial health and safety in contrast to sport. This type of rule change in sport, for example, has decreased head injuries in football (soccer) [23], and reduced injury rates following implementation of the FIFA 11+ structured training program in basketball [24] and soccer players [25], and implementation of new scrum rules in rugby union [26]. Successful injury prevention strategies for other sports are reviewed in detail by Vriend, Gouttebauge [11].

We propose a two-phased approach to data gathering that recognizes the need for immediate progress to understand risks to riders. In Phase 1 existing EID and Equibase capabilities enable simplified flagging of racing incidents. Phase 2 enhances the JID's ability to track rider history absent an EID or Equibase flag.

Phase 1 – The most critical observation of the Racing Safety Data Workshop was that a number of mechanisms pre-exist to enable jockey injury incident data-flags; one or more competent observers are currently on-site for each race – the regulatory veterinarians, and “rider incident” fields already are available in the EID to indicate that an event has occurred. Therefore, Phase 1 implements existing EID infrastructure with additional support developed (e.g. adding minor detail to the jockey incident section of the EID) in order that the regulatory veterinarians may better flag jockey incidents when observed in association with EID-reported racehorse injuries.

The Workshop further noted that jockeys who exit the profession likely have suffered a career-ending injury of some type, that a loss of riding time is a key indicator of injury, and existing Equibase data includes extensive rider information for all races and can be used to estimate both risk exposure and lost time. Race chart data may additionally validate the combined EID and Equibase information.

Phase 2 – The second phase enhances collection of detailed information for jockey injuries sustained in an incident that were unrelated to an equine injury, the severity of injuries, and the equipment in use during the event. Phase 2, similar to Phase 1, can

be implemented with only minor, simplifying modifications of existing information infrastructure. Specifically, ensuring that the data is identifiable and not-redacted to facilitate linkage with horse and race related data. Simplification of the JID would include eliminating per-race particulars from the JID with the exception of track, race number and starting position. Quality data for the JID can be reliably completed through direct contact by researchers and local jockeys' representatives. Respective per-race information would subsequently be acquired from Equibase data sources. Injury or incident data flagged from the EID and JID, subsequently fed into the JHIS supplies users (individual riders) a consistent, more detailed record of their previous injuries and related outcomes. JHIS data quality would continue to require assistance of medical personnel at the track and/or the support of local jockeys' representatives. During this phase the push for regulatory mandating the disclosure of jockey injury information will be necessary which should be tied to compliance with other safety initiatives such as the National Thoroughbred Racing Association (NTRA) Safety and Integrity Alliance racetrack accreditation.

The Workshop recognised that this process is likely to have a five to ten year acceptance time-frame. However, in light of the significant progress made with the EID this seems achievable. The immediate industry benefits accruing from Phase 1 analysis likely would energize a constituency for the second phase of the work.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.injury.2019.06.033>.

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