Spring 2023 Churchill Downs Equine Fatalities: HISA Findings

TABLE OF CONTENTS

I. INTRODUCTION

The Horseracing Integrity and Safety Act was passed by Congress to protect the health and safety of horses and riders, and the integrity of horse racing. Since July 2022 when the Horseracing Integrity and Safety Authority's ("HISA") Racetrack Safety Program was first launched, HISA has been working relentlessly to develop policies and regulations to protect horses and riders and to nurture a culture that prioritizes horse welfare above all else. It was against this backdrop that a cluster of fatalities occurred during Churchill Downs' 2023 Spring Meet. Since HISA's core mission is to protect equine athletes, this was a sober reminder of the complexity and difficulty of the mission, and ultimately a moment of reckoning for the sport and HISA's role within it.

HISA responded quickly to support Churchill Downs and the Kentucky Horse Racing Commission ("KHRC") in their efforts to identify the cause or causes of the breakdowns and prevent further equine injury. HISA provided additional veterinary oversight resources to Churchill Downs, encouraged the implementation of new and enhanced safeguards, and ultimately recommended that the race meet be moved to Ellis Park so that additional investigation and study could be completed before racing resumed at Churchill Downs. The racetrack-related findings included in this report were shared with Churchill Downs (and, where necessary, acted upon) prior to resumption of racing at Churchill Downs in September 2023.

II. SCOPE OF REVIEW

The scope of review for HISA's investigation included the following:

A. All racetrack surface data collected by the Racing Surfaces Testing Laboratory ("RSTL") for the 2023 Spring Meet and several years prior;
B. All relevant racetrack surface data within the custody and control of Churchill Downs;
C. Information regarding the locations of the injuries on the racetrack;
D. The expert opinion and report of Mr. Dennis Moore, a racetrack surface expert;
E. All available veterinary histories of each deceased horse;
F. The necropsy summaries of each deceased horse;
G. The expert opinion and report of Dr. Alina Vale, an equine veterinarian appointed by the California Horse Racing Board to lead equine fatality investigations and to chair its Postmortem Examination Review Program;
H. Analysis of all relevant data in the HISA portal;
I. Expert analysis of the affected horses' high speed exercise histories by Dr. Susan Stover, Chair of HISA's Racetrack Safety Committee and Professor of Veterinary Surgical & Radiological Sciences at the University of California Davis;
J. Supplementary comprehensive records provided by Mr. Saffie Joseph;
K. Racing and training histories of each deceased horse; and
L. All information, interviews, and documents related to the fatalities within the custody and control of the KHRC.

III. FINDINGS

Below is a summary of HISA's findings.

A. Racetrack Surface

1. Independent Expert Review by Mr. Dennis Moore

HISA retained racetrack surface expert Dennis Moore[1] to provide an independent expert opinion regarding the condition of the Churchill Downs racetrack. Mr. Moore spent several days examining the main dirt racetrack and reviewing data collected previously by Churchill Downs and the RSTL, an independent engineering consultancy. The evaluation process included testing several key factors considered critical in the maintenance of a consistent racing surface. Those factors included cushion depth, moisture content, surface grades, and material composition. Ground penetrating radar was also utilized. The results were compared to data collected by Churchill Downs and the RSTL prior to the fatalities.

Based on Mr. Moore's review of the measurements previously collected by Churchill Downs and the RSTL, the Track Superintendent's daily maintenance logs, and the data collected during his evaluation of the dirt surface, Mr. Moore concluded that the relevant metrics remained consistent with prior years and did not identify any major issue with the track surface makeup, conditions, or maintenance. Specifically, he concluded that the metrics did not indicate a correlation between the track surface and the equine catastrophic injuries sustained during the race meet. Nonetheless, Mr. Moore made the following recommendations to Churchill Downs and Churchill Downs subsequently informed HISA of their next steps in response to each of the recommendations:

[1] See Appendix I for Mr. Dennis Moore's Curriculum Vitae.

Dennis Moore Recommendation	Churchill Downs Response	Status of Recommendations
Integrate the new tractors and harrows that were previously purchased by Churchill Downs.	Churchill Downs has informed HISA that they complied with this recommendation in mid-June 2023.	HISA has confirmed the integration of properly sized tractors and harrows.
Screen the existing cushion and pad material through a ≤ ¼ inch slot deck screen once the 2023 season concludes.	Churchill Downs believes that the new equipment and processes in place have resolved the issue of rocks on the racetrack. Churchill Downs therefore informed HISA that this will take place in 2024 if needed.	Churchill Downs' incorporation of a rock picker and other modalities appears to have resolved the issue. However, HISA will maintain an ongoing dialogue with Churchill Downs concerning screening the cushion and pad.
Screen any new material prior to adding it to the track surface using a ≤ ¼ inch slot deck screen.	Churchill Downs has informed HISA that they complied with this recommendation in the summer of 2023.	HISA expects Churchill Downs to continue to screen any material added to the track surface, including stockpiles, using a ≤ ¼ inch slot deck screen.
Install a smart grade accessory on the existing motor grader.	Churchill Downs believes this is not possible due to the incompatibility of the John Deere Smart Grade setup with the grader but has informed HISA that they are investigating other options.	HISA will continue to monitor this issue and expects Churchill Downs to update it on any equipment changes or issues.

Monitor and record tractor speeds daily, especially with the new tractors and harrows.	Churchill Downs has informed HISA that this recommendation is being followed.	A review of RSTL data confirms that this recommendation is being met.
Monitor and record cushion depth and moisture measurements after changing surface conditioning equipment.	Churchill Downs has informed HISA that this recommendation is being followed.	A review of RSTL data confirms that the moisture measurements are being recorded. HISA expects that cushion depth measurements will be recorded as well once the 2023 Fall Meet begins.
Perform surface grades and crossfall measurements, especially with new tractors and harrows.	Churchill Downs has informed HISA that this recommendation is being followed.	A review of RSTL data confirms that this recommendation is being met.
Monitor moisture content throughout the race day to aid in determining how much water to apply as needed.	Churchill Downs has informed HISA that this recommendation is being followed.	A review of RSTL data confirms that this recommendation is being met.

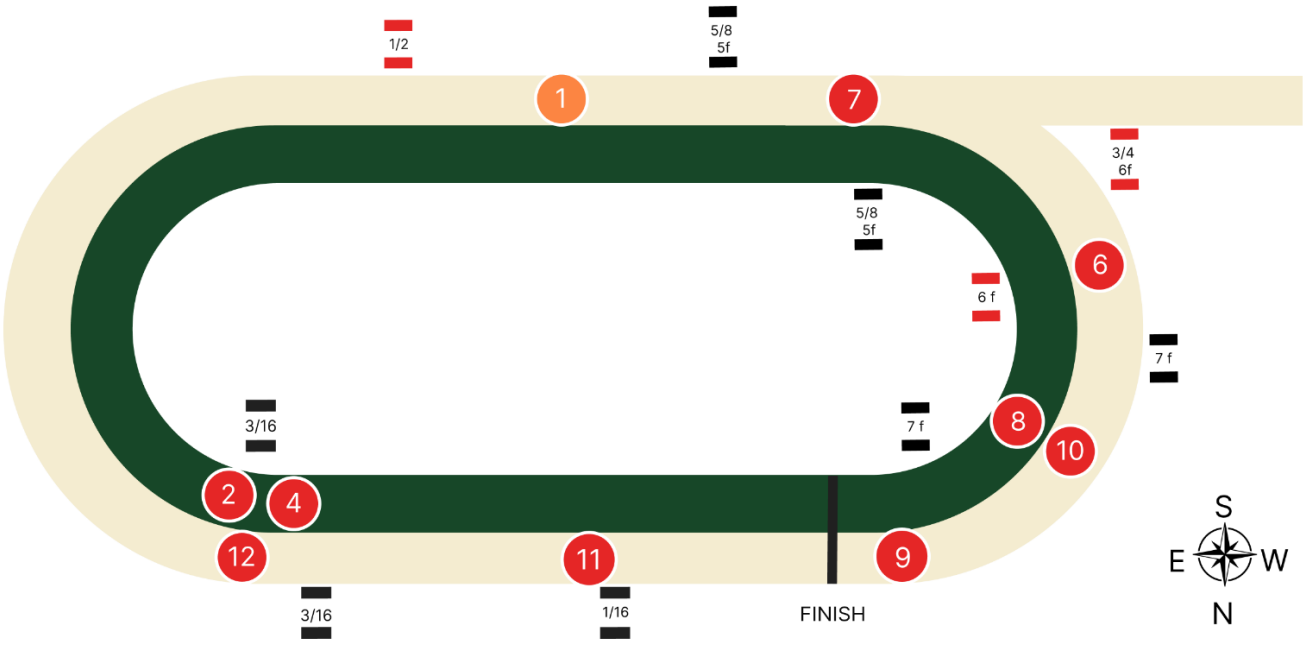
Churchill Downs has requested that HISA perform a compliance review at the conclusion of the 2023 Fall Meet in order to confirm that Churchill Downs is in full compliance with all of HISA's regulations.

2. *Injury Location on the Racetrack*

There were not any statistically relevant or discernible patterns that could be extracted from the locations of the injuries on the racetrack. While the locations were carefully studied, they did not yield any insightful information.[2]

Equine Fatalities at Churchill Downs Racetrack

April 27 – May 27, 2023



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2. Parents Pride - turf course collapsed near the 3/16ths
3. Code of Kings fell in the saddling paddock
4. Take Charge Briana turf fell near the 3/16ths pole
5. Chasing Artie After returning to unsaddle post-race, horse staggered and collapsed
6. Chloe's Dream injured at the 7-furlong pole, pulled up near the 6-furlong pole
7. Freezing Point injured near the 6-furlong marker, pulled up near the 5-furlong marker
8. Bosque Redondo turf injured galloping out, jockey dismounted after pulling up and exiting turf course
9. Rio Moon weakened near the 3/16ths pole, injured just past the finish line
10. Swanson Lake injured and pulled up approaching 7/8ths pole during gallop out
11. Lost in Limbo weakened upper stretch, fell inside the 1/16th marker
12. Kimberley Dream injured upper stretch, pulled up near 3/16ths pole

[2] Appendix II: Diagram of Locations of Equine Fatalities at Churchill Downs Racetrack – April 27 - May 27, 2023

B. Veterinary Review

1. Injury Presentation

There were twelve (12) equine fatalities during the Spring 2023 Meet at Churchill Downs before it was moved to Ellis Park on HISA's recommendation. The causes of the fatalities can be summarized as follows:

- 1 traumatic paddock injury
- 1 fracture sustained in training on the dirt track
- 2 cases of exercise-associated sudden death
- 2 soft tissue injuries sustained in racing on the dirt track
- 2 fractures sustained in racing on the turf track
- 4 fractures sustained in racing on the dirt track

Of the seven (7) horses with inoperable fractures, six (6) involved the metacarpalor metatarsal-phalangeal joint ("ankles," or "fetlocks"). Both soft tissue injuries involved the distal sesamoidean ligament.

The nine (9) musculoskeletal fatalities occurred in races ranging from maiden special weight to claiming to graded stakes, and on dirt surfaces listed as fast and good, and on turf surfaces listed as firm. In other words, there was no discernible pattern.

Of the nine (9) musculoskeletal fatalities, two (2) of the horses' most recent works were over the Churchill Downs surface, seven (7) were not.

Of the nine (9) musculoskeletal fatalities, one (1) of the horses' most recent races were over the Churchill Downs surface, eight (8) were not.[3]

[3] While a change in the surface over which these horses were performing high-speed exercise was a factor noted for the majority of horses during this review, this was not considered unusual for this meet. Kentucky regulations require horses to be inspected by the trainer's private veterinarian prior to shipping in to race. Therefore, it is not unusual for horses to arrive at Churchill Downs just prior to racing. Nonetheless, this factor will be incorporated into HISA's forthcoming data analytics work in order to determine whether it is a causal factor that should be taken into consideration and mitigated.

2. *Necropsy Summary*

Dr. Alina Vale[4] examined the necropsies and determined that there was no identifiable pattern in the necropsy reports that pointed towards a single causal factor of the fatalities.[5] Further, none of the horses tested positive for any Prohibited Substances.[6] However, Dr. Vale did provide the following observations:

a. Two distal sesamoidean ligament ruptures occurred a day apart. Rupture of the distal sesamoidean ligaments, which are part of the equine suspensory apparatus at the back of the pastern, results in complete loss of support in the fetlock joint and the horse cannot bear weight on the limb without fetlock arthrodesis (joint fusion) surgery. These injuries are quite rare and further analysis using data analytics should be conducted to determine if there are any commonalities between these two horses or their histories.

b. In several cases, the final race had a relatively large purse compared to the horse's prior races.

c. Seven (7) of the horses did not perform a high-speed work at Churchill Downs prior to racing.

3. *High Speed Exercise Analysis*

Dr. Susan Stover[7] analyzed the lifetime high-speed exercise history (official timed works and races) of the nine (9) horses that died at Churchill Downs because of a musculoskeletal injury. Their lifetime high-speed histories were compared with three (3) control horses per injured horse matched by participation in the last event (official timed work or race) of the injured horse (exercise histories for control horses are truncated to the date of death of the injured horse). Thus, the deceased horses are similar in age, sex, and quality to the control horses.

[4] See Appendix III for Dr. Alina Vale's Curriculum Vitae.
[5] See Appendix IV for a summary of Dr. Vale's report.
[6] Ten of the 12 fatalities reviewed in connection with this report occurred prior to the effective date of HISA's Anti-Doping and Medication Control Program and were subject to testing conducted by the Kentucky Horse Racing Commission.
[7] See Appendix V for Dr. Susan Stover's Curriculum Vitae.

The exercise histories were reduced to sixty-five (65) variables. Univariate conditional logistic regression was used to find variables that may be different between injured and control horses. Two variables became apparent because they presented differently between injured and control horses.

The data revealed that injured horses had: (i) more races per year in their career and (ii) more days between their last high-speed event and date of death.[8]

In summary, based on this analysis, there are horse-related factors that were associated with increased injury risks. The two factors highlighted above are consistent with current knowledge of repetitive, overuse (fatigue) injuries in racehorses. Frequent high intensity exercise (as observed in injured horses) that does not allow for recovery of exercise-induced microdamage contributes to the development of stress fractures and subchondral stress remodeling which predispose horses to catastrophic injuries.

[8] See Appendix VI for Dr. Stover's full analysis including graphs.

C. Rule Violations/Procedural Deficiencies

HISA's investigation into the twelve (12) fatalities did not reveal any violations of HISA's rules by any Covered Persons that contributed directly to the injuries. However, some procedural and information reporting deficiencies were discovered that must be resolved going forward to optimize HISA's ability to protect equine welfare.

1. *Fatality Notices and Necropsy Reports*

   HISA has not been reliably and consistently receiving fatality notices or necropsy reports as outlined in Racetrack Safety Rules 2131(c)(7) and 2170(e) from many jurisdictions, including Kentucky. In addition, the information and data contained in the necropsy reports have not been sufficiently comprehensive to provide all the information necessary for HISA Veterinarians to conduct a thorough analysis. Consequently, HISA experts in necropsy reporting have been working since the Churchill Downs fatalities with the relevant necropsy laboratories to expand the information provided and clarify the reporting obligations under HISA's preemptive rules.

2. *Timely Injury Reporting*

   HISA is not currently receiving reports of "all equine injuries and fatalities . . . within 72 hours of injury" as required by HISA Racetrack Safety Rule 2131(c)(7). This is not limited to Kentucky but must be rectified going forward to position HISA for maximum effectiveness.

3. *Mortality Reviews in Kentucky Should be Extended to Include Training Fatalities*

   The KHRC's mortality review process pre-dates HISA's requirements, but it has been limited historically to racing fatalities. Going forward, mortality reviews should be conducted for training fatalities as required by HISA Racetrack Safety Rule 2121. Reporting information required by the Safety Rules is necessary to fully harness its predictive value for mitigating injury risks and informing rulemaking.

4. *Horse Registration and Information Accuracy*

Covered Persons are required to register their Covered Horses and keep the information in each horse's record current as required by HISA Registration Rule 9000(i). Of the twelve (12) affected horses, three (3) of the horses had not been registered with HISA within 30 days of becoming a Covered Horse. Four (4) of the twelve (12) reflected an incorrect physical location of the horse in the portal. Having accurate information about the locations of all horses under HISA's jurisdiction is a fundamental underpinning of the ADMC Program which, in turn, helps to assure the integrity of racing.

D. Conclusion

The investigation concludes that there was no causal relationship between the racetrack surface at Churchill Downs and the equine fatalities. Similarly, there was not a clear pattern in medical histories or injury profiles across the fatalities that point to a single, causal explanation for the fatalities. Nor were there any medication violations present. However, analysis of training histories did indicate an increased risk profile for some of the horses due to the frequency and cadence of their exercise and racing schedules. HISA has shared recommendations on track surface testing and maintenance with Churchill Downs and offers additional procedural improvements for the tracking and reporting of injuries to better inform the development of additional rules.

Appendix I

Dennis Moore Curriculum Vitae

DENNIS MOORE TRACKTEK@AOL.COM

Equine Surface Specialist with over 50 years of experience designing, constructing and maintaining racetracks, training tracks and arena surfaces.

Professional Experience

- Currently the Track Superintendent for Del Mar Thoroughbred Club and the primary racetrack consultant for 1st Racing and Los Alamitos.
- Former Hollywood Park and Los Alamitos Track Superintendent. Responsible for daily operations and oversight of major renovations to both racetracks
- Former Remington Park consultant charged with overseeing the design and construction of both the main track and the turf track.
    - Remington Park's main track was the first synthetic racing surface introduced in the US.
- Designed and consulted on over 100 racetracks, training centers and arenas.
- Has worked on projects in Dubai, Abu Dhabi, England, France, Sweden and most states in the US.
- Has considerable experience with Quarter Horse racing as well as Thoroughbred racing.

Industry Leadership

- Served on:
    - California's Racing Safety Committee when the group set standards for rail heights and safety material, track cross slopes, and safety distance requirements objects set inside the track rails.
    - The NTRA Racing Surface Committee. Laying the foundation for surface monitoring and maintenance.
    - The AQHA Racing Committee for several years.
- One of 7 members of the Track Surface Advisory Group. The group provides independent track surface evaluations for HISA.
- Committed to educating new track superintendents and has taught classes on surveying grades, cross slopes grades and motor grader operation.
- Participated in many racing surface information panels including the University of Arizona's RTIP Symposium on Racing.
- Interviewed by Sports Illustrated and numerous trade magazines, radio, TV regarding track surfaces, maintenance and safety.

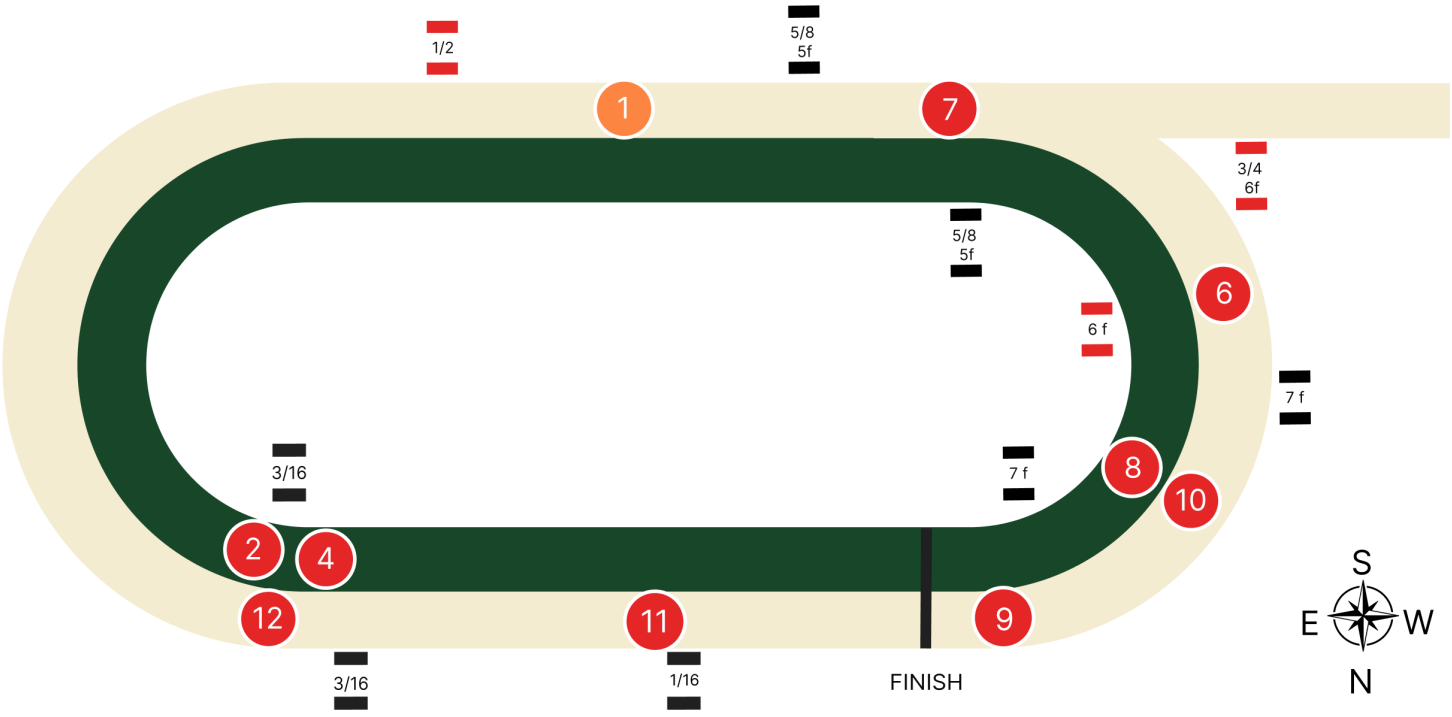
- Instrumental in the development of synthetic track maintenance procedures, including the identification of effective equipment.

Appendix II

Diagram of Locations of Equine Fatalities at Churchill Downs Racetrack – April 27 - May 27, 2023

Equine Fatalities at Churchill Downs Racetrack

April 27 – May 27, 2023



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Appendix III

Dr. Alina Vale Curriculum Vitae

Curriculum Vitae

Alina Vale, DVM, MS, cVMA

Veterinary Experience

Official Veterinarian, California Horse Racing Board. 2019-current. Equine fatality investigations. Chair, Postmortem Review Panel. Pre-race entry screening. Trainer education.

Consultant, Horseracing Integrity & Safety Authority. 2022- current. Support Racetrack Safety Committee develop best practices for tracks to demonstrate compliance with safety regulations; Veterinary records project.

Consultant, British Horse Racing Authority. 2021. Equine Postmortem Study project. 2023 Postmortem Program presentation at the summer Veterinary Officer meeting and staff training to develop a postmortem review program.

Equine Welfare Assessment. 2021-2022. Perform equine welfare assessments at equestrian facilities which include evaluating historical data, tailoring a questionnaire, and conducting a site visit which included observing training. Evaluate horses and the environment to identify potential concerns, educate, and collaborate with owners, trainers, riders, and other stakeholders to provide solutions to improve equine welfare and public perception. Recent projects: AQ Stable, Dubai, UAE. Hipodromo Camarero, Puerto Rico.

Expert Witness, Court of Arbitration for Sport. 2021. Alleged doping and equine abuse case.

Monitoring Veterinarian, Del Mar Thoroughbred Club. 2019. Observe morning training to identify horses not traveling well and provide emergency services. Participate in media interviews to educate the concerned public and meet with government officials to discuss racehorse welfare and safety.

Consultant, FluxErgy. 2018-2021. Provide insight to improve the biotech company's product portfolio, marketing content, and brand awareness for equine veterinary health.

Drug Testing Veterinarian, United States Polo Association. 2018- 2021. Developed a quality, standardized drug testing program to ensure equity, fairness and the appropriate use of therapeutic medications.

Third Party Lasix Administration, Breeder's Cup, Santa Anita Park & Del Mar Thoroughbred Club. 2014- 2019.

Drug Testing Veterinarian, Del Mar Thoroughbred Club, CA, 2010 & 2018 meets- Conducted pre-race TCO2 testing. 2014- Conducted Jockey Club graded stakes out of competition testing.

Hair Sample Collection, Oklahoma Quarter Horse Racing Assoc. 2018. Collected equine hair samples for drug testing.

Endurance Vet, Western US and UAE. 2009 -2018. AERC Certified control judge and treatment vet at endurance rides (including the Tevis Cup, 2010 World Equestrian Games, multi-day events) and Ride and Tie events (Head Vet at 2016 World Championships).

Equine Technical Sales Rep, Ceva Animal Health. Western US. 2014- 2015. Created an equine business unit in 9 states, developed relationships with key accounts, hosted educational meetings and client appreciation events, worked with universities and key opinion leaders, attended conferences, and assisted with marketing strategy.

Associate, von Bluecher, Blea, Hunkin, INC. Los Angeles, CA. 2012- 2013. Worked in a racetrack practice providing routine health care, airway and lameness evaluation, diagnostic imaging, general anesthesia, and emergency services.

Interim Manager/Resident Vet, Emaar Breeding Stable, Dubai, UAE. 2011- 2012. Managed a rapidly expanding 400-horse breeding operation, trained and supervised 28 employees, managed construction and development. Veterinary work included emergencies, routine herd health and foal care, and assisting reproduction veterinarian.

Associate, Dubai Equine Hospital, UAE Oct. 2010-2011. Worked at a stable of 2-year-old Thoroughbreds in training, with racehorses, endurance horses, and traveled abroad with horses.

Intern, Rood and Riddle Equine Hospital, Lexington, KY, 2009-2010. Rotated through the hospital services including internal medicine, lameness and surgery, anesthesia, and emergency duties.

Research Experience

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- Knych HK, **Vale A**, Wilson WD, Kass PH, Arthur RM, Jones JH. Pharmacokinetics of furosemide administered 4 and 24 hours prior to high-speed exercise in horses. J. vet. Pharmacol. Therap. 2018;41:224-229.
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Education

Bachelor's Degree, Veterinary Science, University of California, Davis.

2007

Doctorate of Veterinary Medicine, University of California, Davis.

2009

Medical Acupuncture for Veterinarians, Colorado State University.

2014

Master's Degree, Forensic Veterinary Medicine, University of Florida.

2016

Organizations

American Veterinary Medical Association- Animal Welfare Assessment Contest participant, 2018. Future Leader program, 2017- 2018, Enhanced leadership and communication skills while developing a national Pet Obesity campaign with emphasis on One Health. Participated in networking opportunities, a mentorship program, and speaking engagements including the 2018 Veterinary Leadership Conference and 2018/2019 AVMA Conventions.

2021 Convention Presentation "Can Horseracing in California Survive? Lessons Learned from the CHRB Equine Postmortem Examination Review Program"

2023 Convention Presentation "Sanctioned Horse Racing: The New Rules of Racing"

American Association of Equine Practitioners- Chair of the Welfare & Public Policy Advisory Council. Prior Chair of the Equine Abuse and Neglect subcommittee.

2017 Emerging Leader at the AVMA Veterinary Leadership Conference

2019 Convention: Moderator of Equine Abuse & Neglect Table Topic

2019 Convention Presentation co-author: "Mitigation of 100-mile Fatalities associated with American Endurance Rides (2002-2018)"

2021 Convention Presentation: "How to Develop an Equine Postmortem Examination Review Program"

2023 Round Table panelist: "Social License to Operate: Why does public perception matter for equine sport?"

Association of Racecourse Veterinary Surgeons (Great Britian)

2023 Summer Scientific Meeting Presentations: Postmortem Review Program, Strategy to Reduce Fatalities, Approach to Incidents at California Racetracks

Racing Medication and Testing Consortium RegVet CE

2023 Best Practices- The Racing Regulatory Veterinarian Presentation "Equine Mortality Reviews"

International Veterinary Forensic Science Association

2021-2023 Conference Presentations "Review of the Santa Anita Racetrack Equine Fatality Report", "Sudden Death of Medina Spirit- Postmortem Exam Review", "Equine Abuse & Neglect", "Regulated Racing vs. Unregulated (Match) Racing"

Midwest Veterinary Conference

2022 Conference Presentations (6 hrs) "Equine Abuse & Neglect" for Law Enforcement and Shelter Veterinarians

Ontario Association of Equine Practitioners 2020, Equine Welfare Presentation

Veterinary Information Network 2023, Equine Abuse & Neglect Presentation

American Endurance Ride Conference- served on the Veterinary and Welfare of the Horse Committees. Wrote educational articles in the *Endurance News* magazine and Equine Fatality Reports.

Lecture and mentor pre-vet and veterinary students- Career opportunities, Equine Medicine & Surgery, Acupuncture, Veterinary Forensics, Racehorse Welfare & Safety

Appendix IV

Summary of Dr. Vale's report

Expert Report
Alina Vale, DVM, MS
Consultant

Horseracing Integrity & Safety Authority
Churchill Downs Fatalities Veterinary Review 2023

Veterinary Review

Contents

Professional Experience of the Author

Dr. Alina Vale earned a Bachelor's Degree in Veterinary Science (2007) and Doctorate of Veterinary Medicine (2009) from the University of California, Davis and obtained a Master's Degree in Veterinary Forensic Medicine from the University of Florida (2016). After completing an internship at Rood & Riddle Equine Hospital in Lexington, Kentucky, Dr. Vale worked in Dubai, United Arab Emirates for 2 years, primarily at a stable of Thoroughbreds in race training. Dr. Vale then worked at a Thoroughbred racetrack practice in California, in the veterinary pharmaceutical and biotechnology industries, and with researchers at UC Davis conducting pharmacology studies with racehorses. Dr. Vale has worked as a regulatory veterinarian and helped organizations develop and implement novel drug testing programs, such as hair testing in Quarter Horse racehorses and with the U.S. Polo Association. In 2019 Dr. Vale worked as a monitoring veterinarian for the Del Mar Thoroughbred Club watching horses train to identify those not traveling well and at risk for catastrophic injury. Currently, as an Official Veterinary with the California Horse Racing Board (CHRB) Dr. Vale's role is investigating equine fatalities and serving as Chair of the Postmortem Examination Review Program, and she has also collated data from postmortem examinations for researchers developing bio-marker tests to predict horses at risk for catastrophic injury. Dr. Vale has consulted for the British Horseracing Authority on their postmortem program. Additionally, she has served as an expert witness for the Court of Arbitration for Sport in an alleged doping and equine abuse case.

The current Chair of the American Association of Equine Practitioners (AAEP) Welfare & Public Policy Advisory Council and past chair of the Equine Abuse & Neglect Subcommittee, Dr. Vale is a passionate proponent of the humane use of horses. Dr. Vale has lectured about racehorse fatalities at the AAEP Annual Convention, the International Veterinary Forensic Sciences Conference, the American Veterinary Medical Association Convention, the Racing Medication and Testing Consortium Regulatory Veterinarian event and the Association of Racecourse Veterinary Surgeons Summer Scientific Meeting in Great Britain. An avid horsewoman, she began riding off the track Thoroughbreds at a young age participating in Pony Club and endurance events. An athlete herself, she has transitioned from Ride & Tie and ultramarathon running to the sport of triathlon.

Introduction

The Horseracing Integrity & Safety Authority (HISA) has accumulated data obtained from equine fatalities at Churchill Downs Racetrack in Louisville, Kentucky. Blood samples were reported to be collected at the time of injury or euthanasia for drug testing. All horses were submitted to the University of Kentucky Veterinary Diagnostic Laboratory for necropsy (an animal autopsy, or postmortem examination) and then cremated.

Instructions

I have been asked by Dr. Jennifer Durenberger, HISA's Director of Equine Safety and Welfare, to review information provided by the Kentucky Horse Racing Commission (KHRC), Churchill Downs, and HISA regarding each fatality at Churchill Downs during the Spring of 2023. I have been provided with documents from 12 equine fatality cases, including 2 sudden deaths and 10 musculoskeletal cases. Documents included necropsy reports, KHRC Mortality Reviews, pre-race inspection records, race charts, past performance information, workout histories, and veterinary medical records entered into the HISA electronic portal.

Postmortem Examination Review #1: Wild On Ice

Horse Information: 3-year-old Thoroughbred gelding, Microchip# 981020035758320, Trainer: Joel H. Marr

Incident Summary:
On April 27, 2023 Wild On Ice performed a 5 furlong breeze (timed workout) on the dirt track during morning training. The track was listed as fast. The horse was injured and pulled up after galloping out between the ½ mile and 5/8ths markers. The horse was transported by ambulance off the track, treated by an attending veterinarian, and referred for further evaluation prior to euthanasia.

Necropsy Summary:
A necropsy examination revealed a comminuted lateral condylar fracture, comminuted first phalanx fracture and axial avulsion fracture of the lateral sesamoid in the left hindlimb. Additional findings included abnormally shaped radial and ulnar carpal bones in the right forelimb.

Racing/Training History:
This horse ran 5 races, with the final race a win in the Sunland Derby in New Mexico on 3/26/23. The horse worked 4/7/23 then shipped to Churchill Downs and worked 4/17/23 and 4/27/23, with a 10-day work interval after the final race.

Conclusion:
This horse sustained a complex fetlock breakdown in the left hindlimb after completing a speed work during morning training.

Postmortem Examination Review #2: Parents Pride

Horse Information: 4-year-old Thoroughbred filly, Microchip# 985141001085229 (not confirmed on postmortem examination), Trainer: Saffie Joseph Jr.

Incident Summary:
On April 29, 2023 Parents Pride ran in an Allowance Optional Claiming race at 5 ½ furlongs on the turf course with a purse of $134,000. The weather was clear, and the turf was listed as firm. The horse broke from post position 7 at 9:40 P.M., then displayed severe weakness in the hindlimbs and collapsed near the 3/16ths pole while being eased. The horse died before the KHRC veterinarians could evaluate the horse. The horse was insured.

Necropsy Summary:
A necropsy examination concluded exercise-associated sudden death of undetermined cause. Microscopic examination of the heart, brain, and lungs revealed mild changes the pathologist considered insignificant.

Necropsy and Drug Testing Results:
Drug testing: No prohibited substances detected. No therapeutic medication detected above regulatory threshold concentrations.
Toxicology testing: No substances on the anticoagulant screen were noted. All other substances were within normal limits.

Racing/Training History:
This horse did not race as a 2-year-old. The horse ran 6 races, winning the prior race at Gulfstream Park 3/26/23 with a purse of $25,000. The horse worked 3 furlongs in :37.35 prior to that race and did not work back until a 3-furlong breeze at Keeneland 4/26/23 in :39.80. The horse had a gap between racing 11/18/22 and returning to timed works 1/14/23.

Conclusion:
This horse displayed hindlimb weakness, collapsed, and died during a race. The postmortem examination did not determine the cause of death.

Postmortem Examination Review #3: Code of Kings

Horse Information: 3-year-old Thoroughbred gelding, Microchip# 981020033562271, Trainer: Tim Glyshaw

Incident Summary:
On April 29, 2023 Code of Kings was prepared to run in the 10th race. The horse reared and fell in the saddling paddock and became ataxic (uncoordinated). The horse was transported by ambulance out of the paddock, treated by an attending veterinarian, and referred for further evaluation prior to euthanasia. The horse was insured.

Necropsy Summary:
A necropsy examination revealed a displaced fracture of the fourth cervical vertebra. Microscopic examination of the brain and cervical spinal cord revealed mild hemorrhage associated with trauma.

Racing/Training History:
This horse ran 6 races. The horse was previously trained by another trainer through 2/12/23, in which the horse was eased in the race. The horse raced once with the final trainer 3/10/23. The horse did not work between 4/16/23 and the race 4/29/23.

Conclusion:
This horse reared and fell in the saddling paddock before the 10th race on Opening Night. The horse displayed neurologic signs and radiographs revealed a cervical fracture. Since the KHRC does not conduct interviews/mortality reviews on non-racing fatalities, no potential contributing factors could be identified by this arms'-length review or, alternatively, ruled out.

Postmortem Examination Review #4: Take Charge Briana

Horse Information: 3-year-old Thoroughbred filly, Microchip #981020033559557, Trainer: D. Wayne Lukas

Incident Summary:
On May 2, 2023 Take Charge Briana ran in an Allowance race. The race was 1 1/16th miles on the turf with a purse of $127,000. The weather was clear, and the turf was listed as firm. The horse broke from post position 5 at 2:53 P.M., then was injured and fell near the 3/16ths pole. The horse was euthanized. The horse was insured.
During the KHRC review trainer D. Wayne Lukas speculated that the fall was caused by the horse's back end slipping out from under her when she changed leads. The jockey noted the horse was running right behind the leaders and that the incident occurred when the filly switched leads.

Necropsy Summary:

A necropsy examination revealed an open and disarticulated right front fetlock joint, with a lateral condylar fracture and biaxial proximal sesamoid bone fractures. Additional findings included cartilage loss and erosion of the left carpus (distal radial and intermediate carpal bones).

Drug Testing Results:
No prohibited substances detected. No therapeutic medication detected above regulatory threshold concentrations.

Racing/Training History:
This horse ran 12 races. The horse was placed on the KY Veterinarian's List for being eased in a race on 11/26/22, and there were no works at Churchill Downs after that race. The horse then raced 5 times at Oaklawn Park beginning 12/31/22. The horse worked 3/8/23 then the final race at Oaklawn Park was 4/1/23, finishing 8th of 10 starters. The last workout prior to the final race was 4/16/23.

Conclusion:
This horse sustained an open condylar fracture and biaxial sesamoid bone fractures during a race.

Postmortem Examination Review #5: Chasing Artie

Horse Information: 5-year-old Thoroughbred gelding, Microchip# 985141001085035, Trainer Joseph Saffie Jr.

Incident Summary:
On May 2, 2023 Chasing Artie ran in an Allowance Optional Claiming race at 5 ½ furlongs on the turf course with a purse of $134,000 and claiming price of $80,000. The horse was in for a claim. The weather was clear, and the turf was listed as firm. The horse broke from post position 2 at 4:23 P.M. and was pinched (bumped and squeezed back), trailed the field and was eased. After returning to unsaddle post-race, the horse staggered and collapsed. The horse became agonal with white mucus membranes and was unresponsive. The horse was euthanized.

Necropsy Summary:
A necropsy examination revealed exercise associated collapse and pulmonary hemorrhage (bleeding in the lungs). A cause of collapse could not be determined, despite extensive testing. On microscopic examination of the heart, small areas of fibrosis, inflammation and degeneration were found. Small changes in the heart, including inflammation, myocardial degeneration, or fibrosis can be found at low, or background, levels in Thoroughbreds in training, including those that are euthanized for musculoskeletal conditions. The heart changes in this case were very mild, likely clinically insignificant, and are considered to be incidental findings. The degree of pulmonary hemorrhage was significant, but not to the degree to cause collapse, as this degree of hemorrhage can be found in horses that did not experience exercise associated sudden death (EASD). The presence of hemosiderin-laden macrophages in the lungs is consistent with the history of exercise induced pulmonary hemorrhage (EIPH).

Necropsy and Drug Testing Results:
Drug testing: No prohibited substances detected. No therapeutic medication detected above regulatory threshold concentrations.
Toxicology testing: Toxicology screening for anticoagulant drugs revealed two substances at trace amounts. The pathologist's comments are included below.
"Trace amounts of the anticoagulant rodenticides chlorophacinone and diphacinone were detected in the liver tissue. The concentrations were below the minimum levels of quantification (50 ppb), but above the minimum levels of detection of these analytes. These results indicated possible prior exposure to the anticoagulant rodenticides. These concentrations are not likely high enough to be associated with coagulopathy."

Racing/Training History:
This horse did not race as a 2-year-old. The horse ran 12 races, and was with the prior trainer through a win 7/11/21 then there was a gap in racing until 4/1/22. The horse was reported to have bled (experienced epistaxis attributable to exercise-induced pulmonary hemorrhage) in a race on 9/10/22. The horse worked at Churchill Downs 11/6/22 then was scratched 11/12/22 and did not work until 3/3/23. No timed works were performed between 4/15/23 and 4/26/23.

Conclusion:
This horse performed poorly in a race then collapsed. A cause could not be determined.

Postmortem Examination Review #6: Chloe's Dream

Horse Information: 3-year-old Thoroughbred gelding, Microchip# 981020033623302, Trainer: Jeff Hiles

Incident Summary:
On May 6, 2023 Chloe's Dream ran in the second race. The race was listed as Maiden Special Weight for 3-year-olds and upward at 1 1/16th mile on the dirt track with a purse of $120,000. The weather was cloudy, and the track was listed as fast. The horse broke from post position 9 at 11:02 A.M., then was injured at the 7-furlong pole and pulled up near the 6-furlong pole. The horse was transported by ambulance off the track and evaluated by an attending veterinarian prior to euthanasia. The trainer speculated in the KHRC review that the horse may have clipped heels or taken a bad step. The jockey stated the injury occurred when the horse switched leads in the turn.

Necropsy Summary:
A necropsy examination revealed a comminuted slab fracture of the third carpal bone with associated fractures of the second, intermediate and ulnar carpal bones of the right carpus. The third carpal bone in the left carpus had thinning of the articular cartilage of the proximal dorsal aspect.

Drug Testing Results:
No prohibited substances detected. No therapeutic medication detected above regulatory threshold concentrations.

Racing/Training History:
This horse did not race as a 2-year-old. The horse performed timed workouts 6/22/22 and 6/30/22 then there was a gap until 9/22/22. The trainer reported in the KHRC review there was a 30-day break after the horse was castrated in August 2022. The horse was scratched from a race at Churchill Downs 11/17/22, worked 11/18/22 at Churchill Downs, then took a month until working 12/19/22 and another month until working 1/14/23. The horse ran 2 races with the first start 3/24/23 at Gulfstream Park in Florida, a 5-furlong Maiden Claiming race with a purse of $25,000. The horse took 21 days to work back 4/14/23, a slow 5 furlongs in 1:03.44. The horse performed a 5-furlong work 4/29/23 at High Point Farm Training Center in KY in 102.56. The KHRC noted the horse accumulated 20 high speed furlongs (HSF) in the 30 days leading to the injury, and 35 HSF in the preceding 60 days, which was greater than other horses in the final race. The three final works were slower than the work prior to the final race. The horse was scratched from a race at Keeneland 4/20/23.

Conclusion:
This horse sustained multiple fractures in the carpus during a race.

Postmortem Examination Review #7: Freezing Point

Horse Information: 3-year-old Thoroughbred colt, Microchip # 981020033779781, Trainer: Joe Lejzerowicz

Incident Summary:
On May 6, 2023 Freezing Point ran in the Grade 2 Pat Day Mile Stakes race on the dirt track with a purse of $500,000. The weather was cloudy, and the track was listed as fast. The horse broke from post position 14 at 2:48 P.M., was angling to the inside according to the jockey, and was injured near the 6-furlong marker and pulled up near the 5-furlong marker. The horse was transported by ambulance off the track and evaluated and treated by an attending veterinarian prior to euthanasia. The horse was insured. In the KHRC Review, the trainer expressed concern with the racing surface being a factor in the injury, however, the nature of the concern was not noted.

Necropsy Summary:
A necropsy examination revealed proximal sesamoid bone fractures in the left forelimb. Additional findings included arthrosis of the right carpus (distal radius and proximal intermediate carpal bone).

Drug Testing Results:
No prohibited substances detected. No therapeutic medication detected above regulatory threshold concentrations.

Racing/Training History:
This horse ran 6 races. The horse never worked at Churchill Downs and had not raced at Churchill Downs since 11/3/22. The horse had a break in training after this race and resumed timed workouts 1/21/23. After a race 3/4/23 the horse did not work back until 3/29/23.

Conclusion:
This horse sustained biaxial sesamoid bone fractures in a race.

Postmortem Examination Review #8: Bosque Redondo

Horse Information: 4-year-old Thoroughbred colt, Microchip# 981020031376985, Trainer: Alexis Claire

Incident Summary:
On May 13, 2023 Bosque Redondo ran in an Allowance race at 1 3/8th mile on the turf course with a purse of $127,000. The weather was clear, and the turf was listed as firm. The horse broke from post position 10 at 3:52 P.M. and bumped another horse at the start then finished 10th out of 12 runners. The jockey felt the horse was injured while galloping out after the race and the jockey dismounted after pulling up and exiting the turf course. The horse was transported by ambulance off the track, evaluated by an attending veterinarian, and referred for further evaluation prior to euthanasia.

Necropsy Summary:
A necropsy examination revealed comminuted, mildly displaced lateral condylar fracture and axial, basilar fracture of the medial proximal sesamoid bone in the left forelimb.

Drug Testing Results:
No prohibited substances detected. No therapeutic medication detected above regulatory threshold concentrations.

Racing/Training History:
This horse did not race as a 2-year-old. This was the horse's 4th race with the first race 12/28/22. The horse won the prior race 3/22/23, a Maiden Special Weight race with a purse of $27,000. The horse didn't work back until 4/15/23 and the final work was 4/22/23. The horse had been previously with another trainer. The trainer of record, Alexis Claire, stated in the KHRC review that the horse had been purchased by the owner at the April Selected Horses of Racing Age Sale at Keeneland two weeks prior to the race, on 4/30/23.

Conclusion:
This horse did not race until the end of the 3-year-old year and took 3 weeks to work back after the final race with the prior trainer. The final trainer had the horse 2 weeks and did not work the horse. Retrospective review of the radiographs obtained 2 weeks prior to fracture might be valuable. The goal would not be punitive, but rather to possibly aid our understanding of potential radiographic changes prior to fracture.

Postmortem Examination Review #9: Rio Moon

Horse Information: 3-year-old Thoroughbred colt, Microchip# 981020033766065, Trainer: Dale Romans

Incident Summary:
On May 14, 2023 Rio Moon ran in a Maiden Claiming race at 1 1/16th mile on the dirt track with a purse of $68,440 and claiming price of $50,000. The weather was clear, and the track was listed as good. The race was off at 3:19 P.M., and the horse weakened near the 3/16ths pole. The horse finished 10th out of 11 runners and appeared to be injured just past the finish line. The horse was euthanized. The jockey reported during the KHRC review that he eased the horse in the stretch, thinking that the horse was getting a little tired.

Necropsy Summary:
A necropsy examination revealed an open lateral condylar fracture in the left forelimb that spiraled through the diaphysis and extended into the carpometacarpal joint.

Drug Testing Results:
No prohibited substances detected. No therapeutic medication detected above regulatory threshold concentrations.

Racing/Training History:
This horse ran 6 races and had not worked nor raced at Churchill Downs since November 2022, having raced at Gulfstream Park during the winter and early spring. The KHRC review noted a raise in class from the previous start, only 8 HSF in the preceding 30 days and multiple layoffs in the preceding 6 months. The horse had a 2-week gap in works prior to the final race and before and after the prior race 4/6/23. The horse was scratched from a race in Indiana 5/11/23.

Conclusion:
This horse sustained an open condylar fracture that spiraled up the cannon bone. The jockey felt the horse was tired near the end of the race.

Postmortem Examination Review #10: Swanson Lake

Horse Information: 3-year-old Thoroughbred filly, Microchip# 981020035166837, Trainer: Michael McCarthy

Incident Summary:
On May 20, 2023 Swanson Lake ran in a Maiden Special Weight race at 5 ½ furlongs on the dirt track with a purse of $120,000. The weather was cloudy, and the track was listed as fast. The horse broke from post position 5 at 3:20 P.M., raced toward the back of the field then passed horses in the stretch and finished fourth. The horse was injured and pulled up approaching the 7/8ths pole during the gallop out after the race. The horse was transported by ambulance off the track and evaluated and treated by an attending veterinarian prior to euthanasia.

Necropsy Summary:
A necropsy examination revealed lateral condylar, biaxial sesamoid, and first phalanx fractures in the left hindlimb.

Drug Testing Results:
No prohibited substances detected. No therapeutic medication detected above regulatory threshold concentrations.

Racing/Training History:
This horse did not race as a 2-year-old. This was the horse's 2nd race, with the first on 2/17/23 at Aqueduct. Race notes included an awkward stumble out of the gate. The horse had been performing timed works at Churchill Downs since 4/9/23 and was scratched 5/5/23 due to a post parade incident.

Conclusion:
This horse sustained a complex fetlock breakdown in the left hindlimb after a race.

Postmortem Examination Review #11: Lost in Limbo

Horse Information: 7-year-old Thoroughbred gelding, Microchip # 981020019336717, Trainer: Michael Lauer

Incident Summary:
On May 26, 2023 Lost in Limbo ran in a Claiming race at 6 furlongs on the dirt track with a purse of $78,200 and claiming price of $40,000. The horse was in for a claim. The weather was clear, and the track was listed as fast. The horse unseated the rider pre-race and ran loose then was gathered by an outrider and returned to be remounted. The horse broke from post position 6 at 3:51 P.M., took minor contact from nearby horses at the start, weakened in the upper stretch and fell inside the 1/16th marker. The jockey reported that he was easing up on the horse when the fall occurred. The horse was transported by ambulance off the track and an attending veterinarian was consulted prior to euthanasia. The horse had been claimed, but the claim was subsequently voided.

Necropsy Summary:
A necropsy examination revealed an open rupture of the distal sesamoidean ligaments in the left forelimb. Additional findings included focal osteopenia in the right forelimb medial sesamoid bone.

Drug Testing Results:
No prohibited substances detected. No therapeutic medication detected above regulatory threshold concentrations.

Racing/Training History:
This horse did not race as a 2-year-old. The horse was with the first trainer 3/16/19-2/20/21 except for a race with the second trainer 5/3/19, then the horse re-entered the second trainer's barn until 9/8/21, then was claimed by the final trainer Michael Lauer. The horse ran 35 lifetime races and had not worked nor raced at Churchill Downs since a race 6/22/22. The horse then had a break from racing until resuming timed workouts 11/11/22. During the KHRC review, the trainer reported the horse had surgery on a hind ankle after a barn area accident. The horse ran 3 races at Oaklawn Park. The prior race was 4/15/23, then the horse worked back 4/30/23, which was the final work. The horse was stabled at Indiana Grand and shipped to Churchill Downs 5/25/23.

Conclusion:
This horse weakened in a race then sustained an open rupture of the distal sesamoidean ligaments.

Postmortem Examination Review #12: Kimberley Dream

Horse Information: 7-year-old Thoroughbred mare, Microchip # 981020019478720, Trainer: Freddie Winston

Incident Summary:
On May 27, 2023 Kimberley Dream ran in a Claiming race at 1 1/16th miles on the dirt track with a purse of $78,200 and claiming price of $40,000. The weather was clear, and the track was listed as fast. The race was off at 12:49 P.M., and the horse weakened turning for home. The horse was injured in the upper stretch and pulled up near the 3/16ths pole. The jockey reported that the injury occurred when the horse switched leads coming out of the turn for home. The horse was transported by ambulance off the track and evaluated by an attending veterinarian prior to euthanasia.

Necropsy Summary:
A necropsy examination revealed rupture of the distal sesamoidean ligaments in the left forelimb. There was also a small, basilar, avulsion fracture of the medial sesamoid.

Drug Testing Results:
No prohibited substances detected. No therapeutic medication detected above regulatory threshold concentrations.

Racing/Training History:
This horse ran 61 lifetime races and was with the prior trainer until being claimed by the final trainer March 2019. The horse had a break from racing 11/27/22 until resuming timed workouts 1/5/23. During the KHRC review the trainer reported a slight hock injury that required a layoff, and that he was planning the mare's retirement from racing to become a broodmare. The horse raced 3/24/23 and did not work back until 4/14/23. The horse did not work after the penultimate race 5/14/23.

Conclusion:
This horse weakened in a race then sustained a rupture of the distal sesamoidean ligaments.

Appendix V

Dr. Susan Stover Curriculum Vitae

SUSAN M STOVER, DVM PhD DiplACVS

Distinguished Professor Emeritus, Department of Surgical and Radiological Sciences
University of California, Davis, CA 95616

Current and Previous Positions

2023-present	Distinguished Professor Emeritus, JD Wheat Veterinary Orthopedic Research Laboratory, VM:Surgical and Radiological Sciences, University of California, Davis, Davis, CA
2019-2023	Distinguished Professor and Director, JD Wheat Veterinary Orthopedic Research Laboratory, VM:SRS, University of California, Davis, Davis, CA
2017-2019	Distinguished Professor and Director, JD Wheat Veterinary Orthopedic Research Laboratory, VM:APC, University of California, Davis, Davis, CA
1998-2017	Professor and Director, JD Wheat Veterinary Orthopedic Research Laboratory, VM:APC, University of California, Davis, Davis, CA
1994-1998	Associate Professor, VM:APC, University of California, Davis, Davis, CA
1987-1994	Assistant Professor, Dept. Anatomy, Physiology & Cell Biology (VM:APC), School of Veterinary Medicine, University of California, Davis, Davis, CA
1980-1983	Visiting Lecturer (Equine Surgeon), Department of Surgery, School of Veterinary Medicine, University of California, Davis, Davis, CA
1979-1980	Veterinarian, Central Washington Equine and Livestock Clinic, Yakima, WA

Educational Background

Washington State University, Pullman, WA	BS	1974	Veterinary Science
Washington State University, Pullman, WA	DVM	1976	Veterinary Medicine
University of California, Davis, CA	Internship	1976-1977	Equine Surgery
University of California, Davis, CA	Residency	1977-1979	Equine Surgery
American College of Veterinary Surgeons	Diplomate	1986	Veterinary Surgery
University of California, Davis, CA	PhD	1987	Comparative Pathology

Short Summary

Dr. Stover is a Distinguished Professor Emeritus at the University of California at Davis. She received her veterinary degree from Washington State University, and subsequently completed an Equine Surgery Internship and Residency at University of California at Davis. She was in equine practice in Washington State before returning to the Veterinary Medical Teaching Hospital, UC Davis to teach clinical equine lameness and surgery to veterinary students and residents. She became board certified by the American College of Veterinary Surgeons while pursuing a PhD program focused on equine orthopedic research (Dorsal metacarpal disease ('bucked shins') in Thoroughbred racehorses). She now devotes her time to equine orthopedic research, with over 200 research publications.

Her major research focuses are the biomechanics and prevention of musculoskeletal injuries in equine athletes and treatment of orthopedic disorders in domestic and non-domestic animals. Her key contributions to the safety and welfare of horses include discovery and

detection of lesions that predispose to catastrophic injuries in racehorses and elucidation of factors that contribute to injury development in racehorses and sport horses. Current research efforts are focused on understanding how training and injury affect bone adaptation or propensity for bone fracture and the effects of arena surface materials and shoes on hoof and fetlock biomechanics and thus propensity for injury in athletes.

Honors

1976 Large Animal Surgery Clinics Award, College of Veterinary Medicine, Washington State University
1983 Clinical Faculty Teaching Award, School of Veterinary Medicine, University of California, Davis
1986 Autotutorial Excellence SCAVMA National Symposium Videotape - "Surgical Removal of One Conceptus from the Mare with a Twin Pregnancy"
1996 Norden Distinguished Teaching Award for the School of Veterinary Medicine, Univ California, Davis
1997 Bayer Excellence in Equine Research Award, American Veterinary Medical Association Council on Research
2005 Chancellor's Distinguished Lectureship Series, Louisiana State University, "Clues to the genesis of musculoskeletal injuries from Thoroughbred racehorses"
2007 Faculty Research Award, School of Veterinary Medicine, University of California, Davis
2007 American Horse Publications Award, 3rd place, "Suspensory Ligament Injuries in Horses", co-author
2008 Outstanding Women in Racing
2010 Distinguished Veterinary Alumnus Award for Excellence in Teaching and Research, Washington State University
2013 Alumni Achievement Award, School of Veterinary Medicine, University of California, Davis
2014 American College of Veterinary Surgeons Foundation Award for Career Achievement
2016 American Veterinary Medical Association Lifetime Excellence in Research Award
2016 University of Kentucky Equine Research Hall of Fame Inductee
2018 International Equine Veterinarian Hall of Fame Inductee, American Farriers Journal
2019 John Hickman Memorial Lecture, British Equine Veterinary Association
2022 Frank J. Milne State-of-the-Art Lecture, American Association of Equine Practitioners

Racehorse and Sport Surface Related Publications (from over 200 publications)

1992 Stover SM, Johnson BJ, Daft BM, Read DH, Anderson M, Barr BC, Kinde H, Moore J, Stoltz J, Ardans AA. An association between complete and incomplete stress fractures of the humerus in racehorses. Equine Veterinary Journal, 24(4): 260-3.
1992 Stover SM, Pool RR, Martin RB, Morgan JP. Histological features of the dorsal cortex of the third metacarpal bone mid-diaphysis during postnatal growth in thoroughbred horses. Journal of Anatomy, 181 (Pt 3): 455-69.
1994 Johnson BJ, Stover SM, Daft BM, Kinde H, Read DH, Barr BC, Anderson M, Moore J, Woods L, Stoltz J, Blanchard P. Causes of death in racehorses over a 2 year period. Equine Veterinary Journal, 26(4): 327-30.

1994 Les CM, Keyak JH, Stover SM, Taylor KT, Kaneps AJ. Estimation of material properties in the equine metacarpus with use of quantitative computed tomography. Journal of Orthopedic Research, 12(6): 822-33.
1995 Estberg L, Gardner IA, Stover SM, Johnson BJ, Case JT, Ardans A. Cumulative racing-speed exercise distance cluster as a risk factor for fatal musculoskeletal injury in Thoroughbred racehorses in California. Preventive Veterinary Medicine, 24: 253-63.
1996 Estberg L, Stover SM, Gardner IA, Johnson BJ, Case JT, Ardans A, Read DH, Anderson ML, Barr BC, Daft BM, Kinde H, Moore J, Stoltz J, Woods LW. Fatal musculoskeletal injuries incurred during racing and training in thoroughbreds. Journal of the American Veterinary Medical Association, 208(1): 92-6.
1996 Gustafson MB, Martin RB, Gibson V, Storms DH, Stover SM, Gibeling J, Griffin L. Calcium buffering is required to maintain bone stiffness in saline solution. Journal of Biomechanics, 29(9): 1191-4.
1996 Martin RB, Gibson VA, Stover SM, Gibeling JC, Griffin LV. Osteonal structure in the equine third metacarpus. Bone, 19(2): 165-71.
1996 Kane AJ, Stover SM, Gardner IA, Case JT, Johnson BJ, O'Brien MJ, Read DH, Ardans AA. Postmortem evaluation of homotypic variation in shoe characteristics of 201 thoroughbred racehorses. American Journal of Veterinary Research, 57(8): 1141-6.
1996 Kane AJ, Stover SM, Gardner IA, Case JT, Johnson BJ, Read DH, Ardans AA. Horseshoe characteristics as possible risk factors for fatal musculoskeletal injury of thoroughbred racehorses. American Journal of Veterinary Research, 57(8): 1147-52.
1996 Hornof WJ, Stover SM, Koblik PD, Arthur RM. Oblique views of the ilium and the scintigraphic appearance of stress fractures of the ilium. Equine Veterinary Journal, 28(5): 355-8.
1996 Martin RB, Stover SM, Gibson VA, Gibeling JC, Griffin LV. In vitro fatigue behavior of the equine third metacarpus: remodeling and microcrack damage analysis. Journal of Orthopedic Research, 14(5): 794-801.
1996 Estberg L, Stover SM, Gardner IA, Drake CM, Johnson B, Ardans A. High-speed exercise history and catastrophic racing fracture in thoroughbreds. American Journal of Veterinary Research, 57(11): 1549-55.
1996 Martin RB, Lau ST, Mathews PV, Gibson VA, Stover SM. Collagen fiber organization is related to mechanical properties and remodeling in equine bone. A comparison of two methods. Journal of Biomechanics, 29(12): 1515-21.
1997 Martin RB, Gibson VA, Stover SM, Gibeling JC, Griffin LV. Residual strength of equine bone is not reduced by intense fatigue loading: implications for stress fracture. Journal of Biomechanics, 30(2): 109-14.
1997 Griffin LV, Gibeling JC, Gibson VA, Martin RB, Stover SM. Artifactual nonlinearity due to wear grooves and friction in four-point bending experiments of cortical bone. Journal of Biomechanics, 30(2): 185-8.
1997 Les CM, Stover SM, Keyak JH, Taylor KT, Willits NH. The distribution of material properties in the equine third metacarpal bone serves to enhance sagittal bending. Journal of Biomechanics, 30(4): 355-61.
1997 Les CM, Keyak JH, Stover SM, Taylor KT. Development and validation of a series of three-dimensional finite element models of the equine metacarpus. Journal of Biomechanics, 30(7): 737-42.

1997 Griffin LV, Gibeling JC, Martin RB, Gibson VA, Stover SM. Model of flexural fatigue damage accumulation for cortical bone. Journal of Orthopedic Research, 15(4): 607-14.
1997 Haussler KK, Stover SM, Willits NH. Developmental variation in lumbosacropelvic anatomy of thoroughbred racehorses. American Journal of Veterinary Research, 58(10): 1083-91.
1998 Estberg L, Stover SM, Gardner IA, Johnson BJ, Jack RA, Case JT, Ardans A, Read DH, Anderson ML, Barr BC, Daft BM, Kinde H, Moore J, Stoltz J, Woods L. Relationship between race start characteristics and risk of catastrophic injury in thoroughbreds: 78 cases (1992). Journal of the American Veterinary Medical Association, 212(4): 544-9.
1998 Estberg L, Gardner IA, Stover SM, Johnson BJ. A case-crossover study of intensive racing and training schedules and risk of catastrophic musculoskeletal injury and lay-up in California thoroughbred racehorses. Preventative Veterinary Medicine, 33(1-4): 159-70.
1998 Les CM, Stover SM, Taylor KT, Keyak JH, Willits NH. Ex vivo simulation of in vivo strain distributions in the equine metacarpus. Equine Veterinary Journal, 30(3): 260-6.
1998 Carrier TK, Estberg L, Stover SM, Gardner IA, Johnson BJ, Read DH, Ardans AA. Association between long periods without high-speed workouts and risk of complete humeral or pelvic fracture in thoroughbred racehorses: 54 cases (1991-1994). Journal of the American Veterinary Medical Association, 212(10): 1582-7.
1998 Haussler KK, Stover SM. Stress fractures of the vertebral lamina and pelvis in Thoroughbred racehorses. Equine Veterinary Journal, 30(5): 374-81.
1998 Kane AJ, Stover SM, Gardner IA, Bock KB, Case JT, Johnson BJ, Anderson ML, Barr BC, Daft BM, Kinde H, Larochelle D, Moore J, Mysore J, Stoltz J, Woods L, Read DH, Ardans AA. Hoof size, shape, and balance as possible risk factors for catastrophic musculoskeletal injury of Thoroughbred racehorses. American Journal of Veterinary Research, 59(12): 1545-52.
1999 Haussler KK, Stover SM, Willits NH. Pathologic changes in the lumbosacral vertebrae and pelvis in Thoroughbred racehorses. American Journal of Veterinary Research, 60(2): 143-53.
2001 Norrdin RW, Bay BK, Drews MJ, Martin RB, Stover SM. Overload arthrosis: strain patterns in the equine metacarpal condyle. Journal of musculoskeletal & neuronal interactions, 1(4): 357-62.
2001 Hill AE, Stover SM, Gardner IA, Kane AJ, Whitcomb MB, Emerson AG. Risk factors for and outcomes of noncatastrophic suspensory apparatus injury in Thoroughbred racehorses. Journal of the American Veterinary Medical Association, 218(7): 1136-44.
2002 Malik CL, Gibeling JC, Martin RB, Stover SM. Compliance calibration for fracture testing of equine cortical bone. Journal of Biomechanics, 35(5): 701-5.
2002 Les CM, Stover SM, Keyak JH, Taylor KT, Kaneps AJ. Stiff and strong compressive properties are associated with brittle post-yield behavior in equine compact bone material. Journal of Orthopedic Research, 20(3): 607-14.
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2003 Hill AE, Carpenter TE, Gardner IA, Stover SM. Evaluation of a stochastic Markov-chain model for the development of forelimb injuries in Thoroughbred racehorses. American Journal of Veterinary Research, 64(3): 328-37.
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Appendix VI

Dr. Stover's Full Analysis

UCDAVIS
VETERINARY MEDICINE
J.D. Wheat Veterinary
Orthopedic Research Laboratory

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June 4, 2023

RE: Churchill Exercise History Summary

The lifetime high-speed exercise history (official timed works and races) of the 9 horses that died or were euthanized at Churchill racetrack because of a musculoskeletal injury (excluded the horse with trauma head injury and 2 horses that had sudden death) were compared with 3 control horses per injured horse matched by participating in the last event (official timed work or race) of the injured horse (exercise histories for control horses are truncated to the date of death of the injured horse). Thus, injured horses (Cases) are similar in age, sex, and quality to Control horses.

The exercise histories were reduced to 65 variables. Univariate conditional logistic regression was used to find variables that may be different between injured and control horses. Two variables became apparent that are likely different between injured and control horses ($0.05<p<0.10$, which is notable given that there are only 9 injured and 27 control horses in this sample).

Injured (case) horses had more races per year in their career and more days between last high-speed event and date of death – details in Appendix.

In summary – there are horse level risk factors that likely contributed to risk for injury. The two factors observed are consistent with our knowledge of repetitive, overuse (fatigue) injuries in racehorses. Frequent high intensity exercise (as observed in injured horses) that does not allow for recovery of exercise-induced microdamage contributes to the development of stress fractures and subchondral stress remodeling which predispose horses to catastrophic injuries. Increased time between the last high-speed event and date of death may be associated with trainers' sense that the horse needs more time before the next race.

Happy to have a conversation – and provide detailed data.

Sincerely,

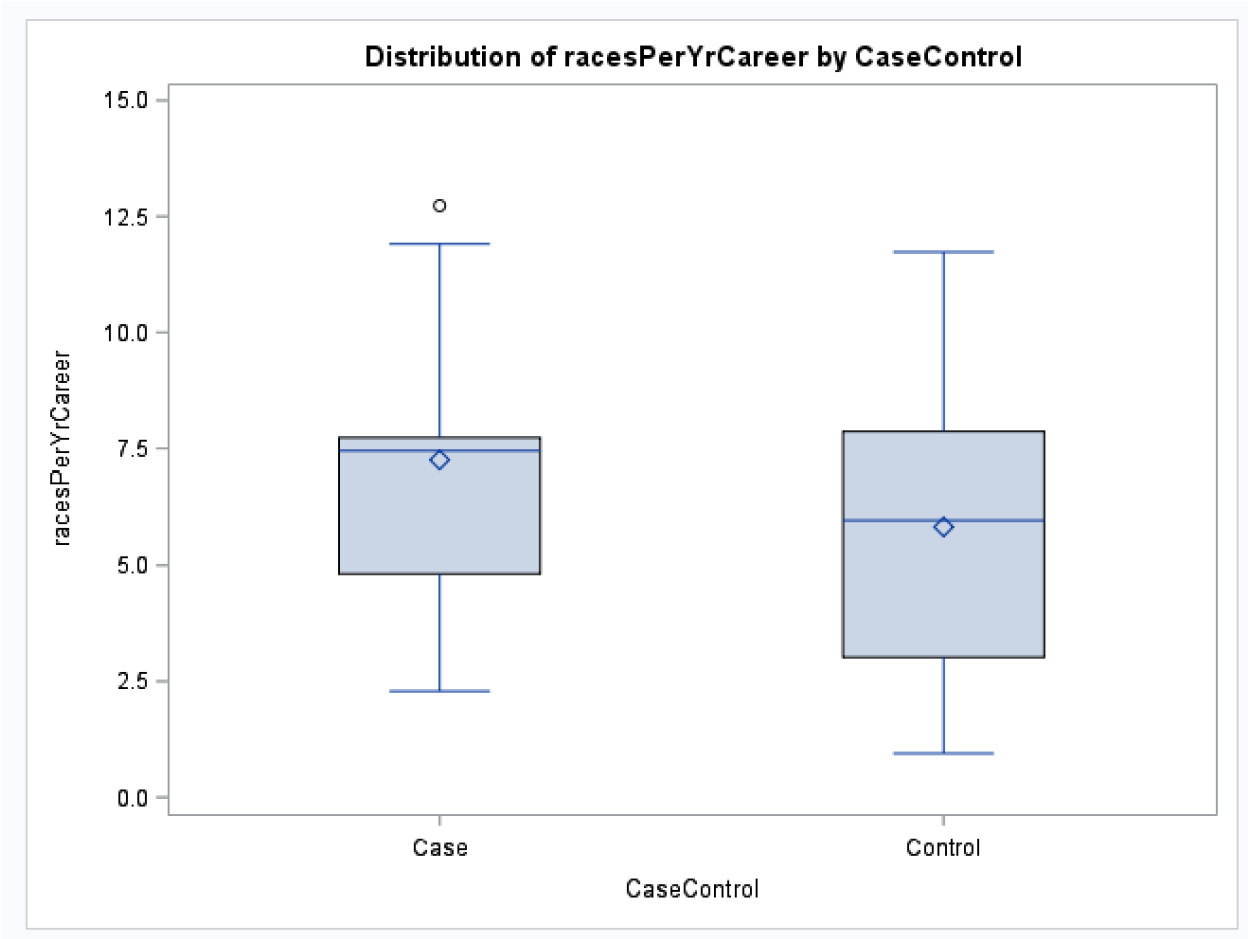
Susan M. Stover, DVM, PhD, Dipl ACVS
Distinguished Professor
Director, JD Wheat Veterinary Orthopedic Research Laboratory

Appendix

Races per year during career – p=0.0953

Control 5.8 ± 2.9 (4.7, 7.0) [mean ± SD, 95% confidence level)

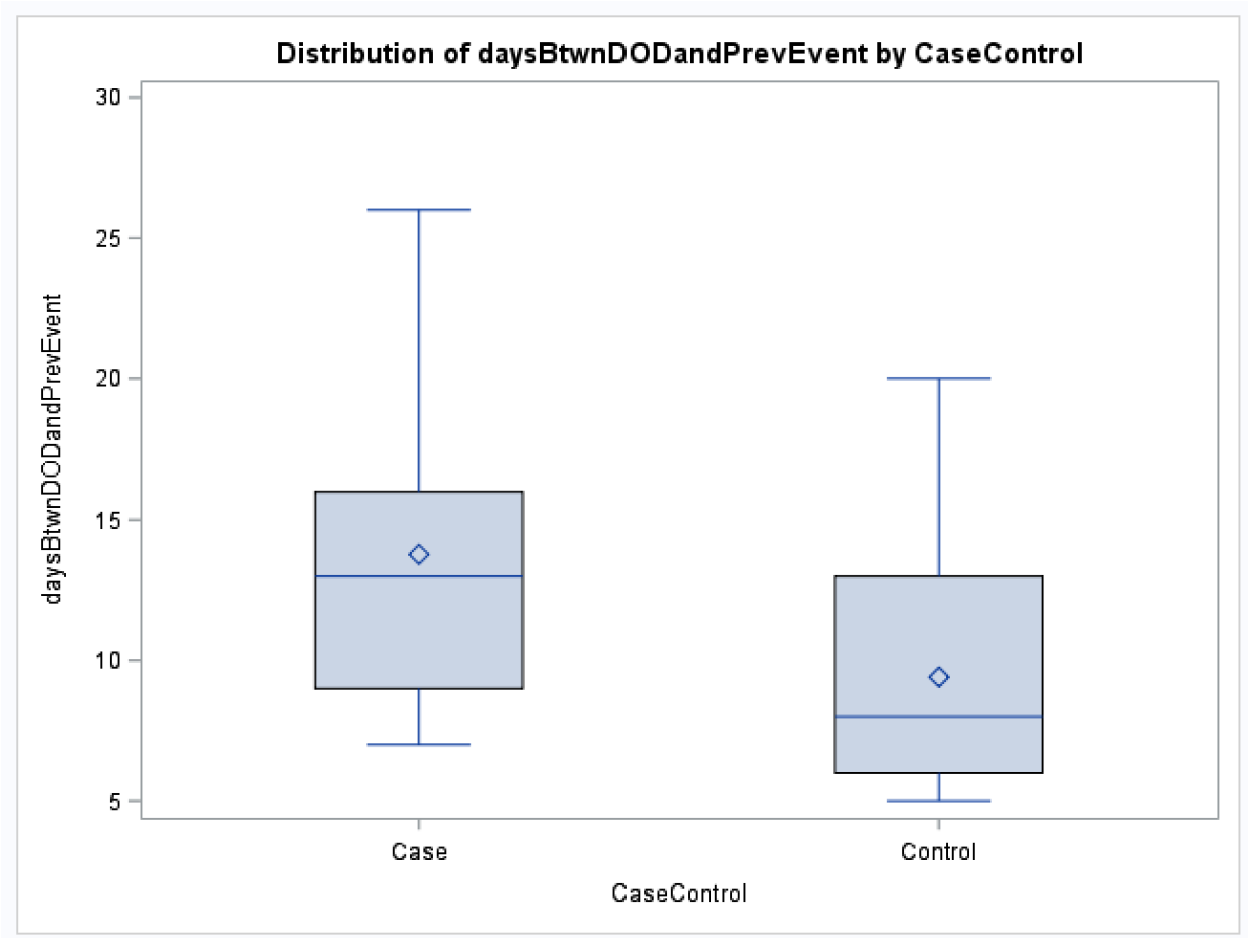
Case 7.3 ± 3.4 (4.7, 9.9)



Days between last high-speed event and date of death – p=0.0636

Control 9.4 ± 4.0 (7.8, 11.0)

Case 13.8 ± 6.5 (8.8, 18.8)



Exercise History Report (Full)

J.D. Wheat Veterinary Orthopedic Research Laboratory

This report summarizes the high speed exercise history for Case Horse. There are four parts to this report:

Part 1 is a graph that depicts the races and officially recorded high speed workouts for Case Horse over the horse's career. The graph is useful for visually assessing features of a horse's career like: career length, periods of layup, and exercise consistency. If Case Horse had zero recorded high-speed exercise events, this graph is not produced. Event histories for three breed, sex, age, and event-matched control horses are also plotted.

Part 2 includes graphs which illustrate Case Horse's exercise history alongside that of Control Horses. These graphs are useful for visually comparing periods of layup and specific rates of exercise in the horses' exercise histories.

Part 3 is a chronological listing of races and officially timed works beginning with the most recent event (race or work).

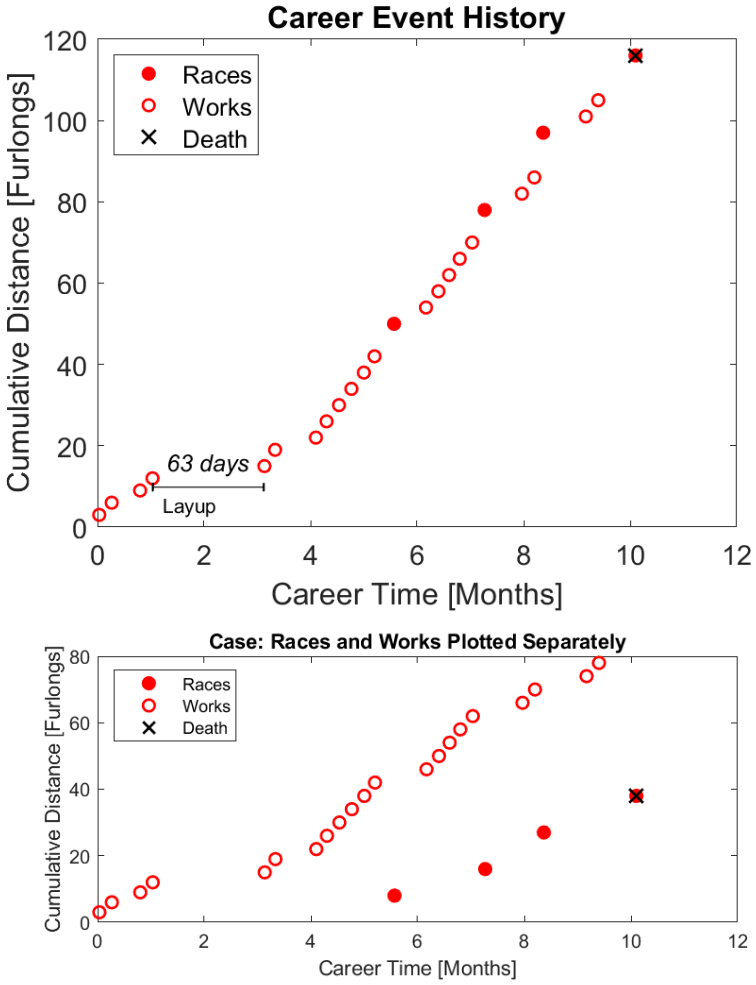
Part 4 is a chart that allows comparison of exercise variables between Case Horse and other racehorses of similar age, sex, and breed that did not die at the same time from an injury. Similar to comparing the results of a blood test to a range of normal values, the values for Case Horse can be assessed in the context of a normal range for 95% of a sample of similar racehorses that did not die during the same time as Case Horse.

Table of Contents

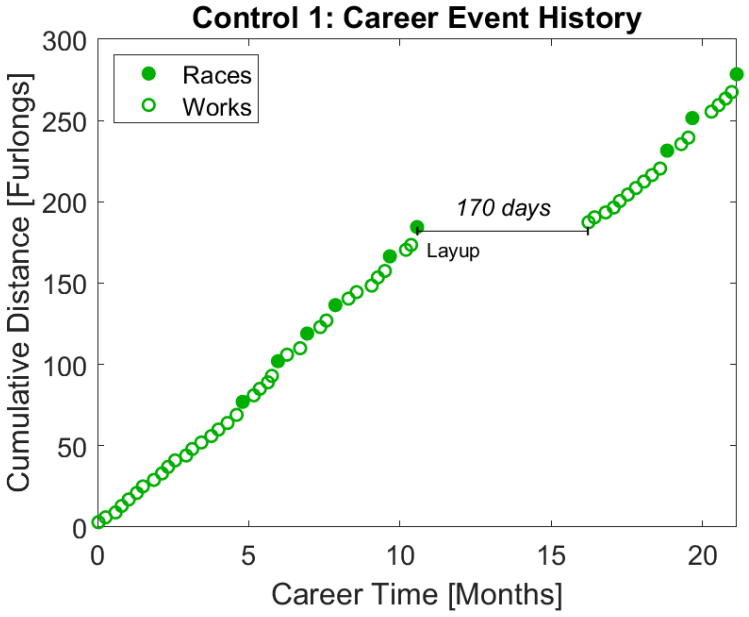
Part 1: Graphical Representation of Individual High-Speed Exercise Histories

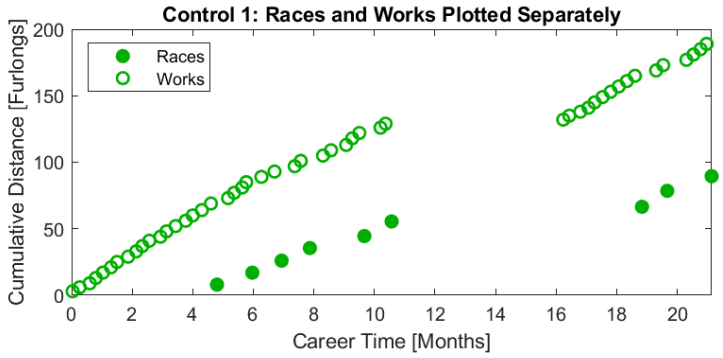
Races (filled circles), officially timed high-speed works (open circles), layups (line with endcaps, periods of time greater than 60 days in length without a race or timed work), and time of death (X) are illustrated over time (Career Time in months). With each event (race or work), the number of furlongs the horse exercised in that event is added to the number of furlongs exercised in all previous events.

Case Horse High Speed Exercise History

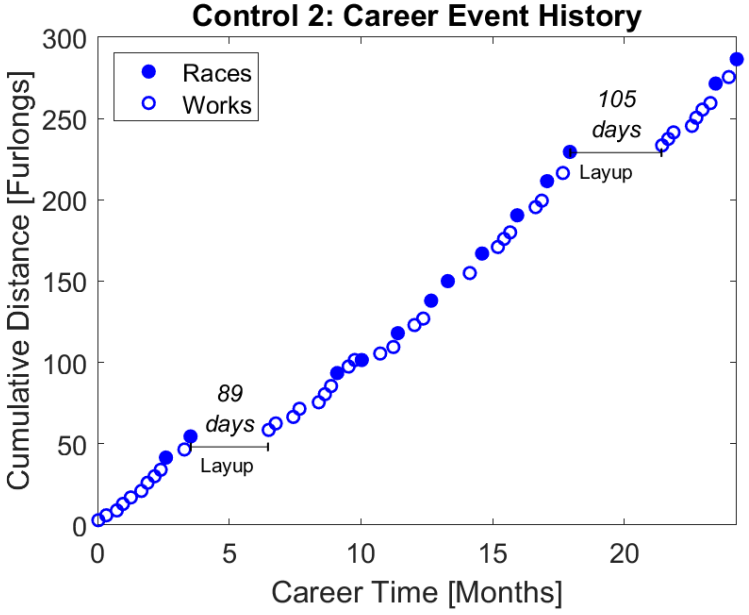


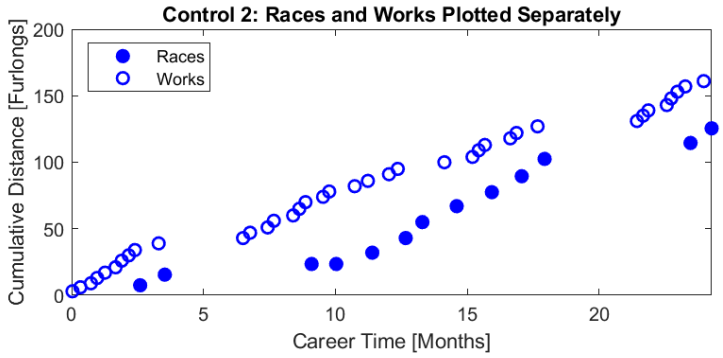
Control 1 High Speed Exercise History



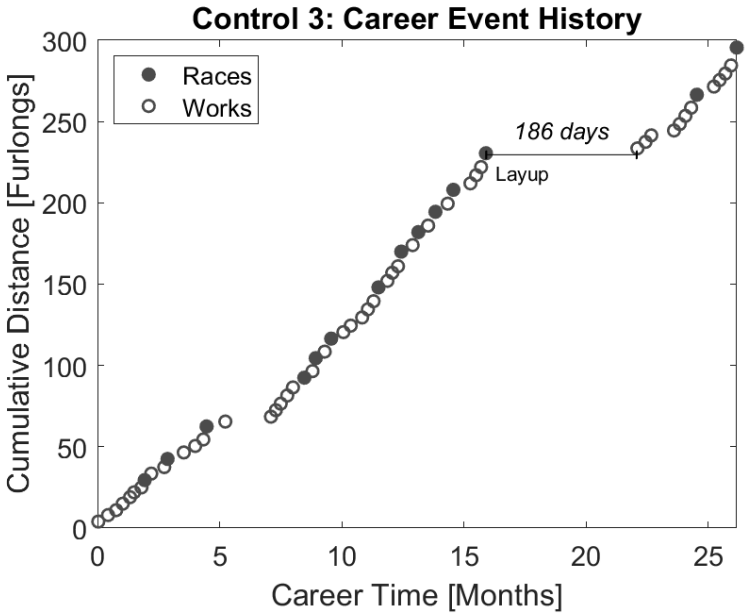


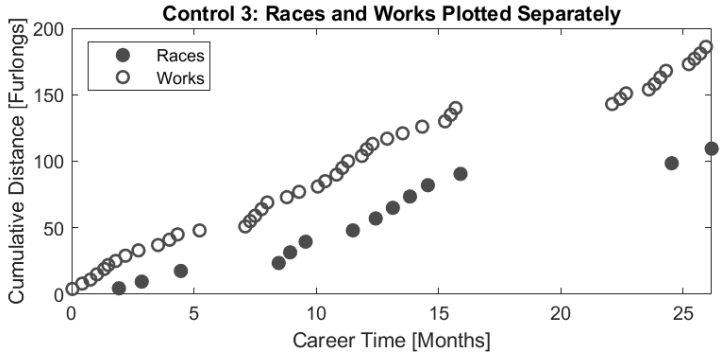
Control 2 High Speed Exercise History



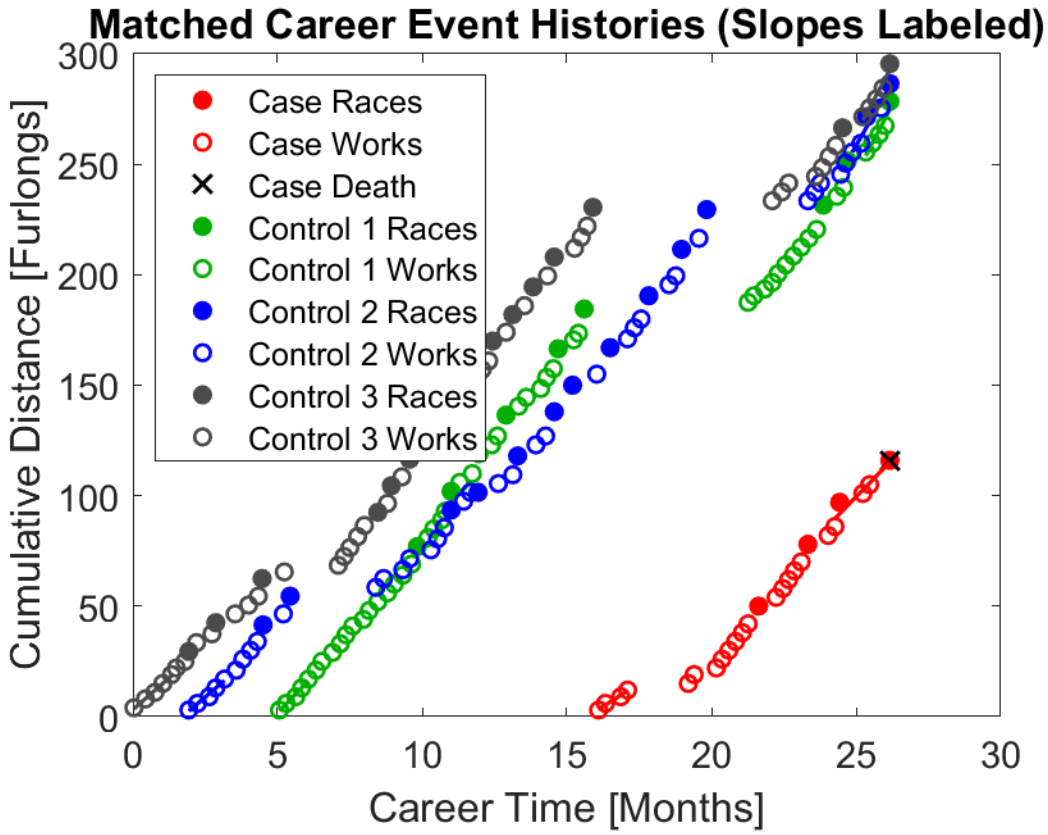


Control 3 High Speed Exercise History

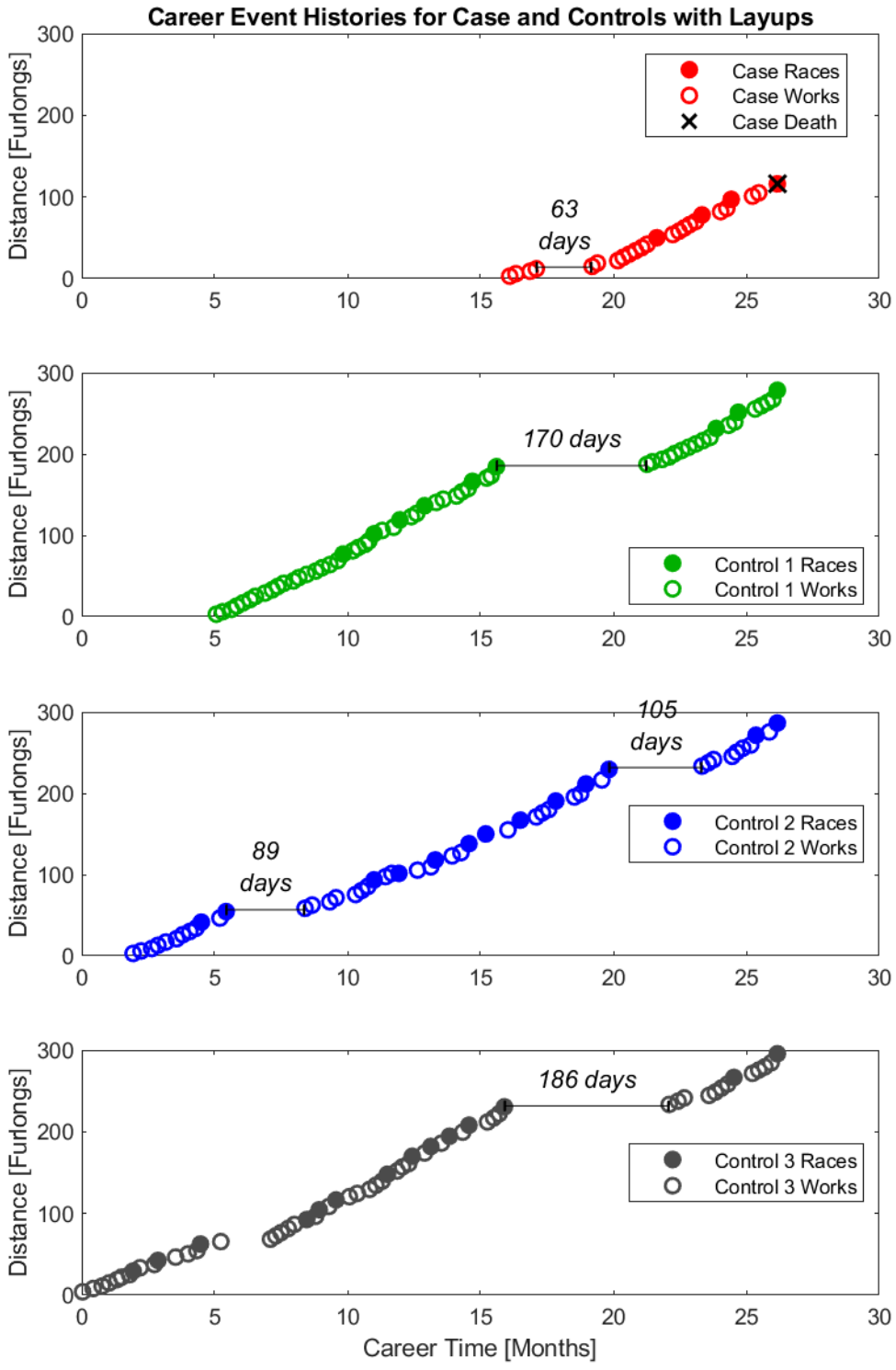


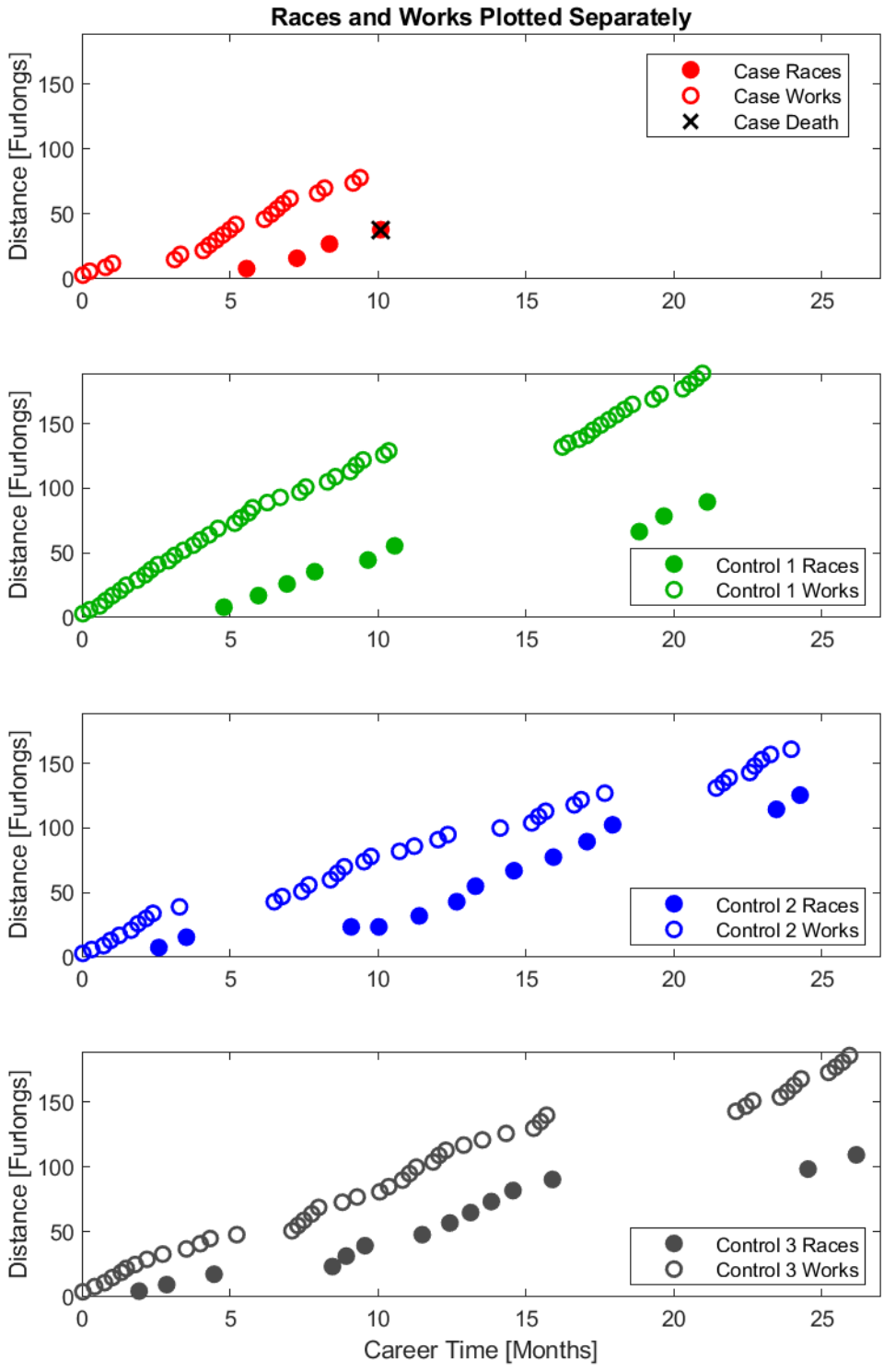


Part 2: Case and Control Horses Plotted Together



Case and Control Horses' exercise event histories are plotted on the same axes. The plots are aligned by the match date (equal to the date of death of Case Horse). Lines segments indicate specific rates of exercise at the start of career, end of career (for Case Horse), and match date (for Control Horses). Event rates are calculated as the slopes of the plots over 2 to 5 events not spanning a layup period, in units of furlongs per month.

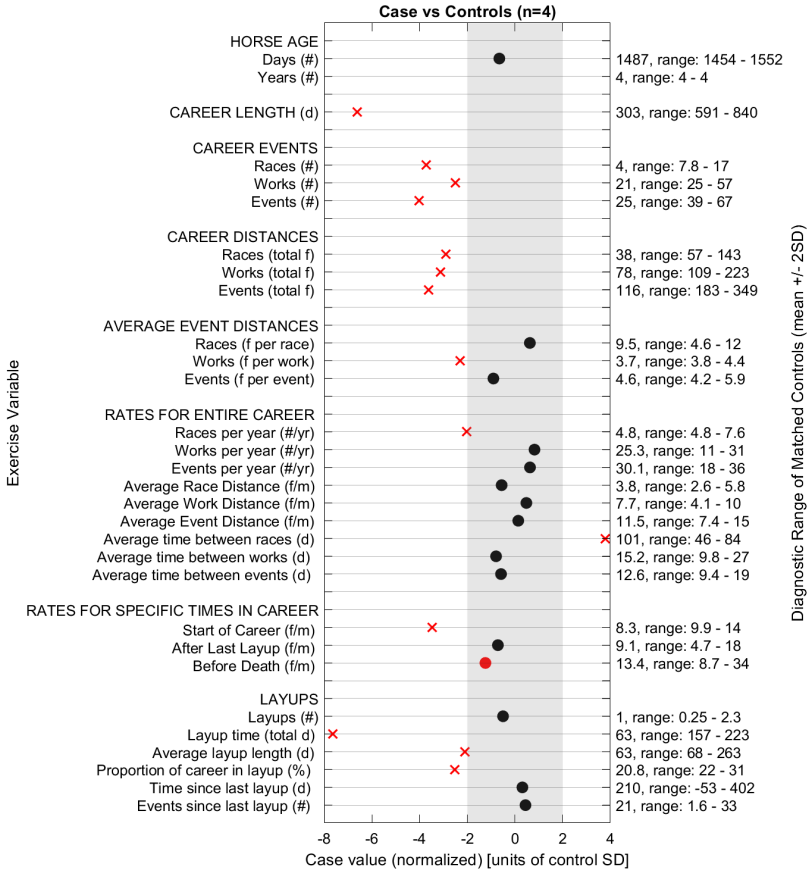

Career Event Histories for Case and Controls with Layups
Distance [Furlongs]
Career Time [Months]
Case Races
Case Works
Case Death
63
days
Control 1 Races
Control 1 Works
170 days
Control 2 Races
Control 2 Works
89
days
105
days
Control 3 Races
Control 3 Works
186 days


Races and Works Plotted Separately
Distance [Furlongs]
Case Races
Case Works
Case Death
Control 1 Races
Control 1 Works
Control 2 Races
Control 2 Works
Control 3 Races
Control 3 Works
Career Time [Months]

Part 3: Case Horse's Event History

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
5/13/2023	R	11.0	CD	Turf	Firm		3U	Alw127000nw11x	1344	10
4/22/2023	W	4.0	PAY	Dirt	Fast	:50.40				
4/15/2023	W	4.0	PAY	Dirt	Fast	:50.40				
3/22/2023	R	11.0	TAM	Turf	Firm		3U	Msw	14400	1
3/17/2023	W	4.0	PAY	Dirt	Fast	:50.40				
3/10/2023	W	4.0	PAY	Dirt	Fast	:50.20				
2/17/2023	R	8.0	GP	Turf	Firm		4U	Msw	3500	4
2/10/2023	W	4.0	PAY	Dirt	Fast	:50.40				
2/3/2023	W	4.0	PAY	Dirt	Fast	:49.60				
1/28/2023	W	4.0	PAY	Dirt	Fast	:50.00				
1/22/2023	W	4.0	PAY	Dirt	Fast	:50.00				
1/15/2023	W	4.0	PAY	Dirt	Fast	:51.20				
12/28/2022	R	8.0	TAM	Turf	Firm		3U	Msw	250	5
12/17/2022	W	4.0	PAY	Dirt	Fast	:49.00				
12/11/2022	W	4.0	PAY	Dirt	Fast	:50.80				
12/4/2022	W	4.0	PAY	Dirt	Fast	:49.60				
11/27/2022	W	4.0	PAY	Dirt	Fast	:49.60				
11/20/2022	W	4.0	PAY	Dirt	Fast	:49.60				
11/14/2022	W	3.0	PAY	Dirt	Fast	:37.80				
10/22/2022	W	4.0	MTH	Dirt training	Good	:50.40				
10/16/2022	W	3.0	MTH	Dirt	Fast	:38.00				
8/14/2022	W	3.0	MTH	Dirt	Fast	:37.80				
8/7/2022	W	3.0	MTH	Dirt	Fast	:37.60				
7/22/2022	W	3.0	FAI	All Weather Training	Fast	:37.40				
7/15/2022	W	3.0	FAI	All Weather Training	Fast	:38.00				

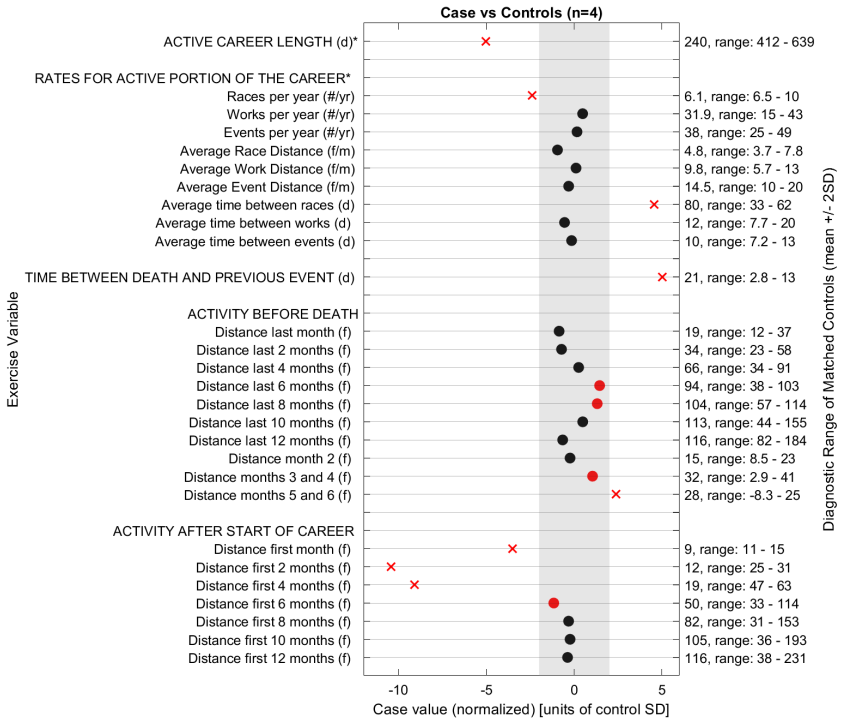
Part 4: Comparison of Exercise Variables between Case Horse and 4 Control Horses (4 year old, male, Thoroughbred)



Case Horse values are indicated by black or red symbols: circles indicate values considered normal for 95% of 4 year old, male, Thoroughbreds (n=4) (gray region) (black and red indicate within 1 and 2 SD, respectively, of mean value of controls), X's indicate values outside of the normal range. Two and 3 year old case horses are also matched to control horses by the quarter in which the case horse died (Jan-Mar, Apr-Jun, Jul-Sep,Oct-Dec). Variables that are not calculable are not plotted (e.g. time between races for a horse with zero events). f=furlongs; yr=year; m=month; d=days.

^Rates are calculated over 2 to 5 events.

*Active Career Length is the career length excluding the time during layups.



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Exercise History Report (Full)

J.D. Wheat Veterinary Orthopedic Research Laboratory

This report summarizes the high speed exercise history for Case Horse. There are four parts to this report:

Part 1 is a graph that depicts the races and officially recorded high speed workouts for Case Horse over the horse's career. The graph is useful for visually assessing features of a horse's career like: career length, periods of layup, and exercise consistency. If Case Horse had zero recorded high-speed exercise events, this graph is not produced. Event histories for three breed, sex, age, and event-matched control horses are also plotted.

Part 2 includes graphs which illustrate Case Horse's exercise history alongside that of Control Horses. These graphs are useful for visually comparing periods of layup and specific rates of exercise in the horses' exercise histories.

Part 3 is a chronological listing of races and officially timed works beginning with the most recent event (race or work).

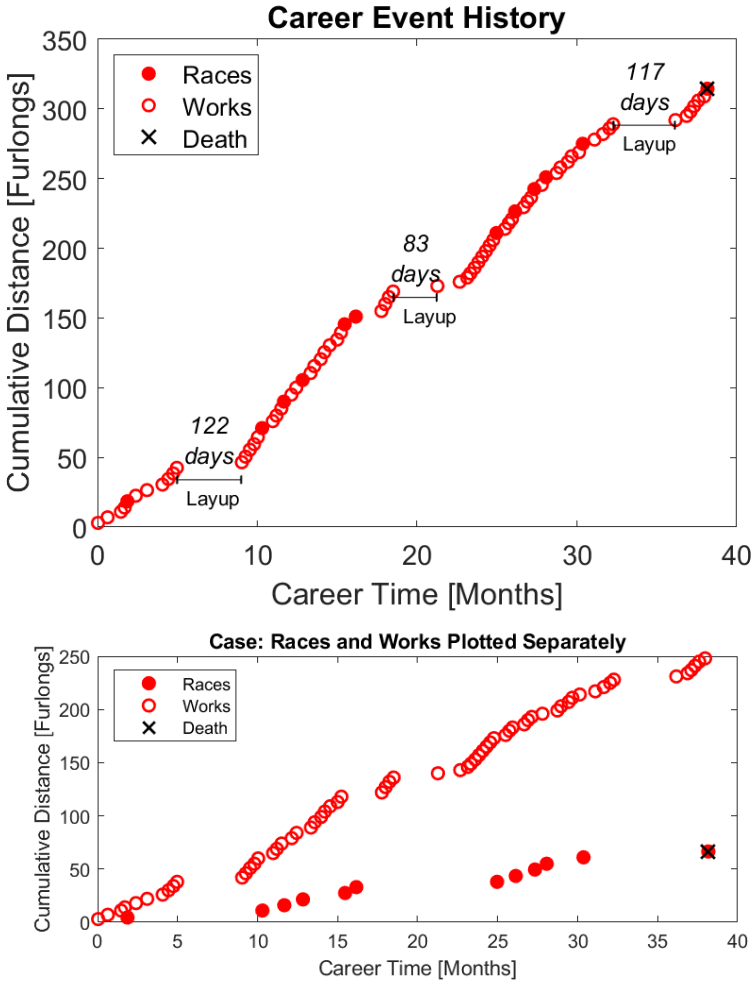
Part 4 is a chart that allows comparison of exercise variables between Case Horse and other racehorses of similar age, sex, and breed that did not die at the same time from an injury. Similar to comparing the results of a blood test to a range of normal values, the values for Case Horse can be assessed in the context of a normal range for 95% of a sample of similar racehorses that did not die during the same time as Case Horse.

Table of Contents

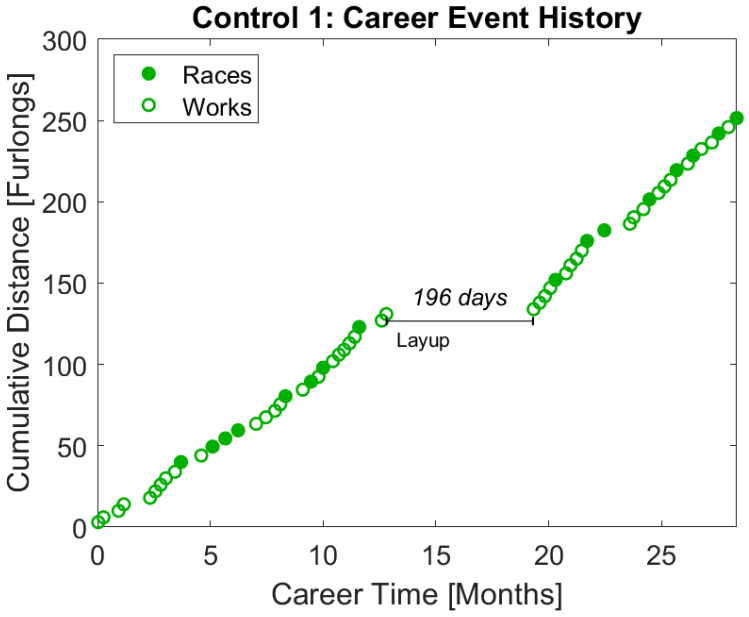
Part 1: Graphical Representation of Individual High-Speed Exercise Histories

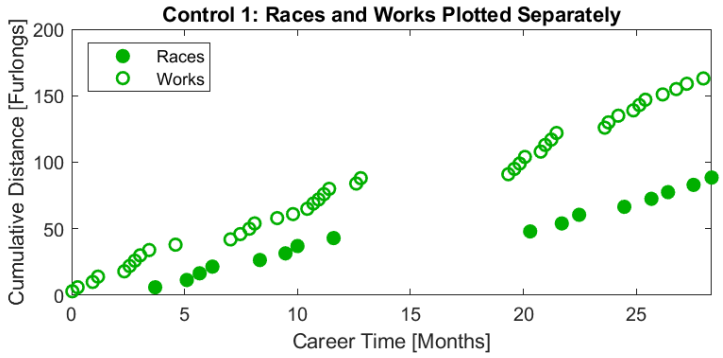
Races (filled circles), officially timed high-speed works (open circles), layups (line with endcaps, periods of time greater than 60 days in length without a race or timed work), and time of death (X) are illustrated over time (Career Time in months). With each event (race or work), the number of furlongs the horse exercised in that event is added to the number of furlongs exercised in all previous events.

Case Horse High Speed Exercise History

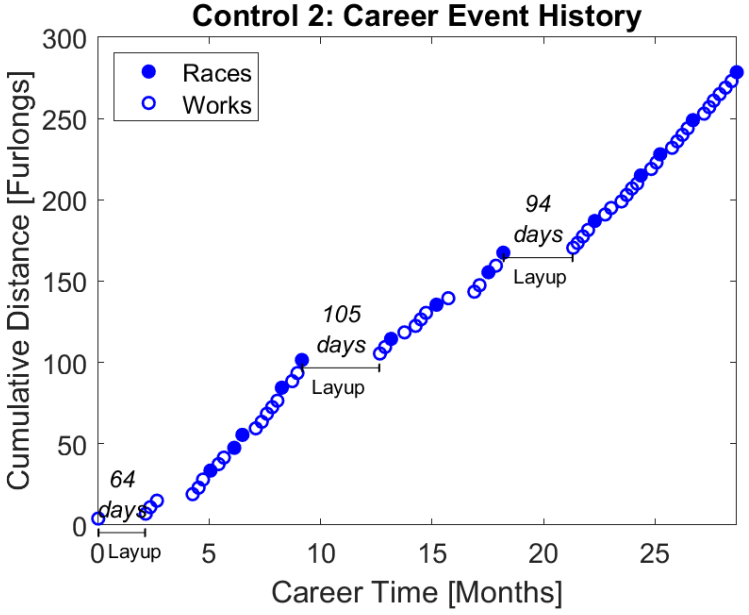


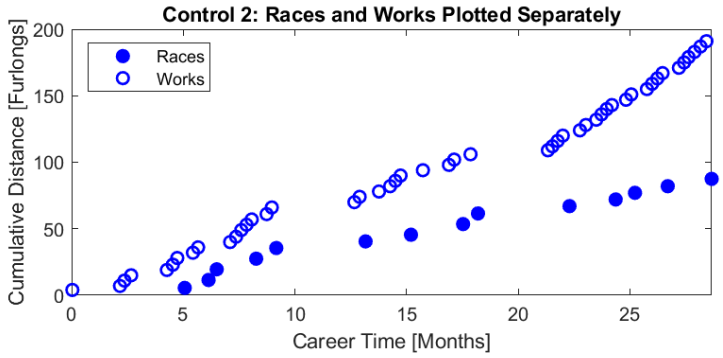
Control 1 High Speed Exercise History



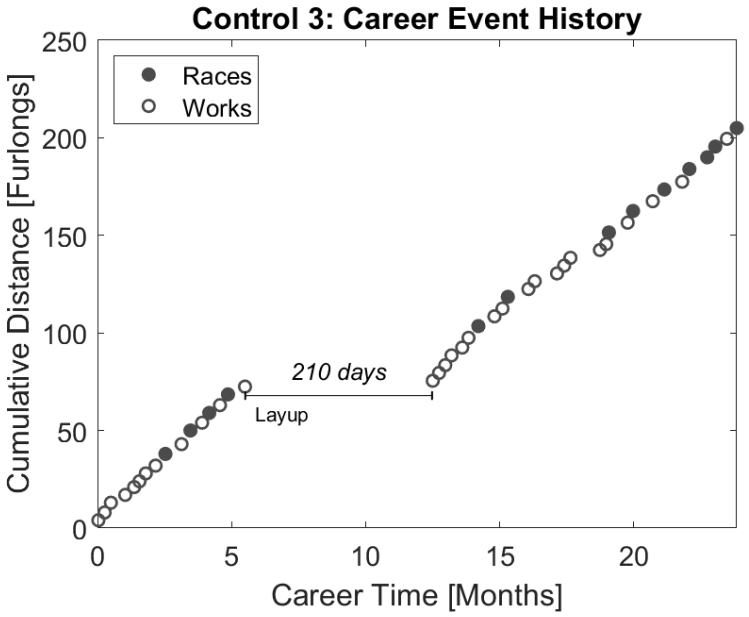


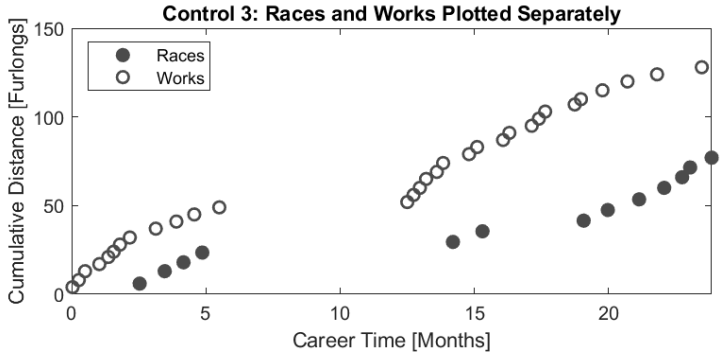
Control 2 High Speed Exercise History



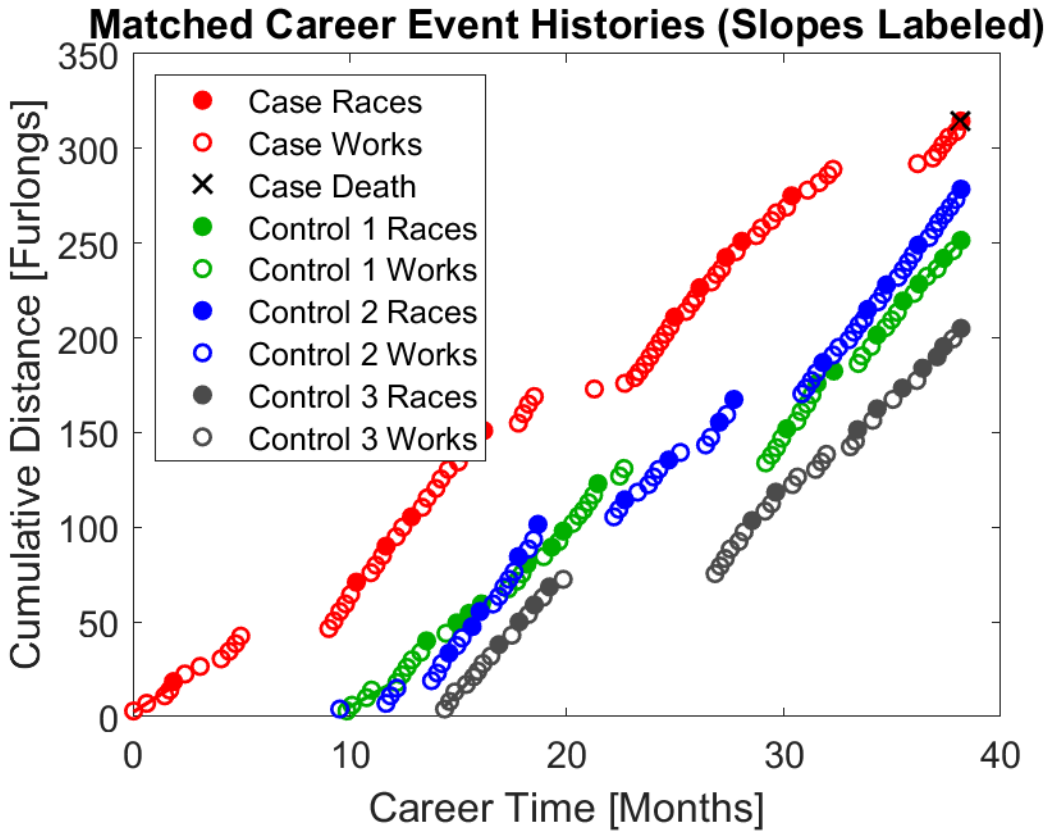


Control 3 High Speed Exercise History

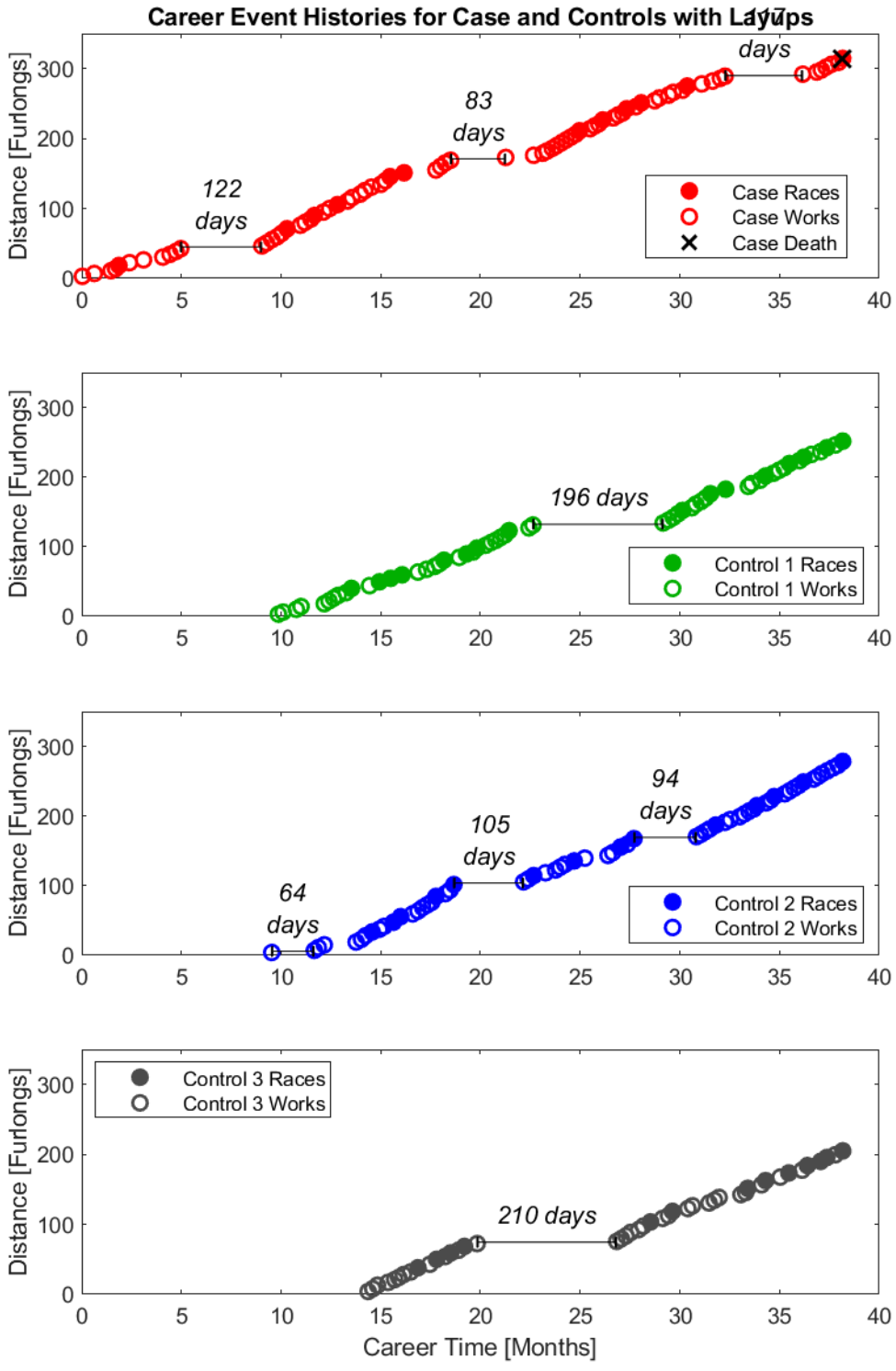


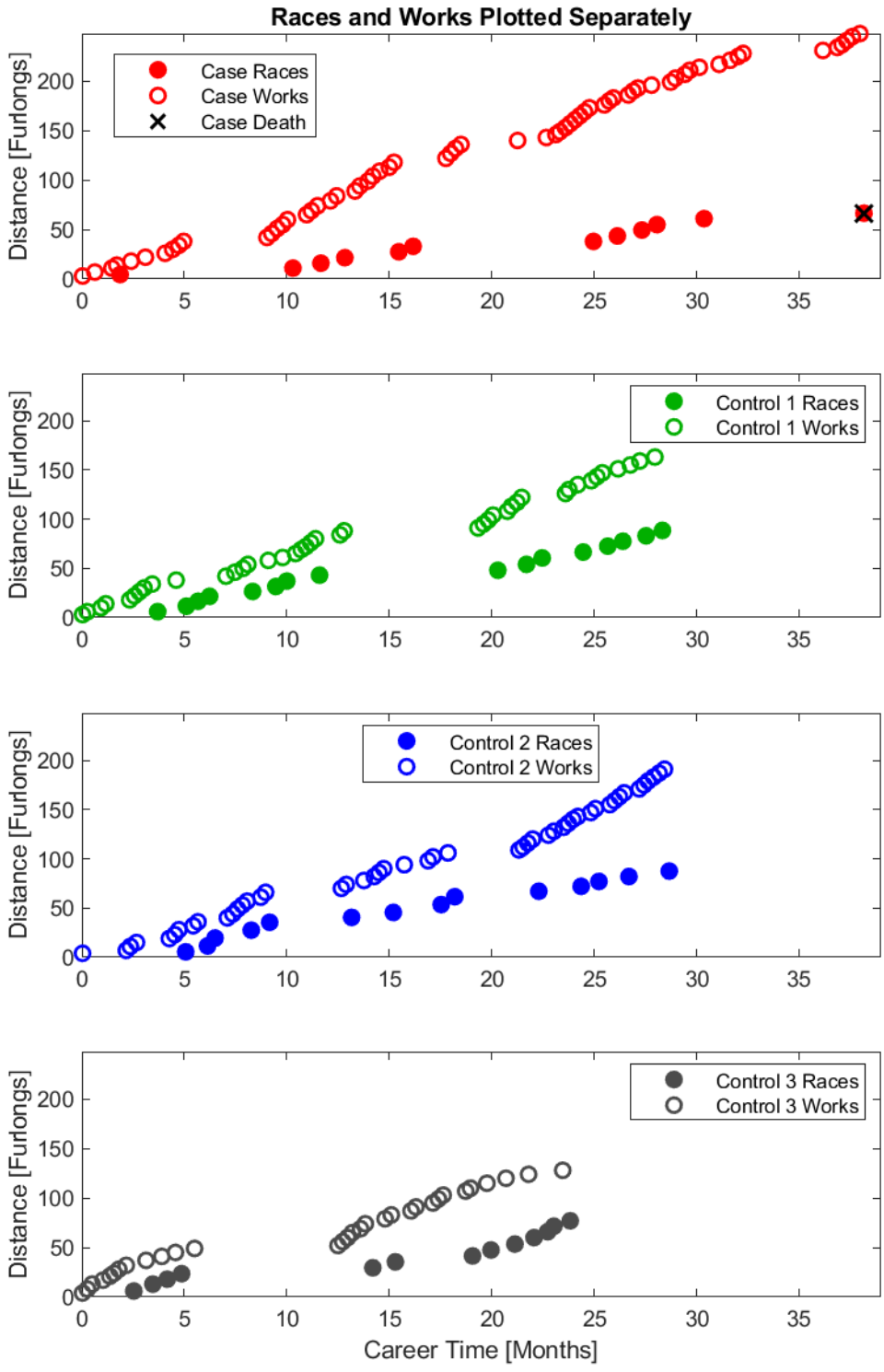


Part 2: Case and Control Horses Plotted Together



Case and Control Horses' exercise event histories are plotted on the same axes. The plots are aligned by the match date (equal to the date of death of Case Horse). Lines segments indicate specific rates of exercise at the start of career, end of career (for Case Horse), and match date (for Control Horses). Event rates are calculated as the slopes of the plots over 2 to 5 events not spanning a layup period, in units of furlongs per month.


Career Event Histories for Case and Controls with Layups
Distance [Furlongs]
Career Time [Months]
122 days
83 days
days
Case Races
Case Works
Case Death
196 days
Control 1 Races
Control 1 Works
64 days
105 days
94 days
Control 2 Races
Control 2 Works
Control 3 Races
Control 3 Works
210 days


Races and Works Plotted Separately
Case Races
Case Works
Case Death
Control 1 Races
Control 1 Works
Control 2 Races
Control 2 Works
Control 3 Races
Control 3 Works
Distance [Furlongs]
Career Time [Months]
0
5
10
15
20
25
30
35
50
100
150
200

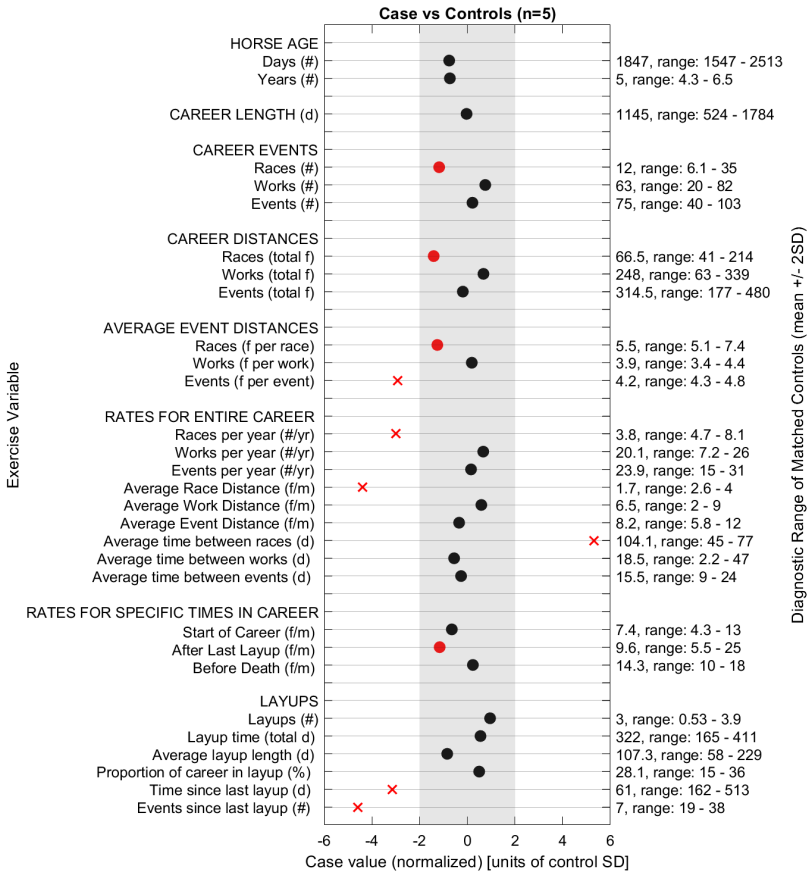
Part 3: Case Horse's Event History

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
5/2/2023	R	5.5	CD	Turf	Firm		3U	Aoc80000nw2$/x	1305	9
4/26/2023	W	3.0	KEE	Dirt	Fast	:37.40				
4/15/2023	W	4.0	PMM	Dirt	Fast	:48.45				
4/7/2023	W	4.0	PMM	Dirt	Fast	:50.50				
3/31/2023	W	3.0	PMM	Dirt	Fast	:39.95				
3/24/2023	W	3.0	PMM	Dirt	Fast	:38.20				
3/3/2023	W	3.0	PMM	Dirt	Fast	:38.30				
11/6/2022	W	3.0	CD	Dirt	Fast	:35.80				
10/30/2022	W	4.0	CD	Dirt	Fast	:48.20				
10/18/2022	W	4.0	CD	Dirt	Fast	:46.60				
10/2/2022	W	3.0	CD	Dirt	Fast	:36.60				
9/10/2022	R	6.0	KD	Turf	Firm		3U	TrfSprntG2 -1000k	5500	9
9/3/2022	W	3.0	PMM	Dirt	Fast	:36.20				
8/20/2022	W	4.0	PMM	Dirt	Fast	:46.65				
8/13/2022	W	4.0	PMM	Dirt	Fast	:48.15				
7/30/2022	W	4.0	PMM	Dirt	Fast	:48.65				
7/23/2022	W	3.0	PMM	Dirt	Fast	:38.80				
7/3/2022	R	5.5	GP	AllWthr	Fast		3U	BUmphSpntB -100k	58200	1
6/25/2022	W	3.0	PMM	Dirt	Fast	:36.85				
6/11/2022	R	6.0	BEL	Turf	Firm		3U	JaipurG1 -400k	1142	13
6/5/2022	W	3.0	BEL	Dirt training	Fast	:39.42				
5/29/2022	W	4.0	BEL	Dirt training	Fast	:49.86				
5/22/2022	W	3.0	BEL	Dirt training	Fast	:37.63				
5/6/2022	R	5.5	CD	Turf	Firm		3U	TurfSprtG2 -500k	5000	8
4/30/2022	W	3.0	KEE	Dirt	Fast	:34.80				

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
4/24/2022	W	4.0	KEE	Dirt	Fast	:48.60				
4/17/2022	W	3.0	KEE	Dirt	Fast	:36.20				
4/1/2022	R	5.0	GP	Turf	Firm		4U	Aoc62500cnd-N	33000	1
3/26/2022	W	4.0	PMM	Dirt	Fast	:49.40				
3/19/2022	W	4.0	PMM	Dirt	Fast	:50.00				
3/12/2022	W	4.0	PMM	Dirt	Fast	:48.00				
3/5/2022	W	4.0	PMM	Dirt	Fast	:49.00				
2/26/2022	W	4.0	PMM	Dirt	Fast	:49.85				
2/19/2022	W	4.0	PMM	Dirt	Fast	:48.25				
2/11/2022	W	3.0	PMM	Dirt	Fast	:38.35				
2/5/2022	W	3.0	PMM	Dirt	Fast	:37.10				
1/22/2022	W	3.0	PMM	Dirt	Fast	:34.45				
12/11/2021	W	4.0	TP	AllWthr	Fast	:49.00				
9/19/2021	W	4.0	TP	AllWthr	Fast	:49.40				
9/11/2021	W	5.0	TP	AllWthr	Fast	01:01.2				
9/4/2021	W	5.0	TP	AllWthr	Fast	01:00.2				
8/28/2021	W	4.0	TP	AllWthr	Fast	:49.20				
7/11/2021	R	5.5	MTH	Turf	Yielding		3	MyFrnchmnB-76k	45000	1
6/20/2021	R	6.0	WO	AllWthr	Fast		3	WoodstockL-125k	11027	3
6/13/2021	W	5.0	CD	Turf	Firm	01:01.2				
6/6/2021	W	4.0	CD	Turf	Firm	:48.80				
5/23/2021	W	5.0	BEL	Inner turf	Firm	01:01.2				
5/13/2021	W	5.0	KEE	Dirt	Fast	:59.00				
5/6/2021	W	5.0	KEE	Dirt	Fast	:59.80				
4/24/2021	W	5.0	KEE	Turf	Good	01:02.8				
4/17/2021	W	5.0	KEE	Turf	Good	01:02.8				
4/2/2021	R	5.5	KEE	Turf	Good		3	PlsdsTSprB-100k	60000	1
3/21/2021	W	5.0	KEE	Dirt	Fast	01:01.0				
3/12/2021	W	5.0	TP	AllWthr	Fast	01:00.8				

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
2/26/2021	R	5.0	GP	Turf	Firm		3	Msw	24000	1
2/21/2021	W	5.0	PMM	Turf	Firm	:58.65				
2/12/2021	W	4.0	PMM	Turf	Firm	:48.60				
2/5/2021	W	5.0	PMM	Turf	Firm	:59.75				
1/16/2021	R	6.5	TP	AllWthr	Fast		3	Mcl15000 (15-10)	2600	2
1/8/2021	W	5.0	TP	AllWthr	Fast	01:01.2				
1/1/2021	W	4.0	TP	AllWthr	Fast	:49.00				
12/24/2020	W	5.0	TP	AllWthr	Fast	01:04.0				
12/16/2020	W	4.0	TP	AllWthr	Fast	:52.00				
12/9/2020	W	4.0	TP	AllWthr	Fast	:50.80				
8/9/2020	W	4.0	SAR	Turf	Firm	:49.80				
8/2/2020	W	4.0	SAR	Turf	Firm	:48.30				
7/24/2020	W	4.0	SAR	Turf	Firm	:50.02				
7/13/2020	W	4.0	SAR	Turf	Firm	:51.30				
6/14/2020	W	4.0	PMM	Turf	Firm	:47.95				
5/24/2020	W	4.0	PMM	Turf	Firm	:47.55				
5/8/2020	R	4.5	GP	Dirt	Fast		2	Msw	400	7
5/3/2020	W	3.0	PMM	Turf	Firm	:35.80				
4/26/2020	W	4.0	GPW	Dirt	Fast	:48.20				
4/1/2020	W	4.0	GPW	Dirt	Wet Fast	:48.60				
3/14/2020	W	3.0	GPW	Dirt	Wet Fast	:37.80				

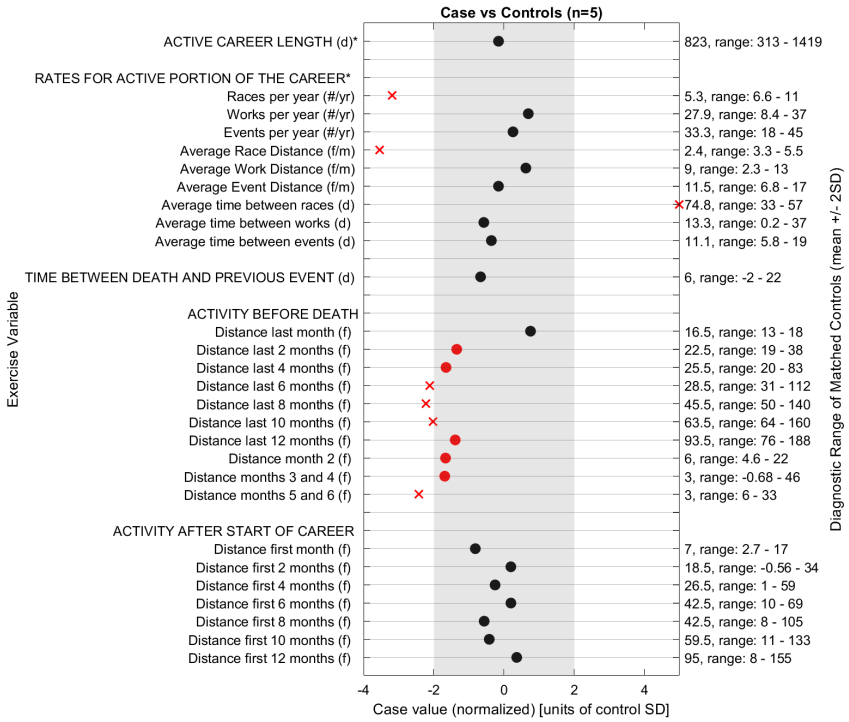
Part 4: Comparison of Exercise Variables between Case Horse and 5 Control Horses (5+ year old, male, Thoroughbred)



Case Horse values are indicated by black or red symbols: circles indicate values considered normal for 95% of 5+ year old, male, Thoroughbreds (n=5) (gray region) (black and red indicate within 1 and 2 SD, respectively, of mean value of controls), X's indicate values outside of the normal range. Two and 3 year old case horses are also matched to control horses by the quarter in which the case horse died (Jan-Mar, Apr-Jun, Jul-Sep,Oct-Dec). Variables that are not calculable are not plotted (e.g. time between races for a horse with zero events). f=furlongs; yr=year; m=month; d=days.

^Rates are calculated over 2 to 5 events.

*Active Career Length is the career length excluding the time during layups.



Case Horse values are indicated by black or red symbols: circles indicate values considered normal for 95% of 5+ year old, male, Thoroughbreds (n=5) (gray region) (black and red indicate within 1 and 2 SD, respectively, of mean value of controls), X's indicate values outside of the normal range. Two and 3 year old case horses are also matched to control horses by the quarter in which the case horse died (Jan-Mar, Apr-Jun, Jul-Sep,Oct-Dec). Variables that are not calculable are not plotted (e.g. time between races for a horse with zero events). f=furlongs; yr=year; m=month; d=days.

^Rates are calculated over 2 to 5 events.

*Active Career Length is the career length excluding the time during layups.

Exercise History Report (Full)

J.D. Wheat Veterinary Orthopedic Research Laboratory

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Part 3 is a chronological listing of races and officially timed works beginning with the most recent event (race or work).

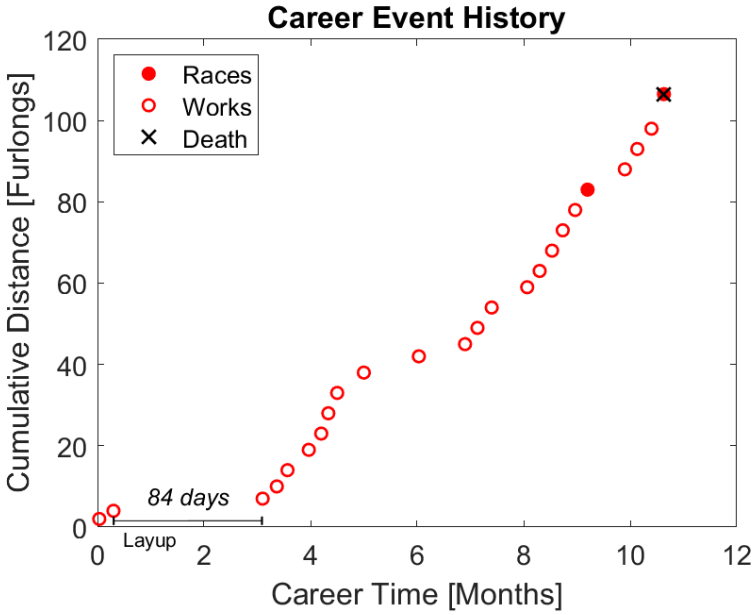
Part 4 is a chart that allows comparison of exercise variables between Case Horse and other racehorses of similar age, sex, and breed that did not die at the same time from an injury. Similar to comparing the results of a blood test to a range of normal values, the values for Case Horse can be assessed in the context of a normal range for 95% of a sample of similar racehorses that did not die during the same time as Case Horse.

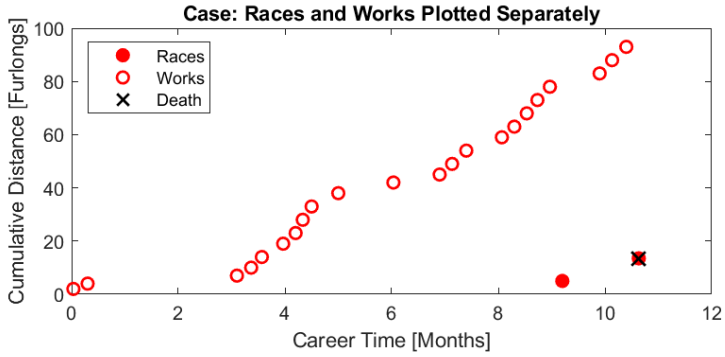
Table of Contents

Part 1: Graphical Representation of Individual High-Speed Exercise Histories

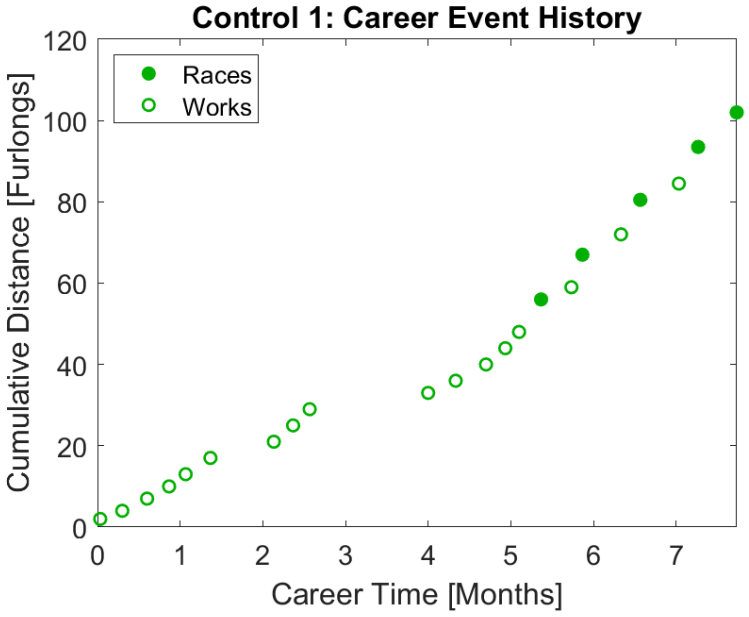
Races (filled circles), officially timed high-speed works (open circles), layups (line with endcaps, periods of time greater than 60 days in length without a race or timed work), and time of death (X) are illustrated over time (Career Time in months). With each event (race or work), the number of furlongs the horse exercised in that event is added to the number of furlongs exercised in all previous events.

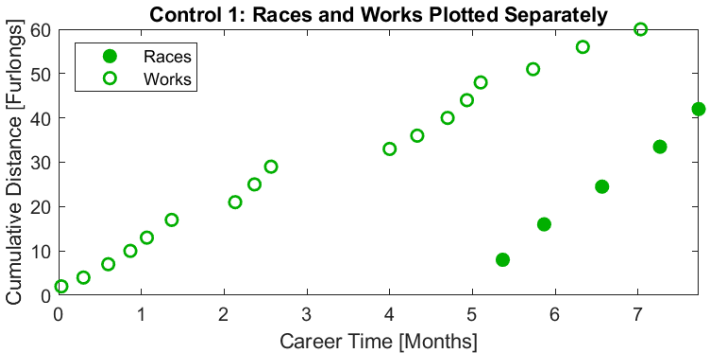
Case Horse High Speed Exercise History



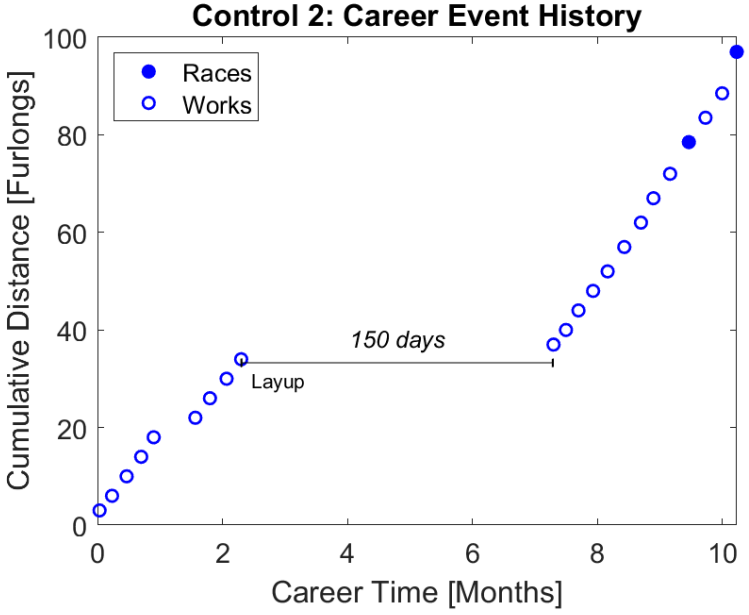


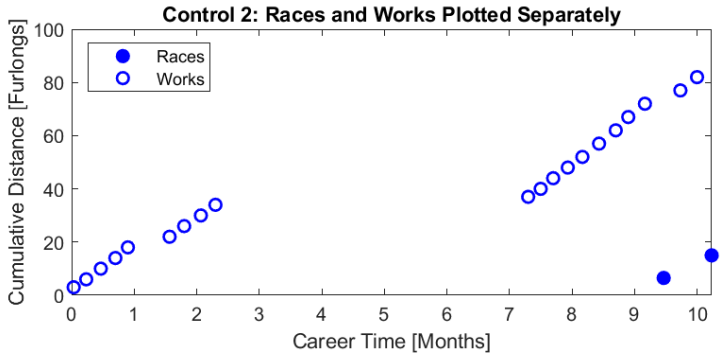
Control 1 High Speed Exercise History



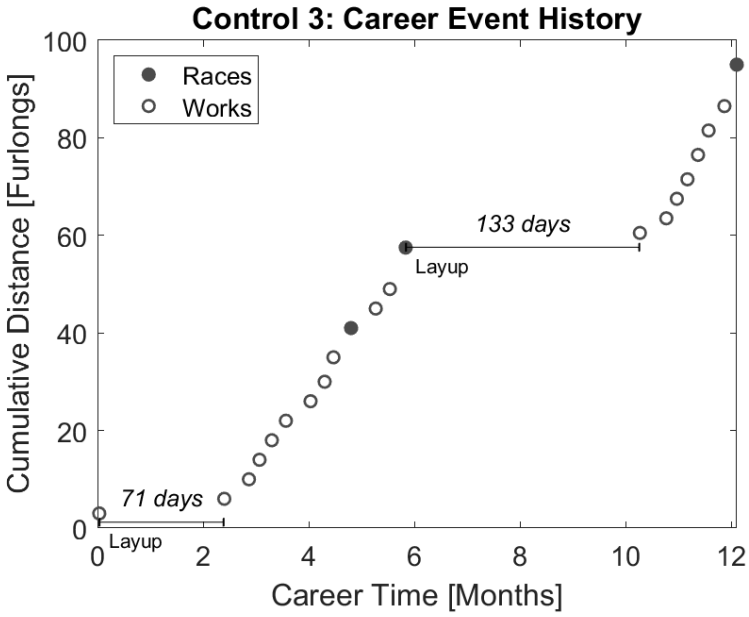


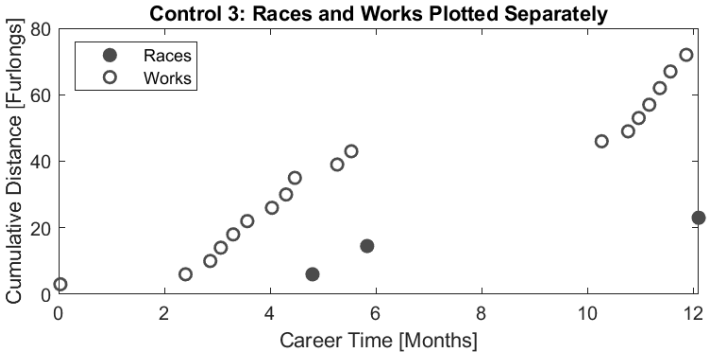
Control 2 High Speed Exercise History



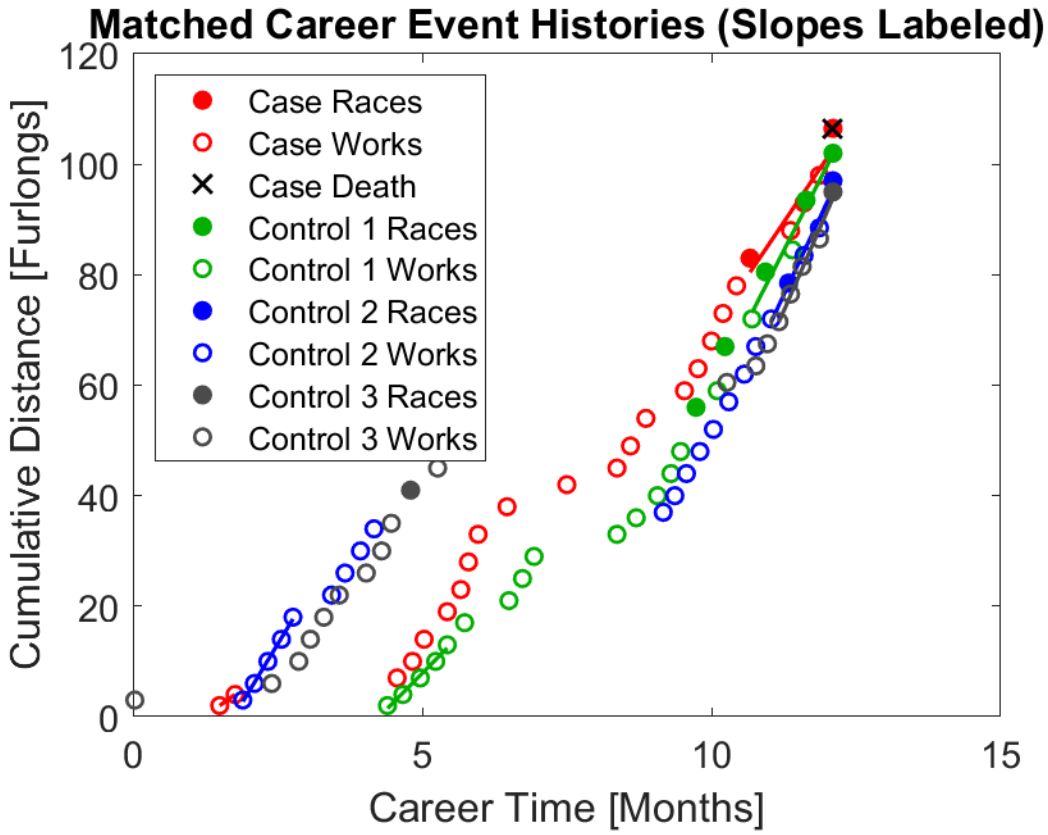


Control 3 High Speed Exercise History

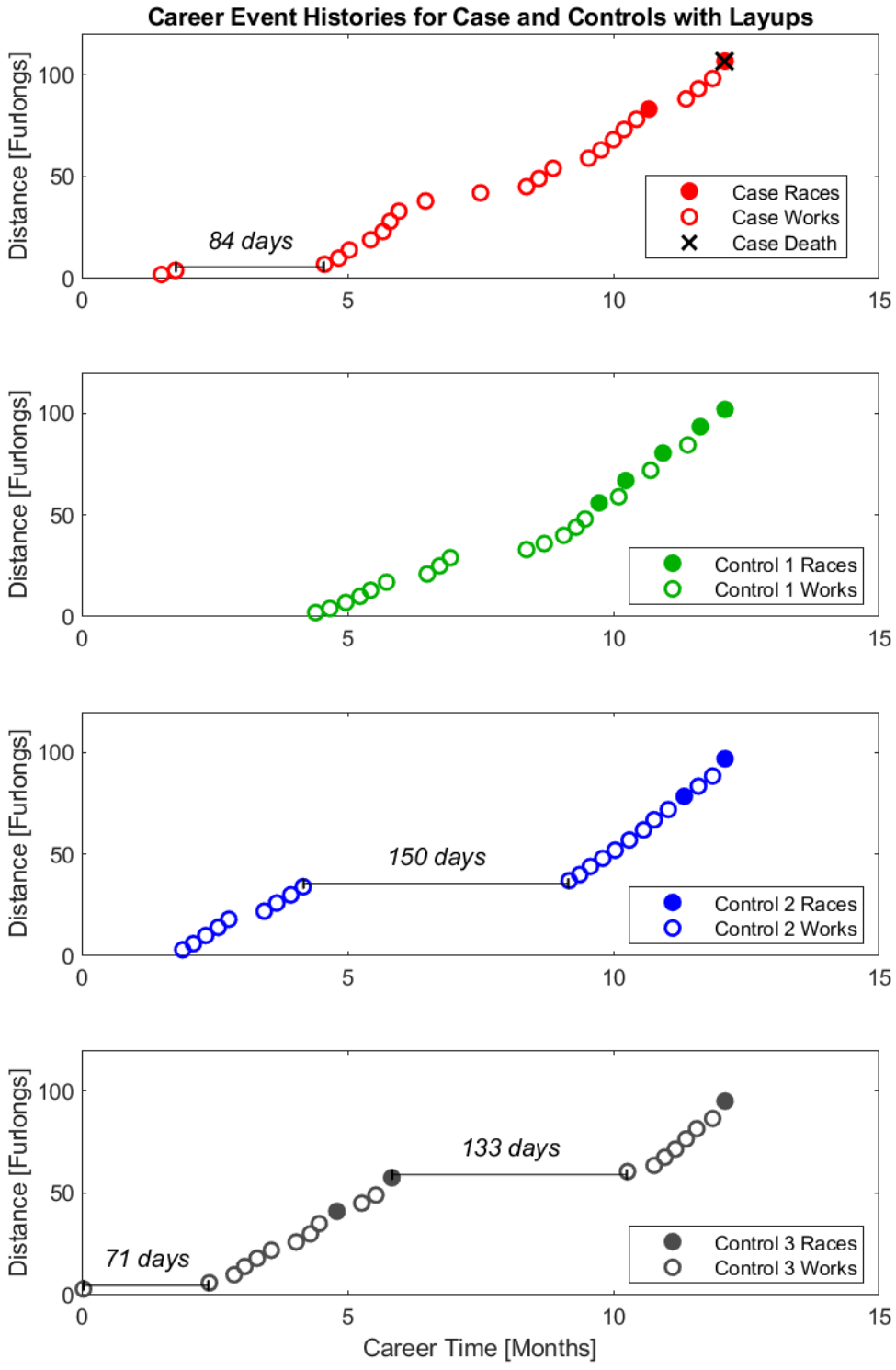


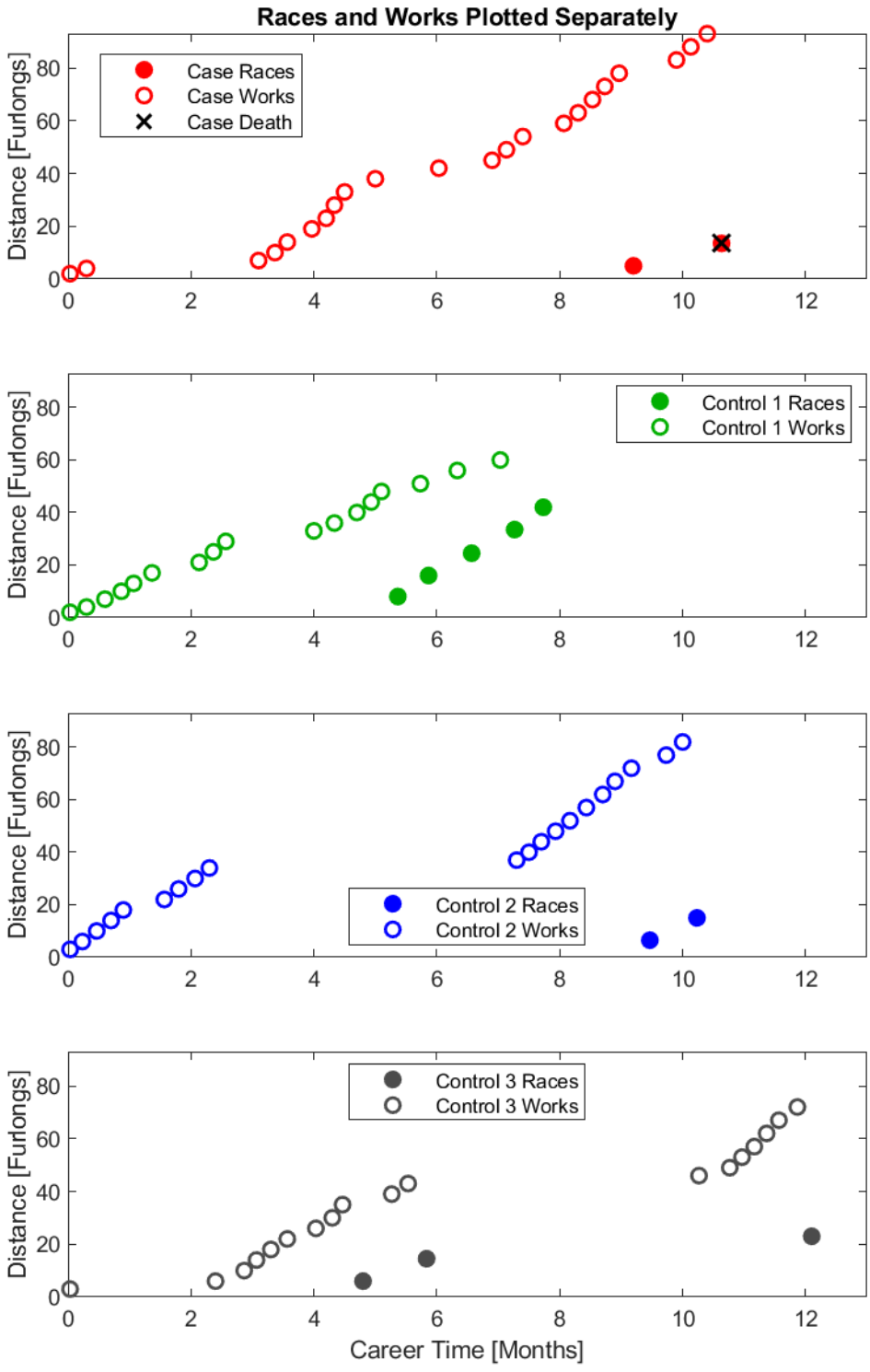


Part 2: Case and Control Horses Plotted Together



Case and Control Horses' exercise event histories are plotted on the same axes. The plots are aligned by the match date (equal to the date of death of Case Horse). Lines segments indicate specific rates of exercise at the start of career, end of career (for Case Horse), and match date (for Control Horses). Event rates are calculated as the slopes of the plots over 2 to 5 events not spanning a layup period, in units of furlongs per month.

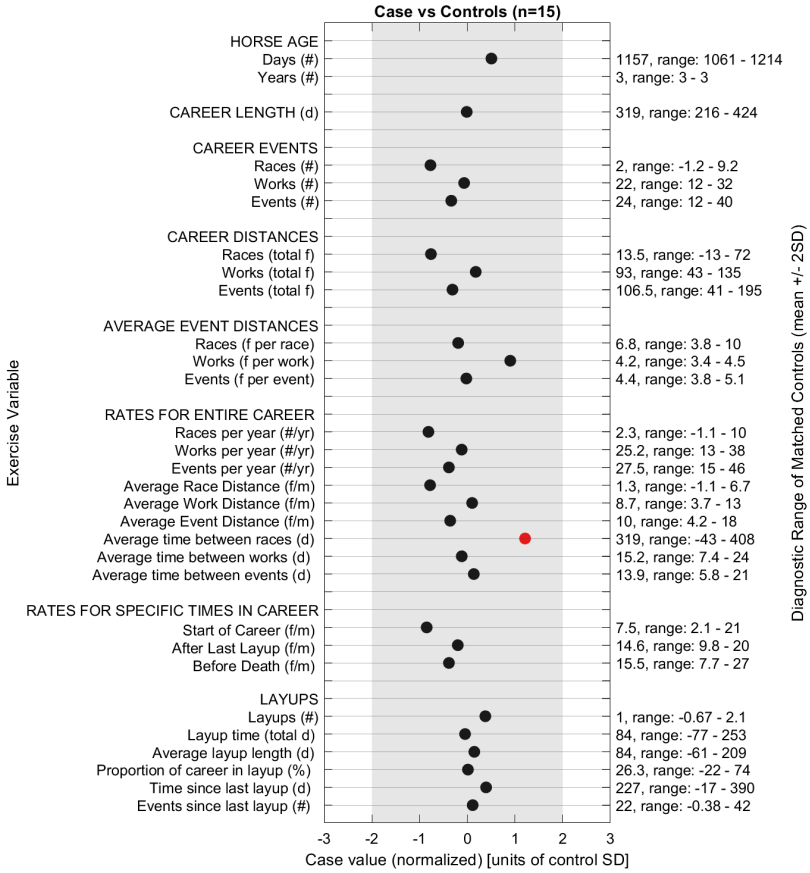

Career Event Histories for Case and Controls with Layups
Distance [Furlongs]
84 days
Case Races
Case Works
Case Death
Control 1 Races
Control 1 Works
150 days
Control 2 Races
Control 2 Works
133 days
71 days
Control 3 Races
Control 3 Works
Career Time [Months]


Races and Works Plotted Separately
Case Races
Case Works
Case Death
Control 1 Races
Control 1 Works
Control 2 Races
Control 2 Works
Control 3 Races
Control 3 Works
Distance [Furlongs]
Career Time [Months]
0
20
40
60
80
0
2
4
6
8
10
12

Part 3: Case Horse's Event History

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
5/6/2023	R	8.5	CD	Dirt	Fast		3U	Msw	0	9
4/29/2023	W	5.0	HPT	Dirt	Good	01:02.6				
4/21/2023	W	5.0	HPT	Dirt	Fast	01:03.2				
4/14/2023	W	5.0	HPT	Dirt	Fast	01:03.4				
3/24/2023	R	5.0	GP	AllWthr	Fast		3	Mcl25000	3080	3
3/17/2023	W	5.0	PMM	Dirt	Fast	01:01.5				
3/10/2023	W	5.0	PMM	Dirt	Fast	01:03.2				
3/4/2023	W	5.0	PMM	Dirt	Fast	01:05.1				
2/25/2023	W	4.0	PMM	Dirt	Fast	:52.80				
2/18/2023	W	5.0	PMM	Dirt	Fast	01:05.8				
1/29/2023	W	5.0	PMM	Dirt	Fast	01:01.5				
1/21/2023	W	4.0	PMM	Dirt	Fast	:50.10				
1/14/2023	W	3.0	PMM	Dirt	Fast	:36.45				
12/19/2022	W	4.0	PMM	Dirt	Fast	:48.80				
11/18/2022	W	5.0	CD	Dirt	Fast	01:00.6				
11/3/2022	W	5.0	CD	Dirt	Fast	01:02.0				
10/29/2022	W	5.0	CD	Dirt	Fast	01:04.6				
10/25/2022	W	4.0	HPT	Dirt	Fast	:52.00				
10/18/2022	W	5.0	HPT	Dirt	Fast	01:06.7				
10/6/2022	W	4.0	HPT	Dirt	Fast	:52.15				
9/30/2022	W	3.0	HPT	Dirt	Fast	:38.35				
9/22/2022	W	3.0	HPT	Dirt	Fast	:38.71				
6/30/2022	W	2.0	HPT	Dirt	Fast	:27.00				
6/22/2022	W	2.0	HPT	Dirt	Fast	:26.84				

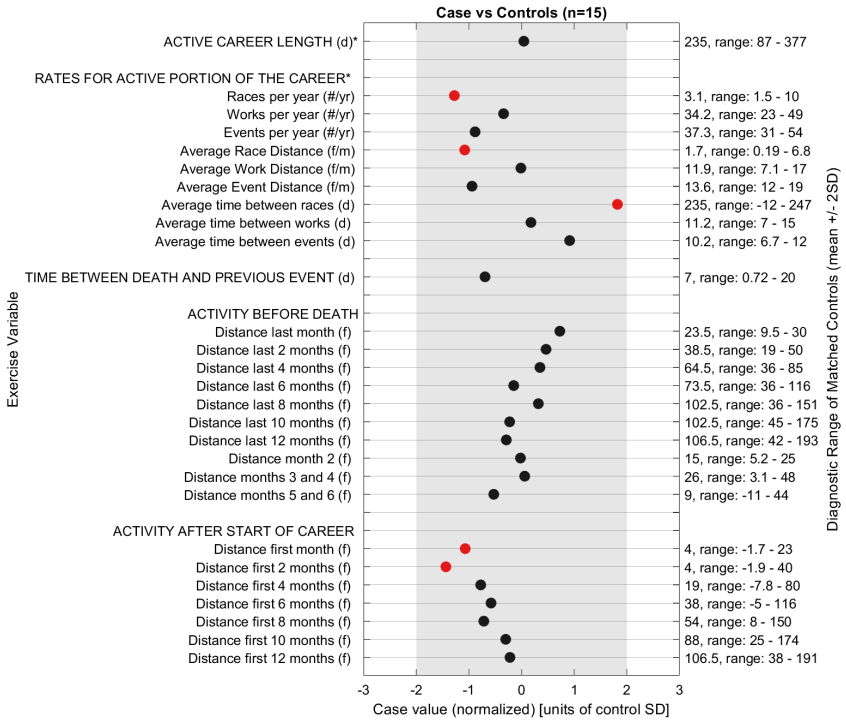
Part 4: Comparison of Exercise Variables between Case Horse and 15 Control Horses (3 year old, male, Thoroughbred)



Case Horse values are indicated by black or red symbols: circles indicate values considered normal for 95% of 3 year old, male, Thoroughbreds (n=15) (gray region) (black and red indicate within 1 and 2 SD, respectively, of mean value of controls), X's indicate values outside of the normal range. Two and 3 year old case horses are also matched to control horses by the quarter in which the case horse died (Jan-Mar, Apr-Jun, Jul-Sep,Oct-Dec). Variables that are not calculable are not plotted (e.g. time between races for a horse with zero events). f=furlongs; yr=year; m=month; d=days.

^Rates are calculated over 2 to 5 events.

*Active Career Length is the career length excluding the time during layups.



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Exercise History Report (Full)

J.D. Wheat Veterinary Orthopedic Research Laboratory

This report summarizes the high speed exercise history for Case Horse. There are four parts to this report:

Part 1 is a graph that depicts the races and officially recorded high speed workouts for Case Horse over the horse's career. The graph is useful for visually assessing features of a horse's career like: career length, periods of layup, and exercise consistency. If Case Horse had zero recorded high-speed exercise events, this graph is not produced. Event histories for three breed, sex, age, and event-matched control horses are also plotted.

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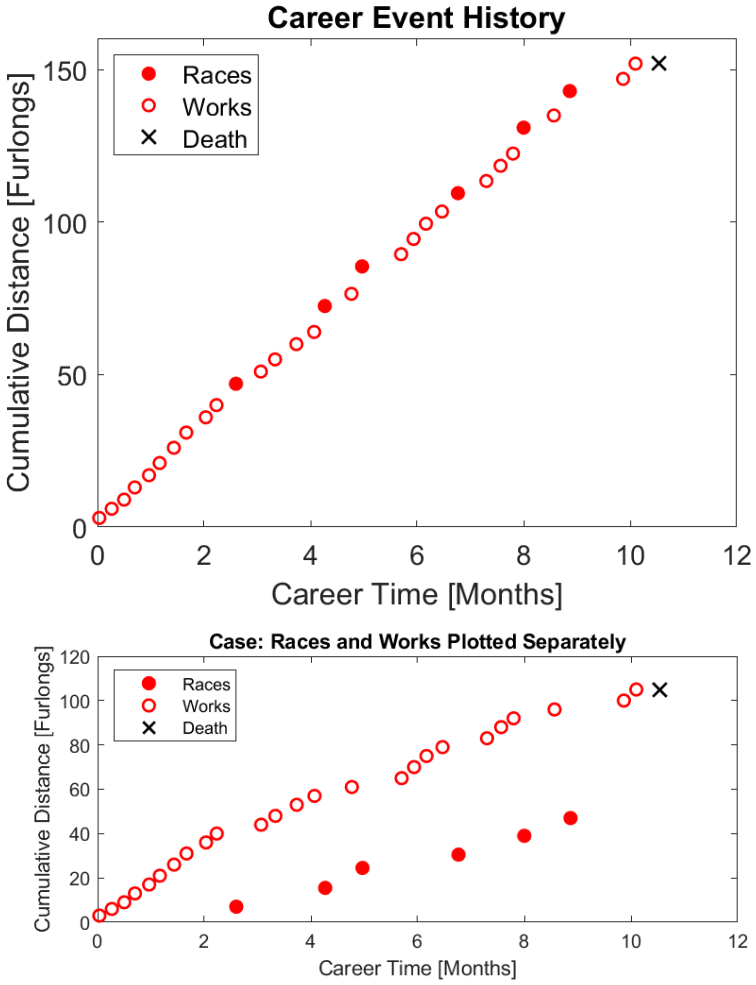
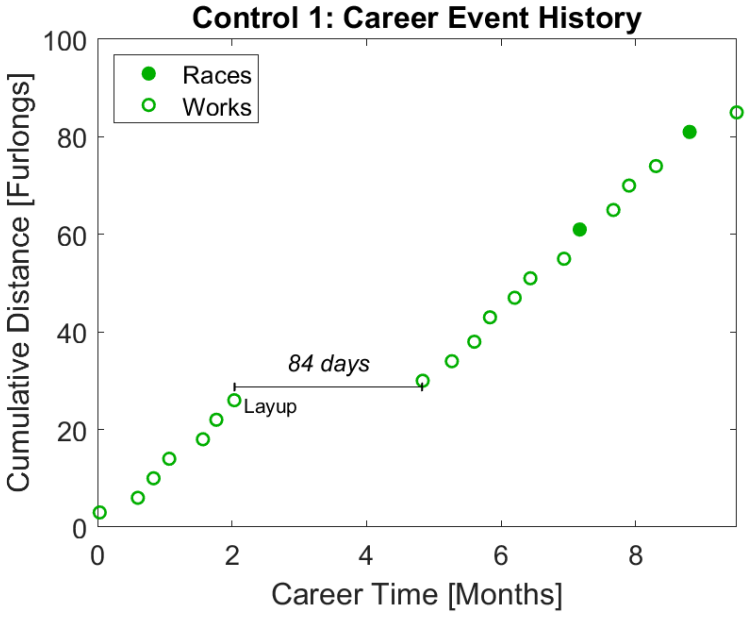
Part 1: Graphical Representation of Individual High-Speed Exercise Histories

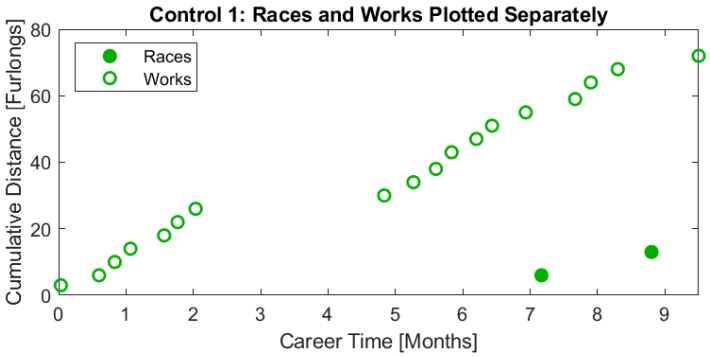
Races (filled circles), officially timed high-speed works (open circles), layups (line with endcaps, periods of time greater than 60 days in length without a race or timed work), and time of death (X) are illustrated over time (Career Time in months). With each event (race or work), the number of furlongs the horse exercised in that event is added to the number of furlongs exercised in all previous events.

Case Horse High Speed Exercise History

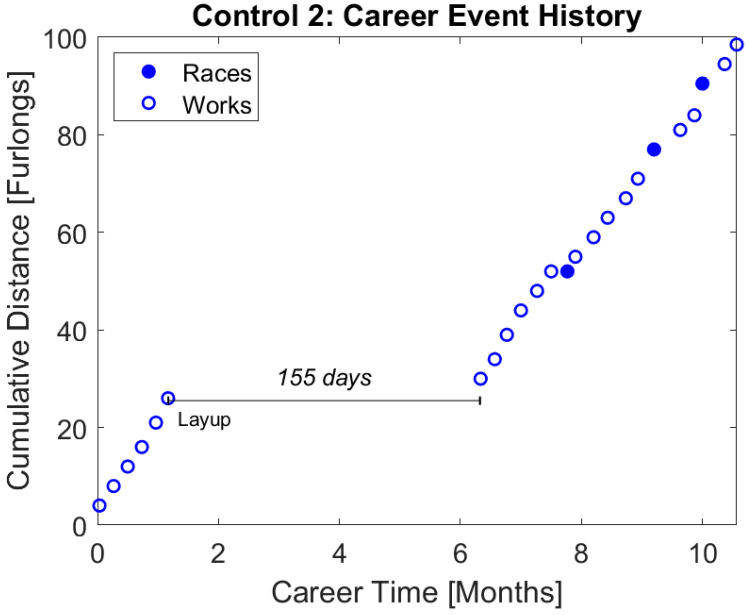


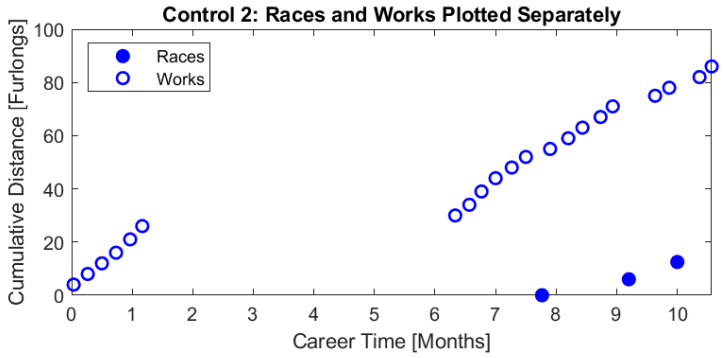
Control 1 High Speed Exercise History



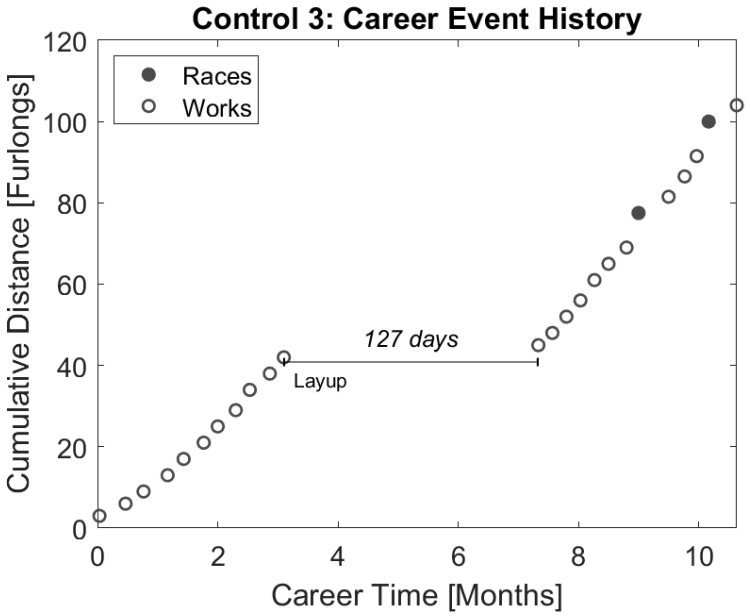


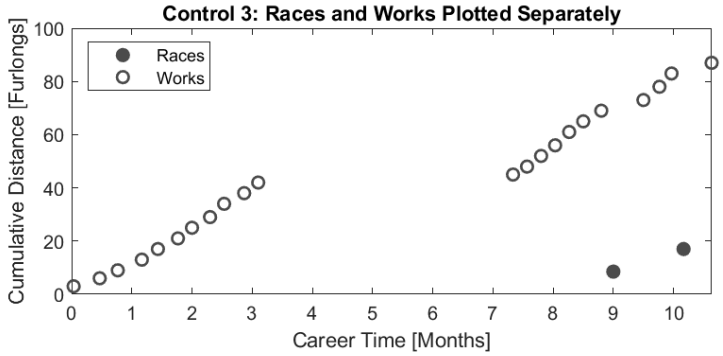
Control 2 High Speed Exercise History



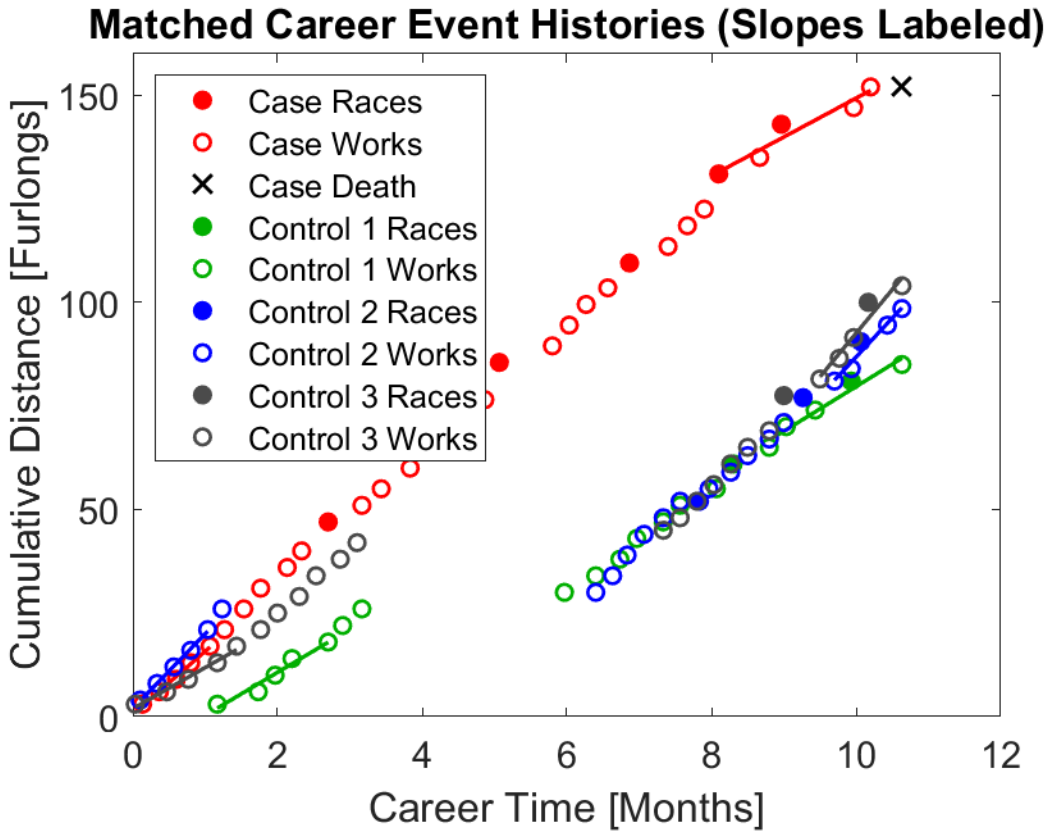


Control 3 High Speed Exercise History

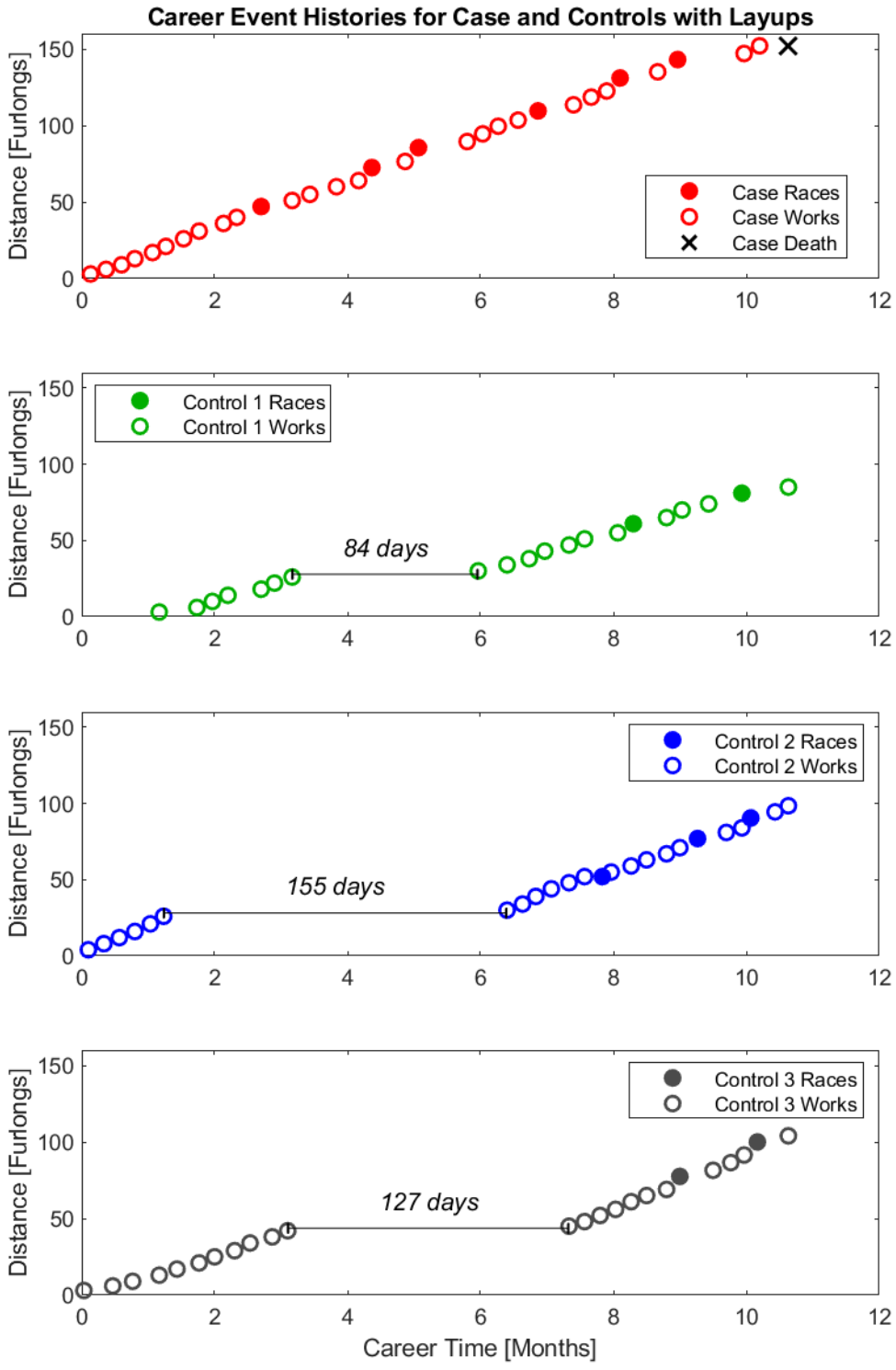


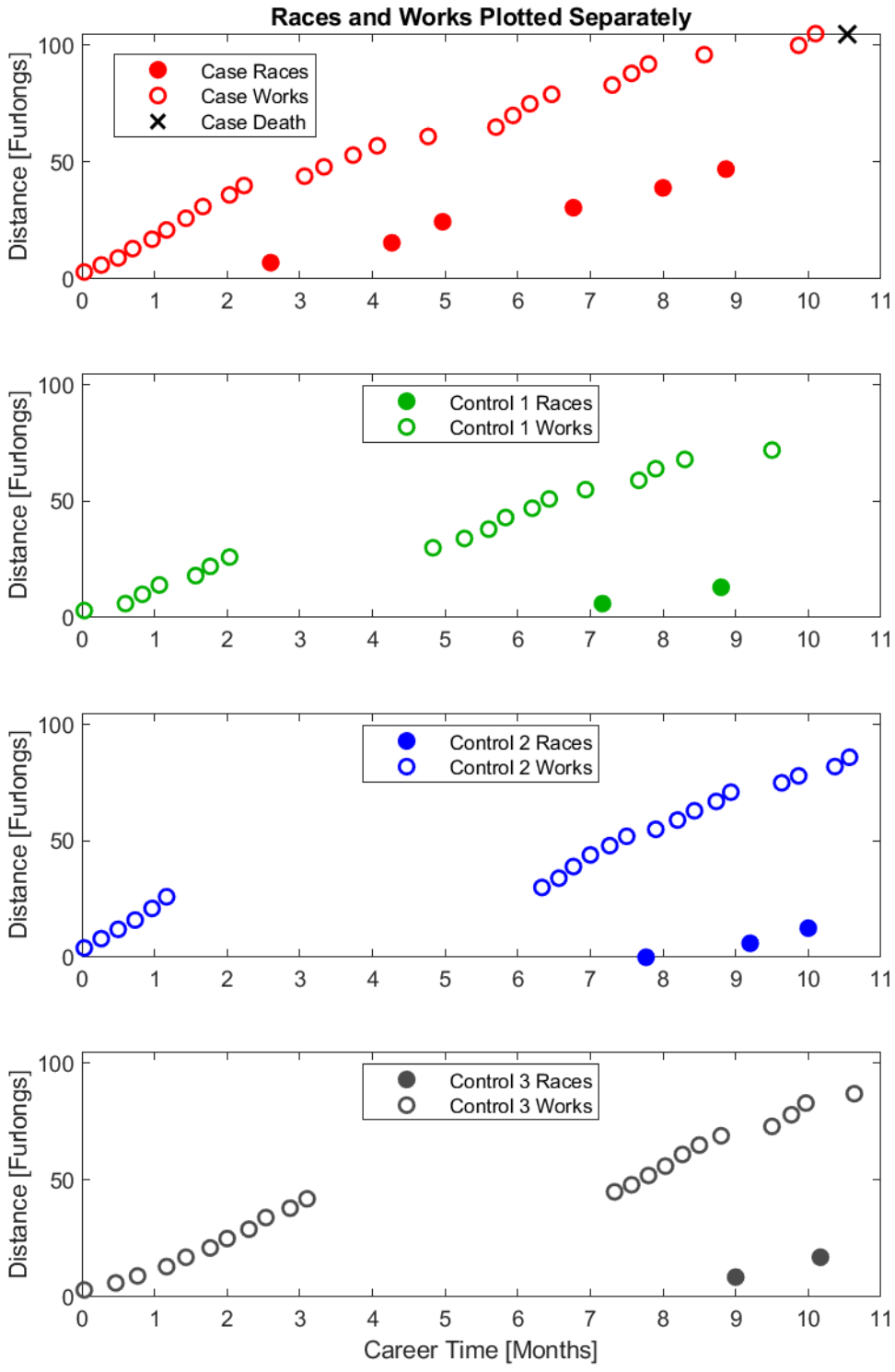


Part 2: Case and Control Horses Plotted Together



Case and Control Horses' exercise event histories are plotted on the same axes. The plots are aligned by the match date (equal to the date of death of Case Horse). Lines segments indicate specific rates of exercise at the start of career, end of career (for Case Horse), and match date (for Control Horses). Event rates are calculated as the slopes of the plots over 2 to 5 events not spanning a layup period, in units of furlongs per month.


Career Event Histories for Case and Controls with Layups
Distance [Furlongs]
Case Races
Case Works
Case Death
Control 1 Races
Control 1 Works
84 days
Control 2 Races
Control 2 Works
155 days
Control 3 Races
Control 3 Works
127 days
Career Time [Months]

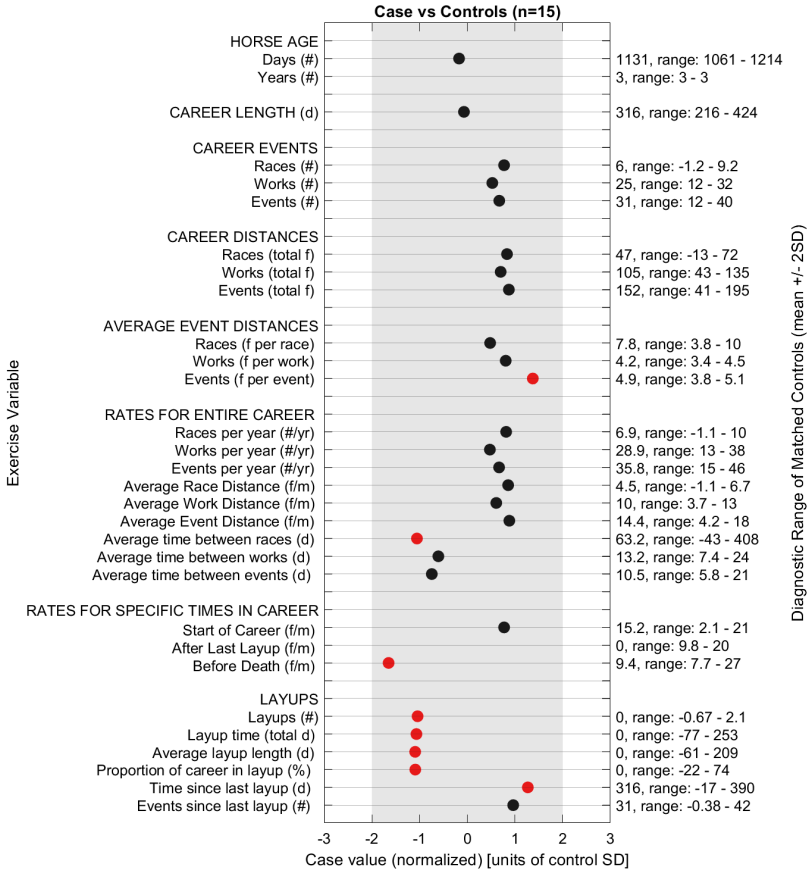

Races and Works Plotted Separately
Case Races
Case Works
Case Death
Control 1 Races
Control 1 Works
Control 2 Races
Control 2 Works
Control 3 Races
Control 3 Works
Distance [Furlongs]
Career Time [Months]

Part 3: Case Horse's Event History

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
4/16/2023	W	5.0	CDT	Dirt	Fast	01:02.0				
4/9/2023	W	4.0	CDT	Dirt	Fast	:48.60				
3/10/2023	R	8.0	TP	AllWthr	Fast		3	Mcl50000 (50-40)	360	9
3/1/2023	W	4.0	CDT	Dirt	Fast	:49.20				
2/12/2023	R	8.5	LRL	Dirt	Sloppy		3	Msw	1560	5
2/6/2023	W	4.0	LRL	Dirt	Fast	:48.80				
1/30/2023	W	5.0	LRL	Dirt	Fast	01:01.6				
1/22/2023	W	4.0	LRL	Dirt	Fast	:49.40				
1/6/2023	R	6.0	LRL	Dirt	Good		3	Msw	300	7
12/28/2022	W	4.0	LRL	Dirt	Fast	:49.80				
12/19/2022	W	5.0	LRL	Dirt	Fast	01:01.8				
12/12/2022	W	5.0	LRL	Dirt	Fast	01:02.0				
12/5/2022	W	4.0	LRL	Dirt	Fast	:49.00				
11/13/2022	R	9.0	LRL	Turf	Good		2	Msw	300	11
11/7/2022	W	4.0	LRL	Dirt	Fast	:49.40				
10/23/2022	R	8.5	LRL	Turf	Firm		2	Msw	1560	5
10/17/2022	W	4.0	LRL	Dirt	Fast	:49.40				
10/7/2022	W	5.0	LRL	Dirt	Fast	01:01.8				
9/25/2022	W	4.0	LRL	Turf	Yielding	:51.60				
9/17/2022	W	4.0	FAI	Dirt	Fast	:49.40				
9/3/2022	R	7.0	SAR	Dirt	Fast		2	Msw	786	9
8/23/2022	W	4.0	FAI	Dirt	Fast	:48.80				
8/17/2022	W	5.0	FAI	All Weather Training	Fast	01:01.8				
8/6/2022	W	5.0	FAI	Dirt	Fast	01:02.0				
7/30/2022	W	5.0	FAI	Dirt	Fast	01:02.8				
7/22/2022	W	4.0	FAI	Dirt	Fast	:49.00				
7/16/2022	W	4.0	FAI	Dirt	Fast	:49.00				
7/8/2022	W	4.0	FAI	Dirt	Fast	:49.00				
7/2/2022	W	3.0	FAI	Dirt	Fast	:37.60				

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
6/25/2022	W	3.0	FAI	Dirt	Fast	:37.80				
6/18/2022	W	3.0	FAI	Dirt	Fast	:38.40				

Part 4: Comparison of Exercise Variables between Case Horse and 15 Control Horses (3 year old, male, Thoroughbred)



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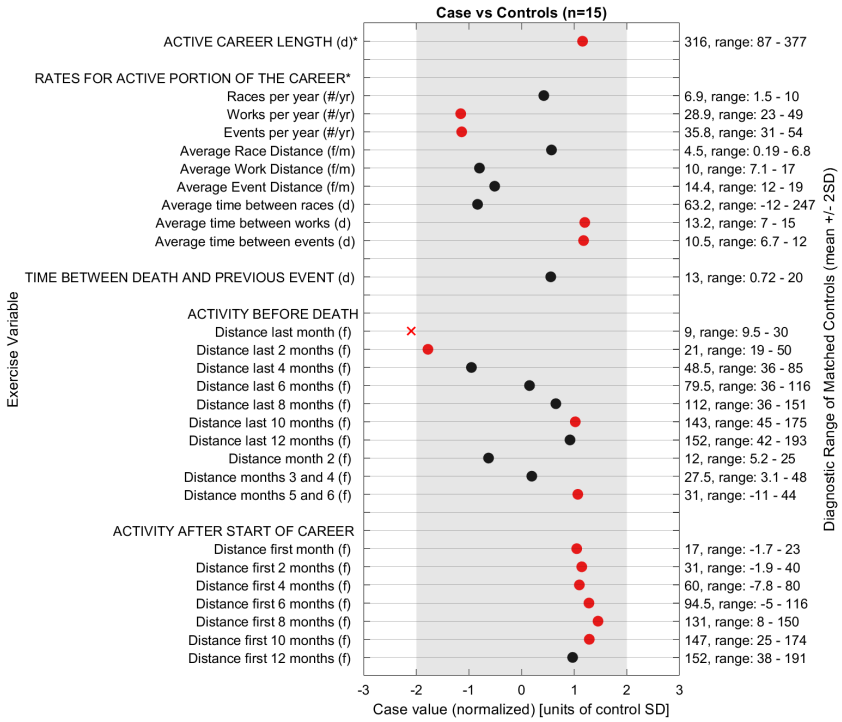

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J.D. Wheat Veterinary Orthopedic Research Laboratory

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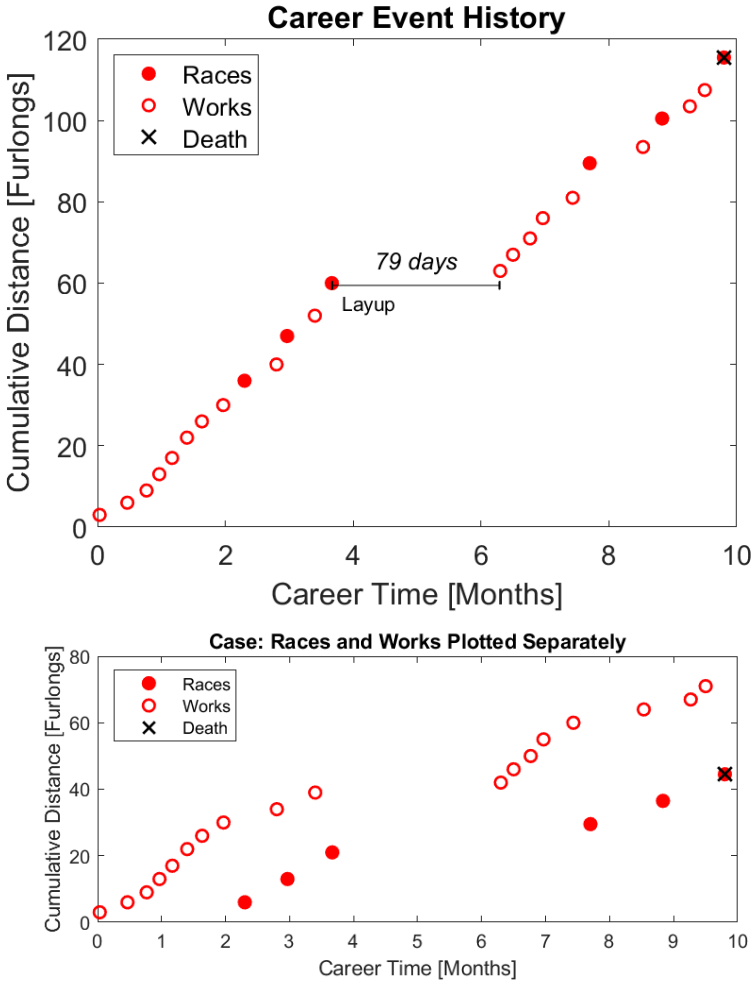
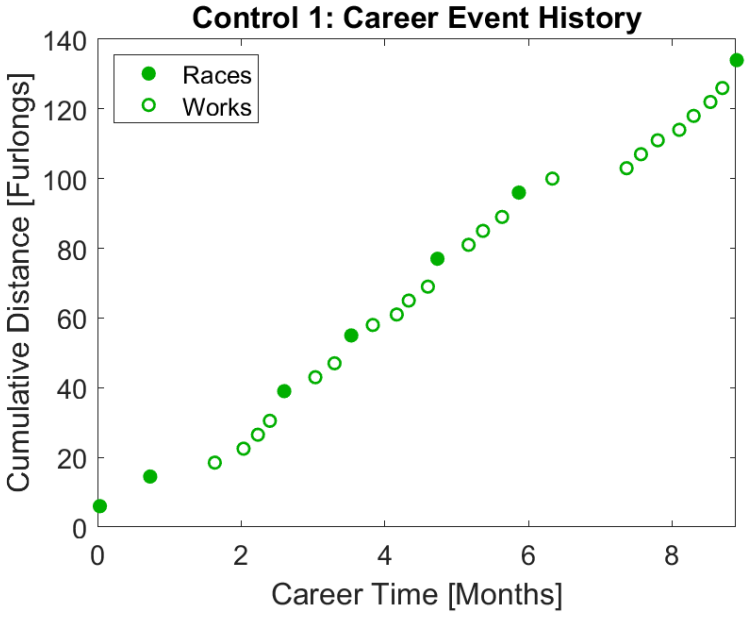
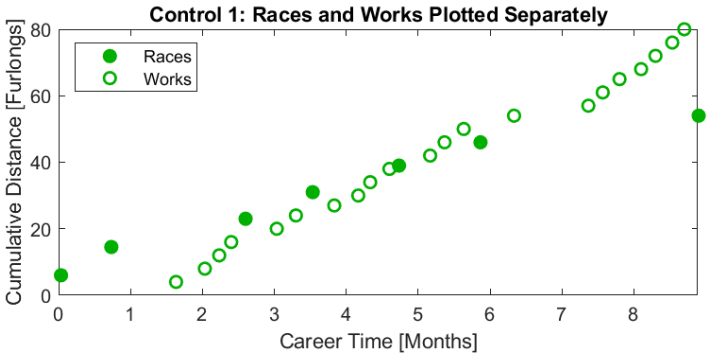
Case Horse High Speed Exercise History

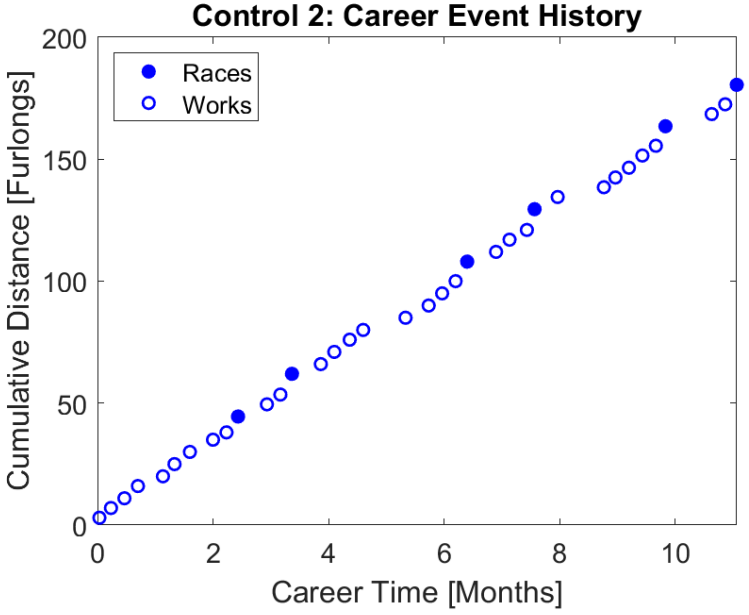


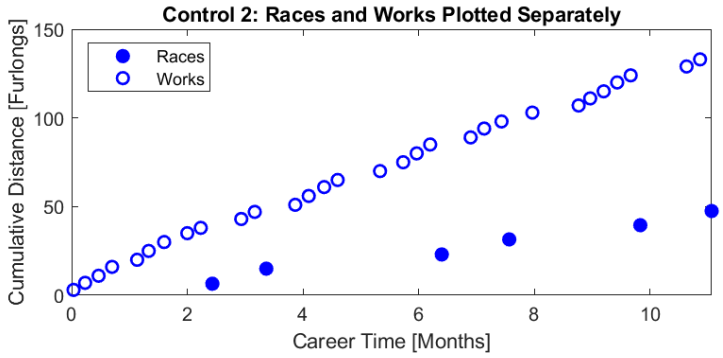
Control 1 High Speed Exercise History



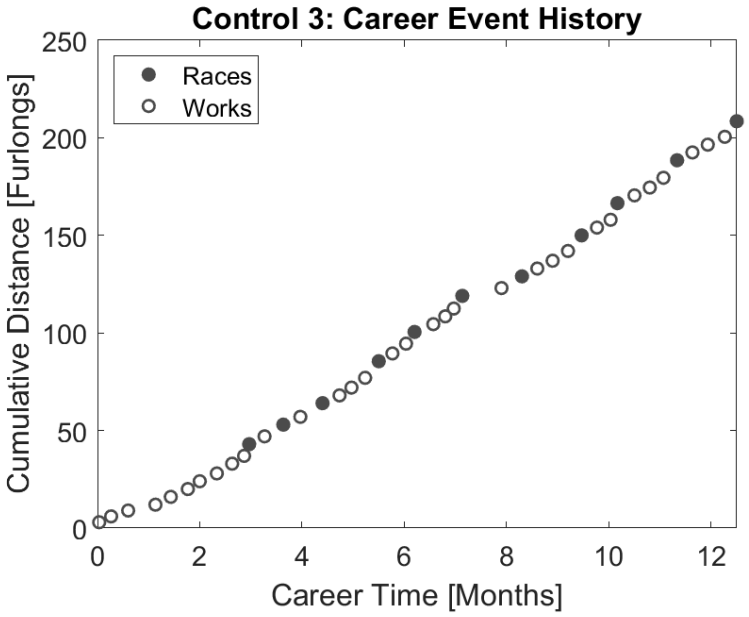


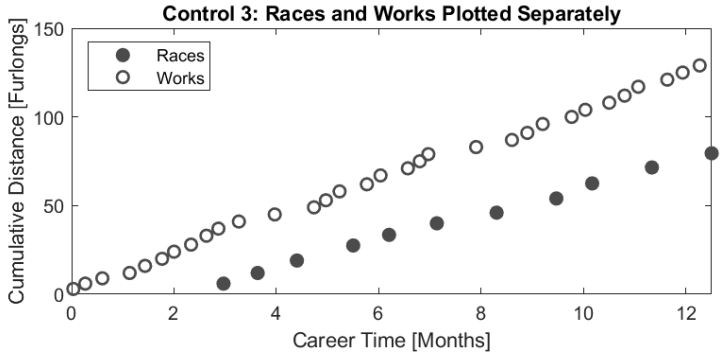
Control 2 High Speed Exercise History





Control 3 High Speed Exercise History





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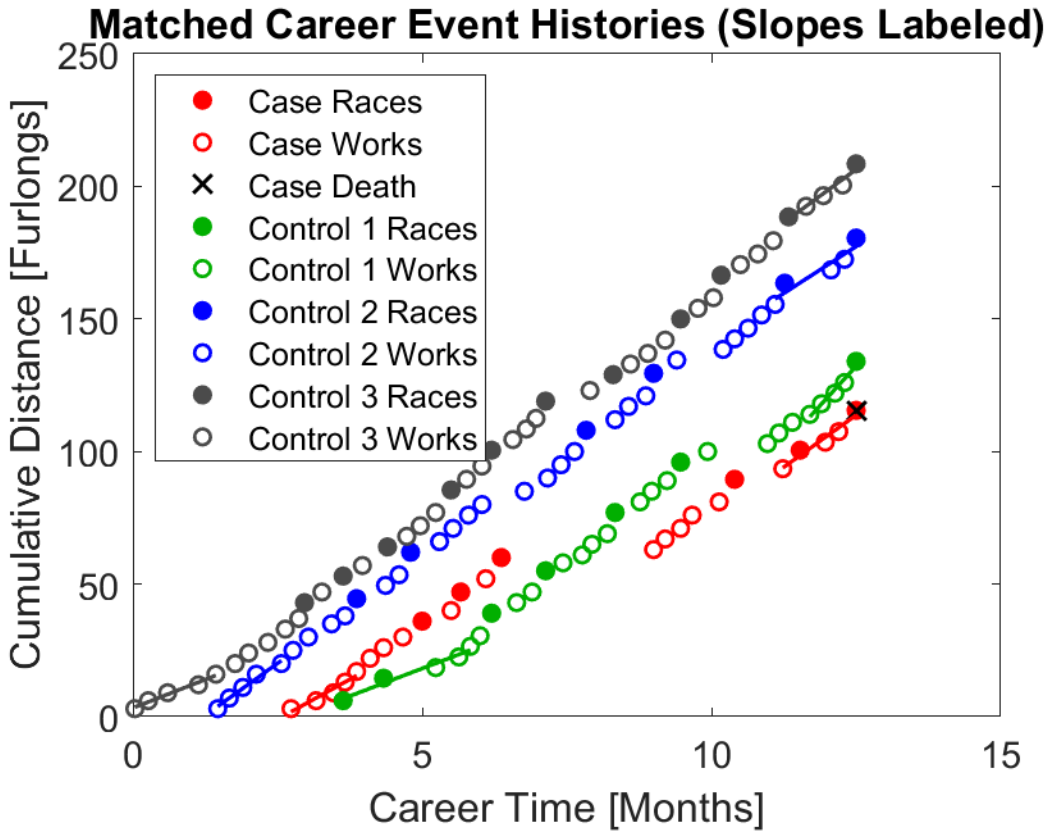

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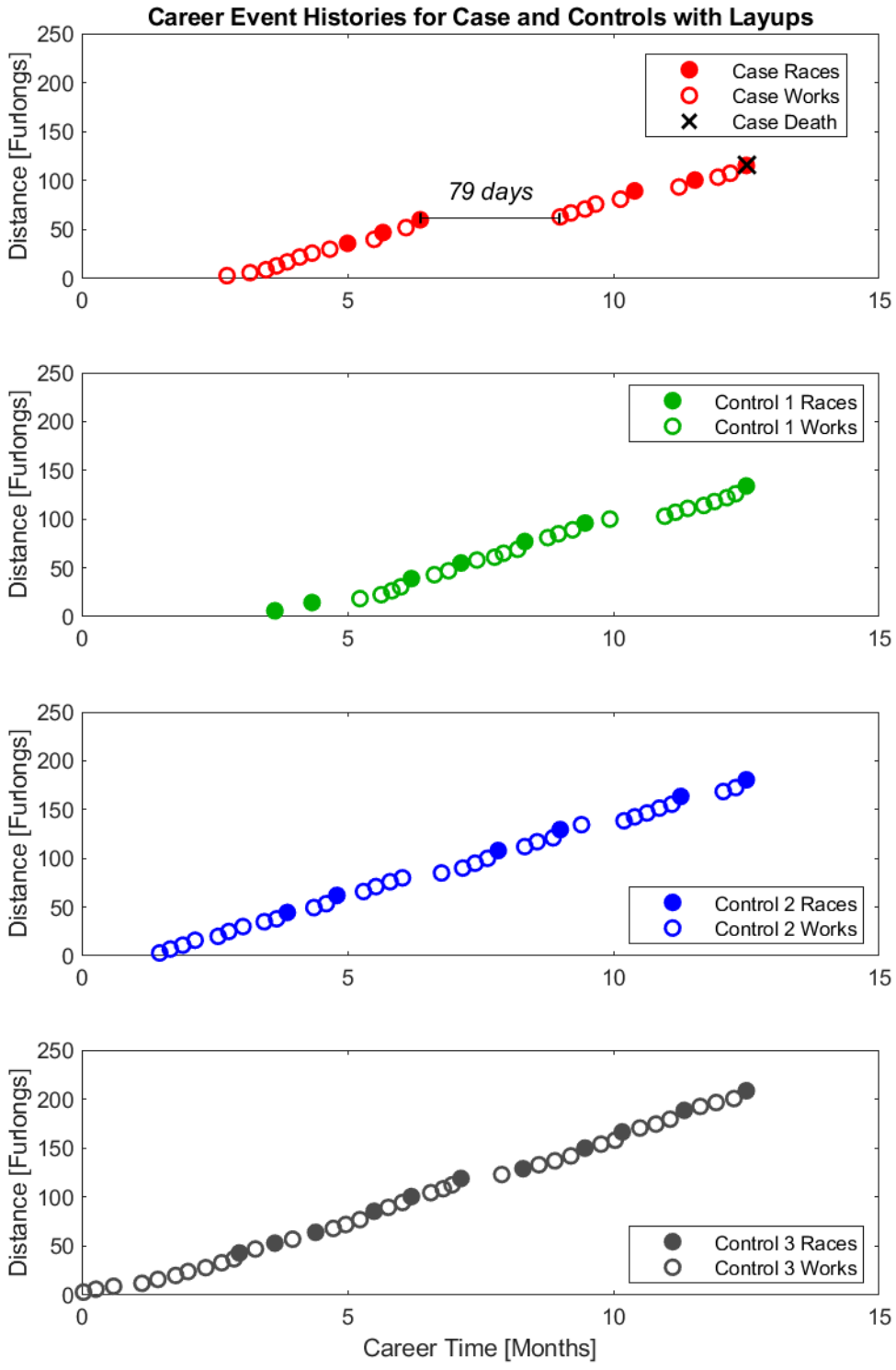
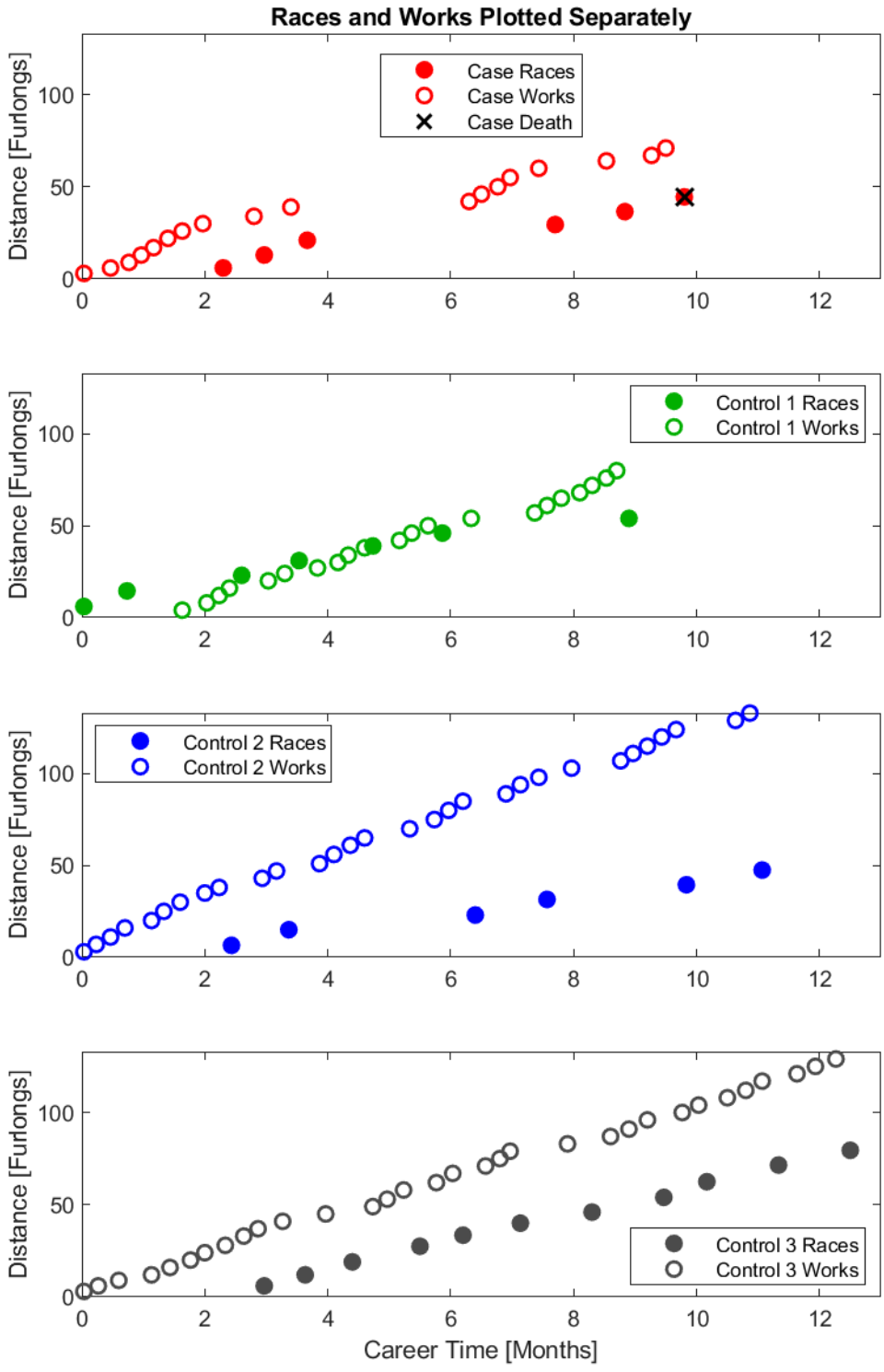

Career Event Histories for Case and Controls with Layups
Distance [Furlongs]
Case Races
Case Works
Case Death
79 days
Control 1 Races
Control 1 Works
Control 2 Races
Control 2 Works
Control 3 Races
Control 3 Works
Career Time [Months]


Races and Works Plotted Separately
Case Races
Case Works
Case Death
Control 1 Races
Control 1 Works
Control 2 Races
Control 2 Works
Control 3 Races
Control 3 Works
Distance [Furlongs]
Career Time [Months]
0
50
100
0
2
4
6
8
10
12

Part 3: Case Horse's Event History

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
5/6/2023	R	8.0	CD	Dirt	Fast		3	PDayMileG2 -500k	0	13
4/27/2023	W	4.0	KEE	Dirt	Fast	:48.80				
4/20/2023	W	3.0	KEE	Dirt	Fast	:36.60				
4/7/2023	R	7.0	KEE	Dirt	Fast		3	LafayetteB -400k	39000	3
3/29/2023	W	4.0	KEE	Dirt	Fast	:48.00				
3/4/2023	R	8.5	TP	AllWthr	Fast		3	JBttglaM-L -150k	1140	11
2/24/2023	W	5.0	TP	AllWthr	Fast	01:01.6				
2/10/2023	W	5.0	FG	Dirt	Fast	01:00.8				
2/4/2023	W	4.0	FG	Dirt	Fast	:50.00				
1/27/2023	W	4.0	FG	Dirt	Fast	:49.20				
1/21/2023	W	3.0	FG	Dirt	Fast	:36.80				
11/3/2022	R	8.0	CD	Dirt	Fast		2	(A) Msw	52320	1
10/26/2022	W	5.0	KEE	All Weather Training	Fast	:59.60				
10/13/2022	R	7.0	KEE	Dirt	Fast		2	Msw	1250	8
10/8/2022	W	4.0	KEE	Dirt	Fast	:47.80				
9/23/2022	R	6.0	CD	Dirt	Fast		2	(A) Msw	9200	3
9/13/2022	W	4.0	KEE	Dirt	Fast	:48.20				
9/3/2022	W	4.0	KEE	Dirt	Fast	:50.00				
8/27/2022	W	5.0	KEE	Dirt	Fast	:59.40				
8/20/2022	W	4.0	KEE	Dirt	Fast	:47.20				
8/14/2022	W	4.0	KEE	Dirt	Fast	:46.80				
8/8/2022	W	3.0	KEE	Dirt	Fast	:36.00				
7/30/2022	W	3.0	KEE	Dirt	Fast	:36.40				
7/17/2022	W	3.0	KEE	Dirt	Fast	:36.00				

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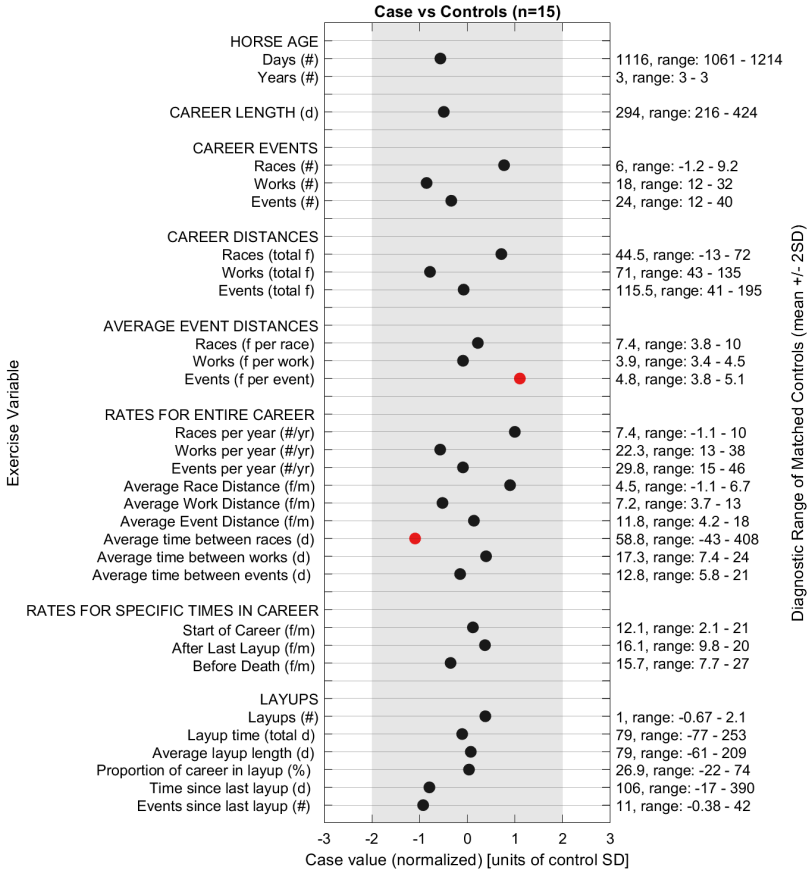

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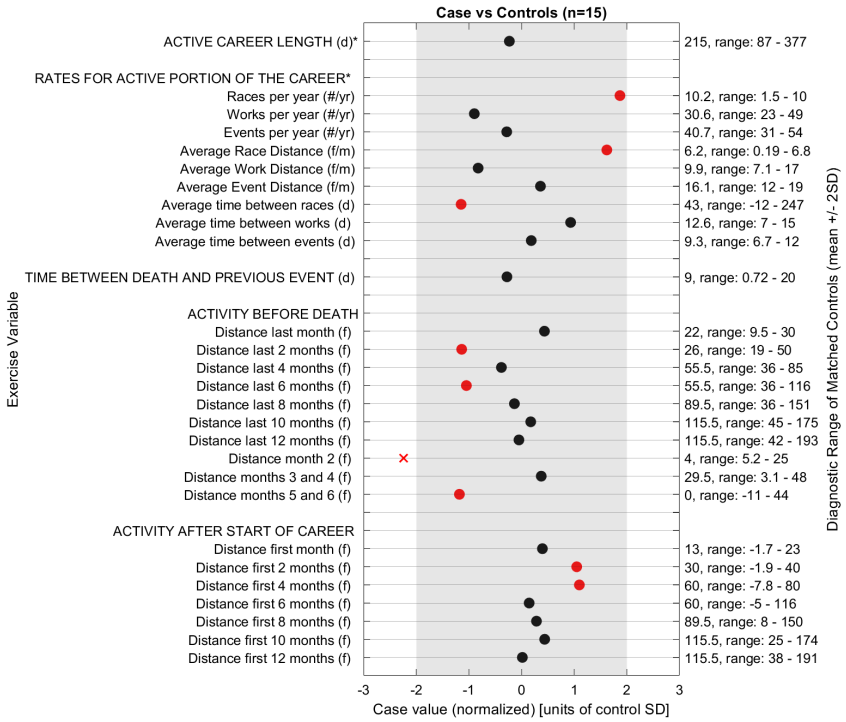

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J.D. Wheat Veterinary Orthopedic Research Laboratory

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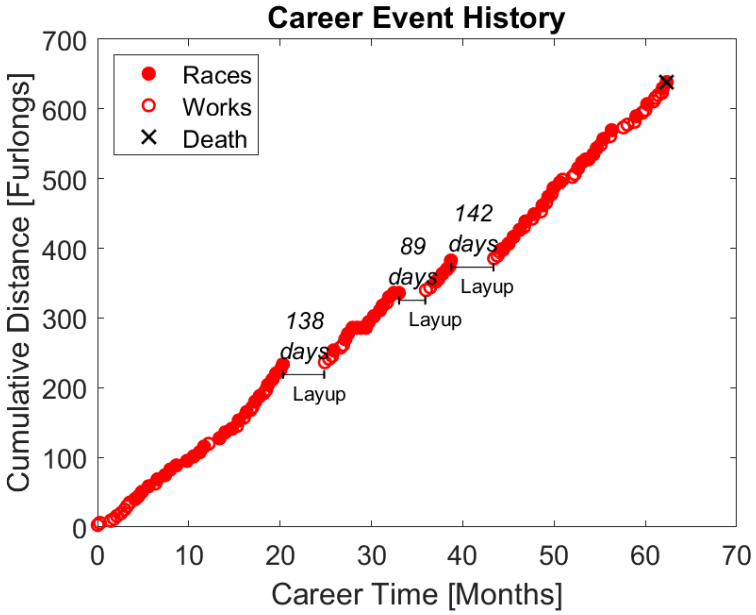
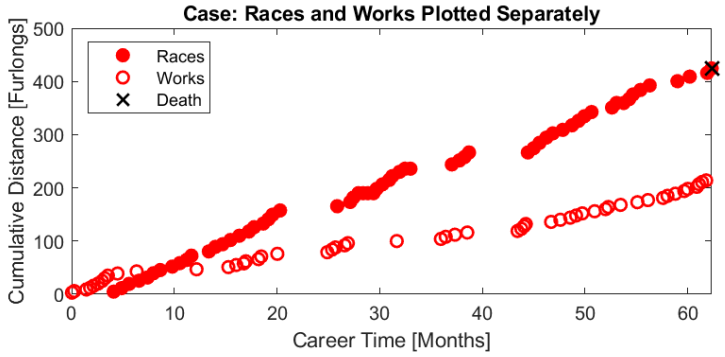
Part 1: Graphical Representation of Individual High-Speed Exercise Histories

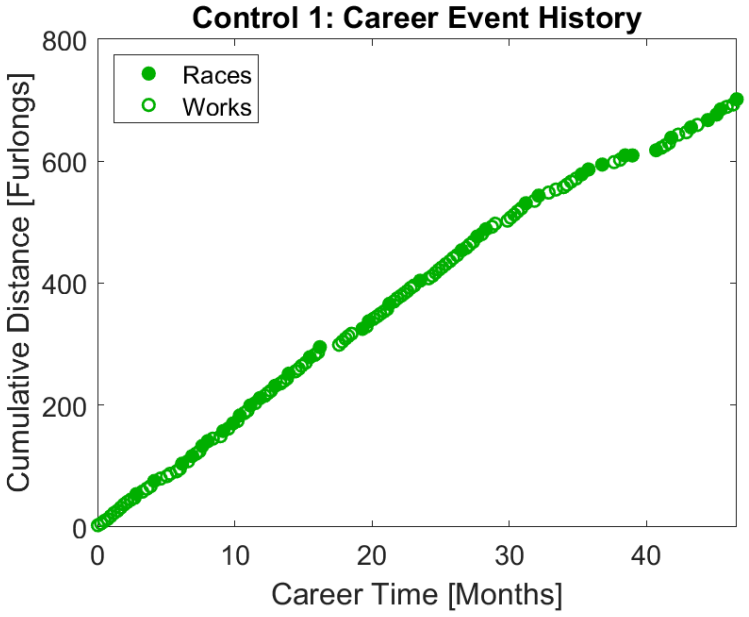
Races (filled circles), officially timed high-speed works (open circles), layups (line with endcaps, periods of time greater than 60 days in length without a race or timed work), and time of death (X) are illustrated over time (Career Time in months). With each event (race or work), the number of furlongs the horse exercised in that event is added to the number of furlongs exercised in all previous events.

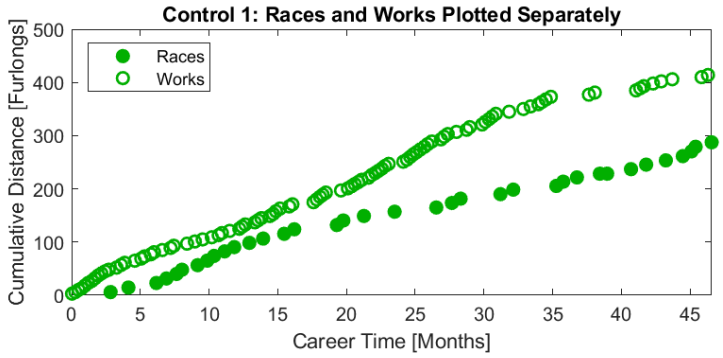
Case Horse High Speed Exercise History



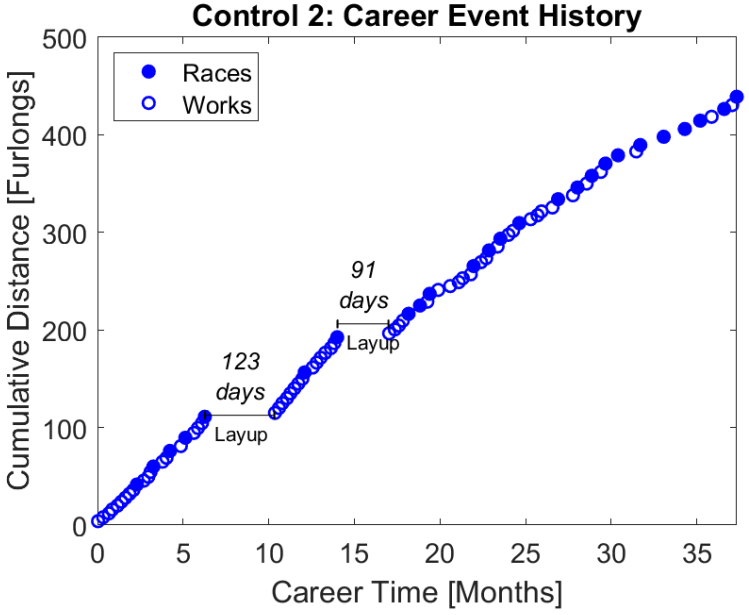


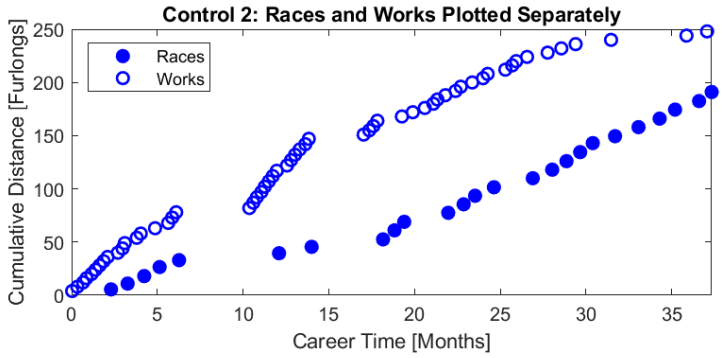
Control 1 High Speed Exercise History



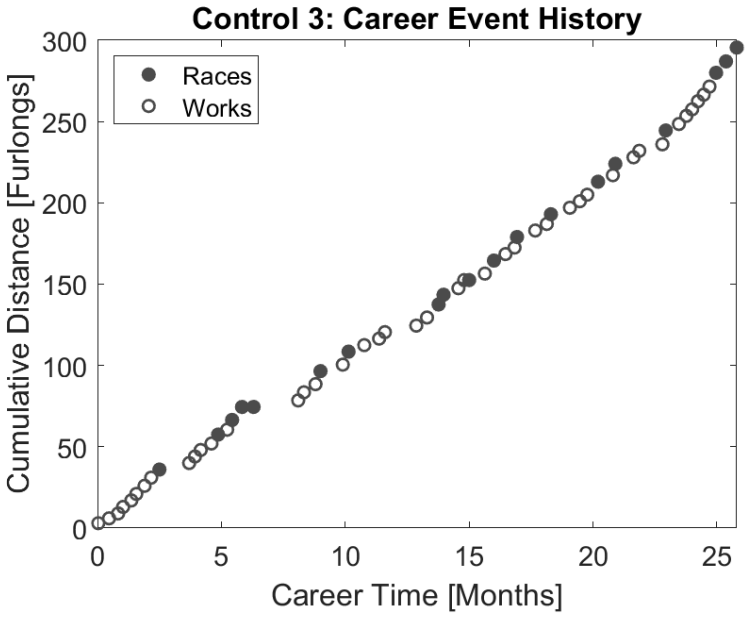


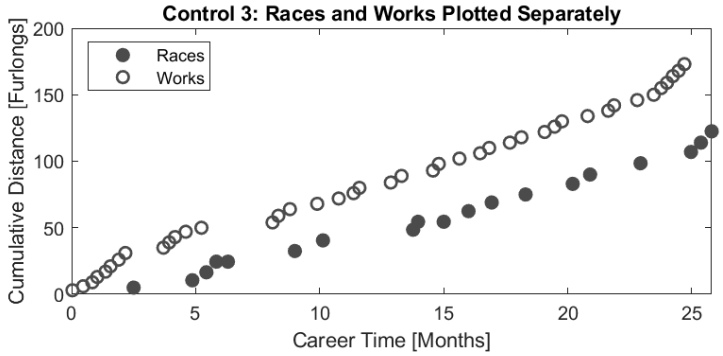
Control 2 High Speed Exercise History



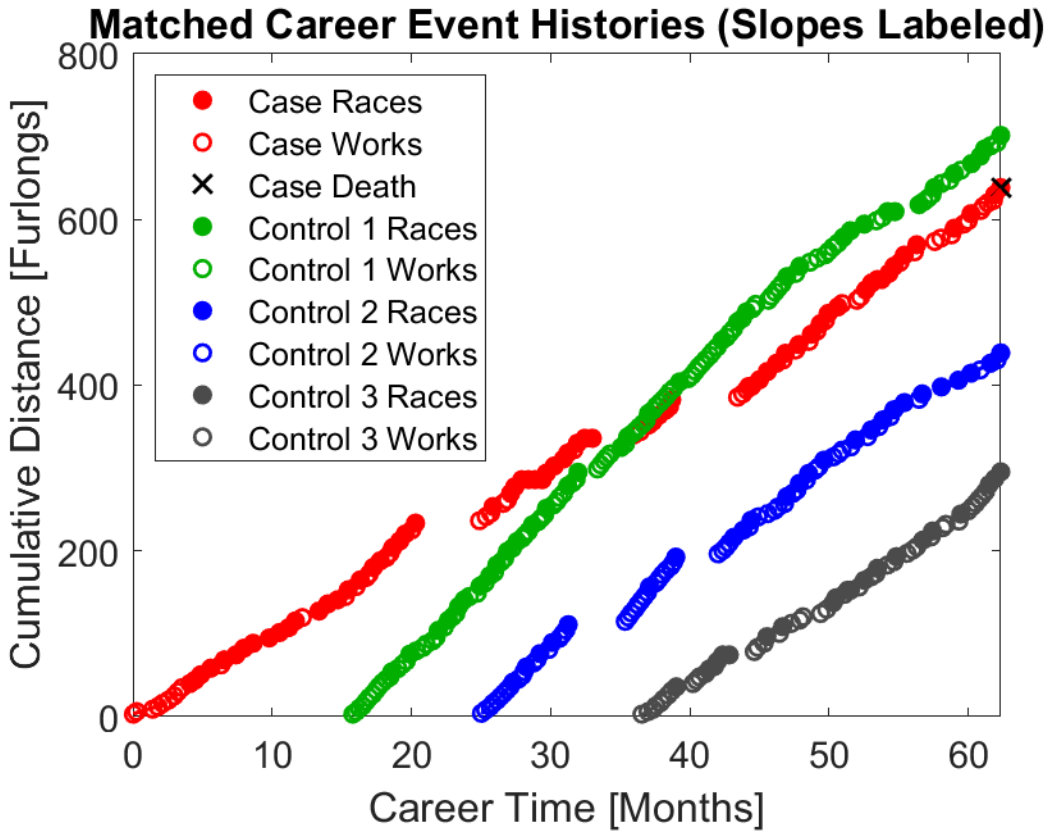


Control 3 High Speed Exercise History

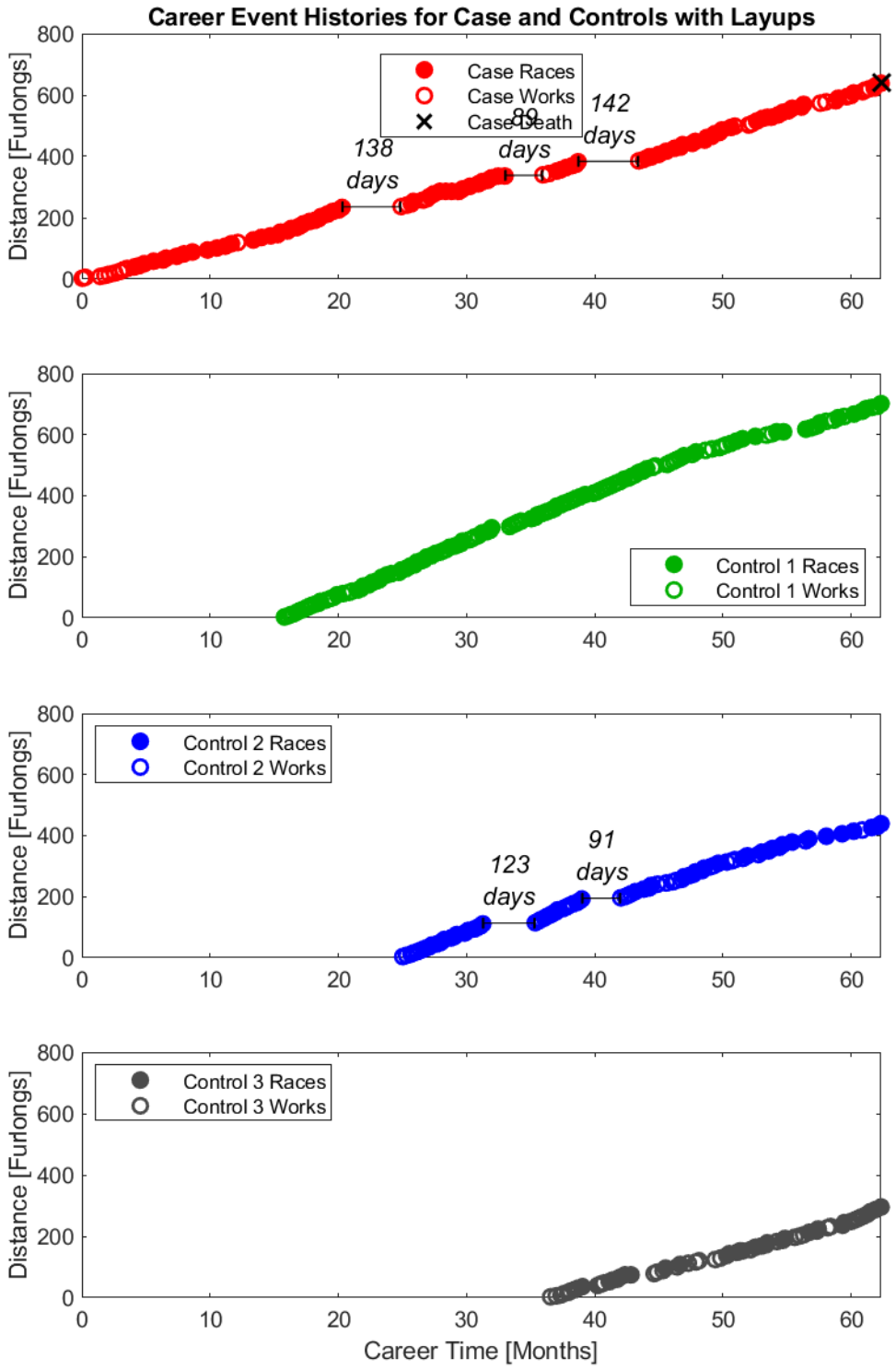


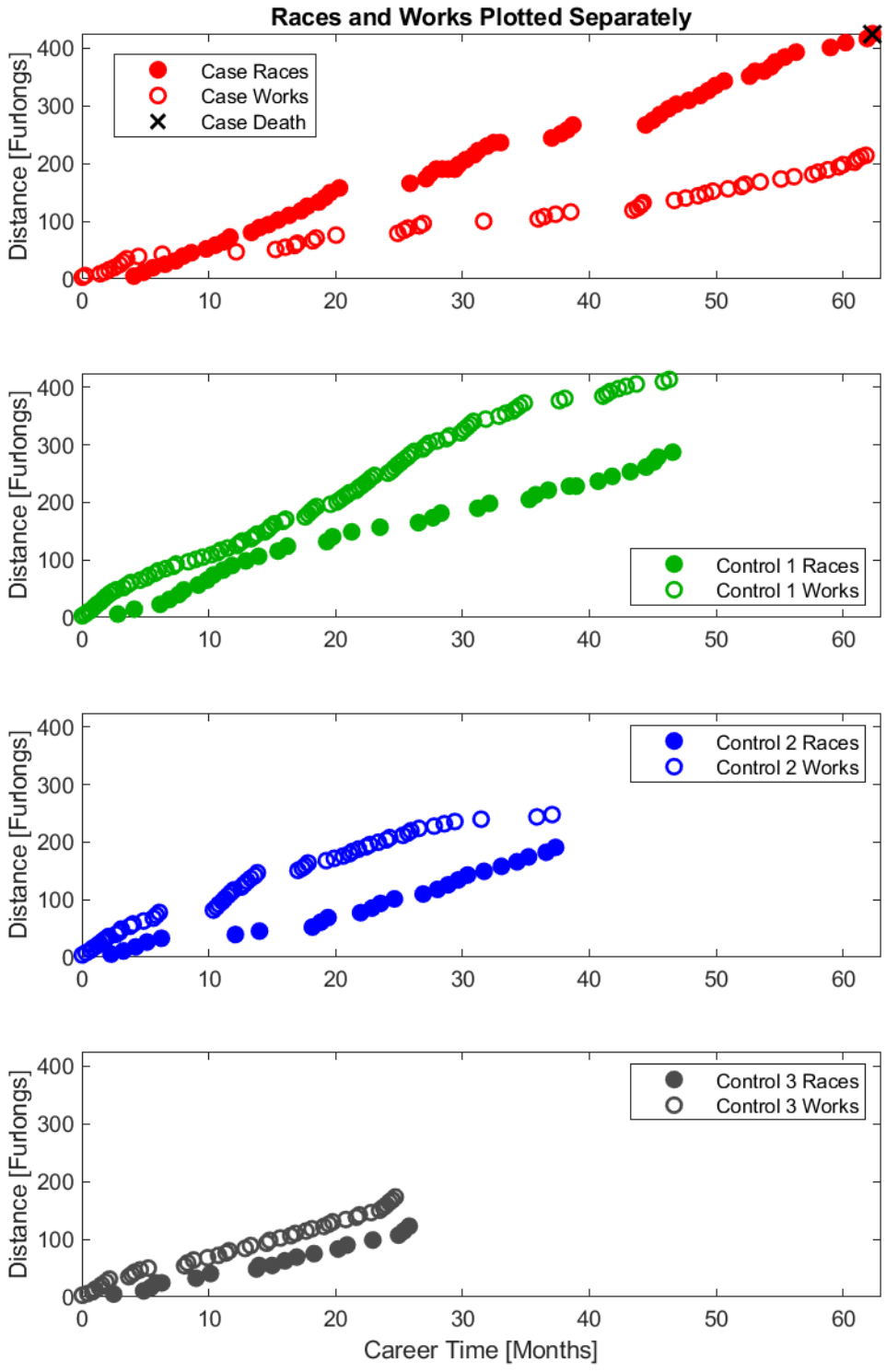


Part 2: Case and Control Horses Plotted Together



Case and Control Horses' exercise event histories are plotted on the same axes. The plots are aligned by the match date (equal to the date of death of Case Horse). Lines segments indicate specific rates of exercise at the start of career, end of career (for Case Horse), and match date (for Control Horses). Event rates are calculated as the slopes of the plots over 2 to 5 events not spanning a layup period, in units of furlongs per month.


Career Event Histories for Case and Controls with Layups
Distance [Furlongs]
Case Races
Case Works
Case Death
138 days
89 days
142 days
Control 1 Races
Control 1 Works
Control 2 Races
Control 2 Works
123 days
91 days
Control 3 Races
Control 3 Works
Career Time [Months]


Races and Works Plotted Separately
Distance [Furlongs]
Case Races
Case Works
Case Death
Control 1 Races
Control 1 Works
Control 2 Races
Control 2 Works
Control 3 Races
Control 3 Works
Career Time [Months]

Part 3: Case Horse's Event History

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
5/27/2023	R	8.5	CD	Dirt	Fast		4U / FM	Clm40000	0	5
5/14/2023	R	7.0	CD	Dirt	Fast		4U / FM	Str20000	1056	7
5/11/2023	W	3.0	CDT	Dirt	Fast	:37.20				
4/29/2023	W	4.0	CDT	Dirt	Fast	:50.00				
4/20/2023	W	5.0	CDT	Dirt	Fast	01:02.2				
4/14/2023	W	4.0	CDT	Dirt	Fast	:47.80				
3/24/2023	R	8.5	TP	AllWthr	Fast		3U / FM	Aoc40000nw2$/5 x-N	518	10
3/18/2023	W	4.0	CDT	Dirt	Fast	:50.40				
3/8/2023	W	5.0	CDT	Dirt	Fast	01:03.0				
2/16/2023	R	8.0	TP	AllWthr	Fast		3U / FM	Aoc40000nw2$/5 x	546	7
2/10/2023	W	4.0	CDT	Dirt	Fast	:51.00				
1/18/2023	W	4.0	CDT	Dirt	Fast	:49.20				
1/5/2023	W	4.0	CDT	Dirt	Fast	:51.00				
11/27/2022	R	8.5	CD	Dirt	Sloppy		3U / FM	Clm25000	1932	5
11/22/2022	W	4.0	CDT	Dirt	Fast	:49.00				
10/31/2022	R	8.5	IND	Dirt	Sloppy		3U / FM	Aoc40000nw2$/3 x-N	880	6
10/22/2022	W	5.0	CDT	Dirt	Fast	01:02.6				
10/9/2022	R	8.5	KEE	Dirt	Fast		3U / FM	Str20000	12048	2
9/28/2022	R	7.5	CD	Dirt	Fast		3U / FM	Str20000	1089	7
9/12/2022	R	0.0	IND	Dirt	Sloppy		3U / FM	SOC 16000 - N	18000	1
9/3/2022	W	4.0	CDT	Dirt	Fast	:49.40				
8/22/2022	R	8.5	BTP	Dirt	Good		3U / FM	SOC 15000/25000	3680	2
8/9/2022	R	8.5	BTP	Dirt	Fast		3U / FM	Aoc18000nw1/ x	183	9

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
7/29/2022	W	4.0	CDT	Dirt	Good	:47.60				
7/21/2022	W	4.0	CDT	Dirt	Fast	:50.40				
6/19/2022	W	4.0	CDT	Dirt	Fast	:47.20				
6/10/2022	R	8.0	CD	Dirt	Fast		4U / FM	Clm32000	3100	4
5/20/2022	R	8.5	CD	Dirt	Fast		4U / FM	Clm16000	9600	2
5/14/2022	W	4.0	CDT	Dirt	Fast	:47.20				
5/3/2022	R	8.5	CD	Dirt	Sloppy		4U / FM	Clm20000	780	7
4/26/2022	W	4.0	CDT	Dirt	Fast	:48.20				
4/14/2022	R	8.5	KEE	Dirt	Fast		4U / FM	Clm16000	1900	4
4/9/2022	W	4.0	CDT	Dirt	Fast	:48.80				
3/18/2022	R	6.5	TP	AllWthr	Fast		3U / FM	Aoc25000nw1$/x	427	9
3/11/2022	W	4.0	SKY	AllWthr	Fast	:49.20				
2/17/2022	R	8.0	TP	AllWthr	Fast		4U / FM	Clm18000 (18-16)	600	5
2/12/2022	W	4.0	SKY	AllWthr	Fast	:50.00				
1/29/2022	R	10.0	TP	AllWthr	Fast		4U / FM	Aoc25000nw1$/x	439	9
1/9/2022	R	10.0	TP	AllWthr	Fast		4U / FM	Aoc25000nw1$/x	427	8
12/23/2021	R	8.0	TP	AllWthr	Fast		3U / FM	Clm20000 (25-20)	330	8
12/6/2021	R	0.0	MVR	Dirt	Sloppy		3U / FM	Alw24000nw2/x	480	6
11/30/2021	W	4.0	CDT	Dirt	Fast	:47.60				
11/25/2021	W	5.0	CDT	Dirt	Sloppy	01:03.4				
11/17/2021	W	4.0	CDT	Dirt	Fast	:48.80				
11/6/2021	W	3.0	CDT	Dirt	Fast	:38.60				
6/17/2021	R	8.5	CD	Dirt	Fast		4U / FM	Clm32000	695	7
6/12/2021	W	4.0	HPT	Dirt	Good	:51.20				

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
6/4/2021	R	6.5	BTP	Dirt	Muddy		3U / FM	Aoc18000nw1/ y/x-N	860	4
5/20/2021	R	7.5	IND	Turf	Firm		3U / FM	Aoc40000nw2/ x	345	8
5/7/2021	W	4.0	HPT	Dirt	Fast	:49.00				
4/28/2021	R	8.0	IND	Dirt	Fast		3U / FM	Aoc40000nw2/ x-N	1380	5
4/10/2021	W	4.0	HPT	Dirt	Fast	:51.60				
3/27/2021	W	4.0	HPT	Dirt	Fast	:55.11				
12/28/2020	R	0.0	MVR	Dirt	Sloppy		3U / FM	Alw21200nw1/ x	13144	1
12/12/2020	R	6.0	TP	AllWthr	Fast		3U / FM	Str5000	140	7
11/26/2020	R	8.0	CD	Dirt	Fast		3U / FM	SOC 10000 - N	495	7
11/18/2020	W	4.0	CDT	Dirt	Fast	:49.60				
11/5/2020	R	7.0	CD	Dirt	Fast		3U / FM	SOC 10000 - N	495	6
10/27/2020	R	8.5	IND	Dirt	Sloppy		3U / FM	Str16000	6000	2
10/7/2020	R	8.5	KEE	Dirt	Fast		3U / FM	SOC 5000 - N	2100	3
9/20/2020	R	8.0	CD	Dirt	Fast		3U / FM	SOC 5000 - N	4400	2
9/11/2020	R	0.0	BTP	Dirt	Fast		3U / FM	Str5000	2440	2
8/26/2020	R	0.0	BTP	Dirt	Good		3U / FM	Str5000	1220	3
8/12/2020	R	0.0	BTP	Dirt	Fast		3U / FM	Str5000	2640	2
7/29/2020	R	8.5	BTP	Turf	Firm		3U / FM	Str5000	122	7
7/14/2020	R	8.0	BTP	Dirt	Fast		3U / FM	Str5000	1220	3
7/5/2020	R	8.0	ELP	Turf	Firm		3U / FM	SOC 5000 - N	130	7

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
6/28/2020	W	4.0	CDT	Dirt	Muddy	:49.20				
6/19/2020	W	4.0	CDT	Dirt	Fast	:47.80				
5/28/2020	R	8.0	CD	Dirt	Fast		4U / FM	SOC 5000 - N	390	10
5/23/2020	W	4.0	CDT	Dirt	Fast	:49.40				
5/13/2020	W	5.0	HPT	Dirt	Fast	01:04.3				
4/29/2020	W	3.0	HPT	Dirt	Fast	:43.60				
12/13/2019	R	8.0	TP	AllWthr	Fast		3U / FM	Str5000	140	6
12/5/2019	W	5.0	CDT	Dirt	Fast	01:03.4				
11/21/2019	R	8.5	CD	Dirt	Fast		3U / FM	SOC 5000 - N	19040	1
11/9/2019	R	8.0	CD	Dirt	Fast		3U / FM	SOC 5000 - N	19040	1
10/25/2019	R	7.0	KEE	Dirt	Fast		3U / FM	Alw73000nw1/ x	292	10
10/19/2019	W	5.0	CDT	Dirt	Fast	01:02.4				
10/11/2019	W	4.0	CDT	Dirt	Fast	:49.80				
9/28/2019	R	8.0	CD	Dirt	Fast		3U / FM	SOC 5000 - N	3400	3
9/13/2019	R	8.0	CD	Dirt	Fast		3U / FM	SOC 10000 - N	16720	1
9/4/2019	W	4.0	CDT	Dirt	Fast	:48.80				
8/29/2019	W	3.0	CDT	Dirt	Fast	:36.00				
8/16/2019	R	8.0	ELP	Dirt	Fast		3U / FM	SOC 10000 - N	195	7
8/7/2019	W	4.0	CDT	Dirt	Fast	:49.00				
7/21/2019	R	8.0	ELP	Turf	Firm		3U / FM	Str5000	3400	2
7/15/2019	W	4.0	HPT	Dirt	Fast	:50.00				
6/28/2019	R	5.0	BTP	Turf	Firm		3U / FM	SOC 0 - N	155	7
6/7/2019	R	8.5	BTP	Turf	Good		3U / FM	SOC 7500 - N	644	4

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
5/19/2019	R	8.0	BTP	Turf	Firm		3 /F	Clm15000nw2/ L	7380	1
4/13/2019	W	4.0	HPT	Dirt	Fast	:49.80				
3/29/2019	R	8.0	TP	AllWthr	Fast		3U / FM	Clm5000nw2/ L-c	61	5
3/15/2019	R	6.0	TP	AllWthr	Fast		3U / FM	Clm5000nw2/ L	610	3
2/23/2019	R	6.5	TP	AllWthr	Fast		3 /F	Clm15000 (15-10)	450	4
2/1/2019	R	6.5	TP	AllWthr	Fast		3 /F	Clm10000 (15-10)	900	3
12/28/2018	R	6.0	TP	AllWthr	Fast		2 /F	Mcl7500	3660	1
12/8/2018	R	8.0	TP	AllWthr	Fast		2 /F	Mcl20000 (30-20)	300	5
11/21/2018	R	6.0	CD	Dirt	Fast		2 /F	Mcl15000 (15-12.5)	925	4
10/27/2018	R	6.0	KEE	Dirt	Sloppy		2 /F	Mcl30000	70	11
10/20/2018	W	4.0	TTC	Dirt	Muddy	:51.60				
9/28/2018	R	8.0	CD	Dirt	Fast		2 /F	Mcl45000 (50-45)	150	6
9/6/2018	R	6.5	KD	Turf	Firm		2 /F	Msw	955	9
8/25/2018	W	4.0	TTC	Dirt	Fast	:49.40				
8/14/2018	R	5.0	IND	Turf	Firm		2 /F	Msw	154	11
7/28/2018	W	5.0	TTC	Dirt	Fast	01:03.0				
7/19/2018	W	5.0	TTC	Dirt	Fast	01:03.8				
7/11/2018	W	5.0	TTC	Dirt	Fast	01:03.4				
6/29/2018	W	4.0	TTC	Dirt	Fast	:48.40				
6/16/2018	W	4.0	TTC	Dirt	Fast	:50.40				
6/6/2018	W	3.0	TTC	Dirt	Fast	:38.40				
5/26/2018	W	3.0	TTC	Dirt	Fast	:39.00				
4/21/2018	W	3.0	OEC	Dirt	Fast	:39.02				
4/14/2018	W	3.0	OEC	Dirt	Fast	:38.00				

Part 4: Comparison of Exercise Variables between Case Horse and 2 Control Horses (5+ year old, female, Thoroughbred)

This graph is not produced since there are fewer than 3 control horses that are 5+ year old, female, Thoroughbreds to compare to Case Horse. Two and 3 year old case horses must also be matched to control horses by the quarter in which the case horse died (Jan-Mar, Apr-Jun, Jul-Sep,Oct-Dec).

Exercise History Report (Full)

J.D. Wheat Veterinary Orthopedic Research Laboratory

This report summarizes the high speed exercise history for Case Horse. There are four parts to this report:

Part 1 is a graph that depicts the races and officially recorded high speed workouts for Case Horse over the horse's career. The graph is useful for visually assessing features of a horse's career like: career length, periods of layup, and exercise consistency. If Case Horse had zero recorded high-speed exercise events, this graph is not produced. Event histories for three breed, sex, age, and event-matched control horses are also plotted.

Part 2 includes graphs which illustrate Case Horse's exercise history alongside that of Control Horses. These graphs are useful for visually comparing periods of layup and specific rates of exercise in the horses' exercise histories.

Part 3 is a chronological listing of races and officially timed works beginning with the most recent event (race or work).

Part 4 is a chart that allows comparison of exercise variables between Case Horse and other racehorses of similar age, sex, and breed that did not die at the same time from an injury. Similar to comparing the results of a blood test to a range of normal values, the values for Case Horse can be assessed in the context of a normal range for 95% of a sample of similar racehorses that did not die during the same time as Case Horse.

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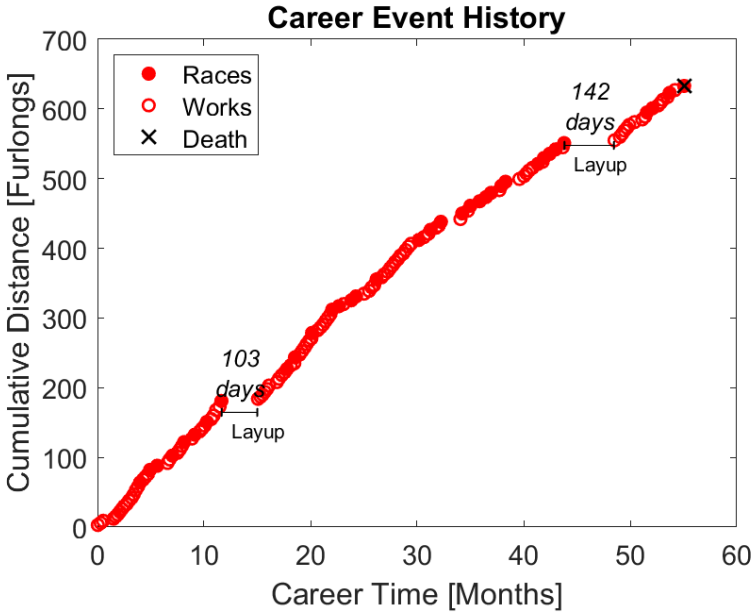
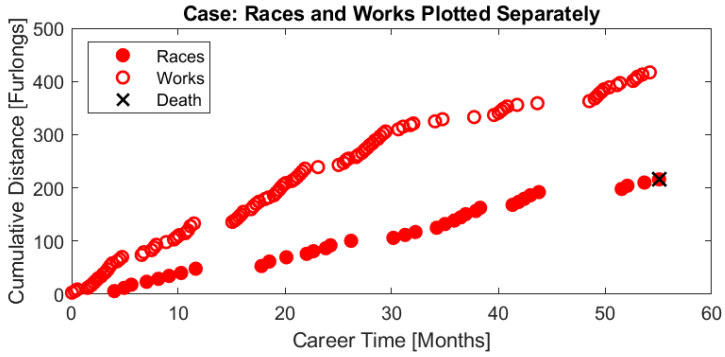
Part 1: Graphical Representation of Individual High-Speed Exercise Histories

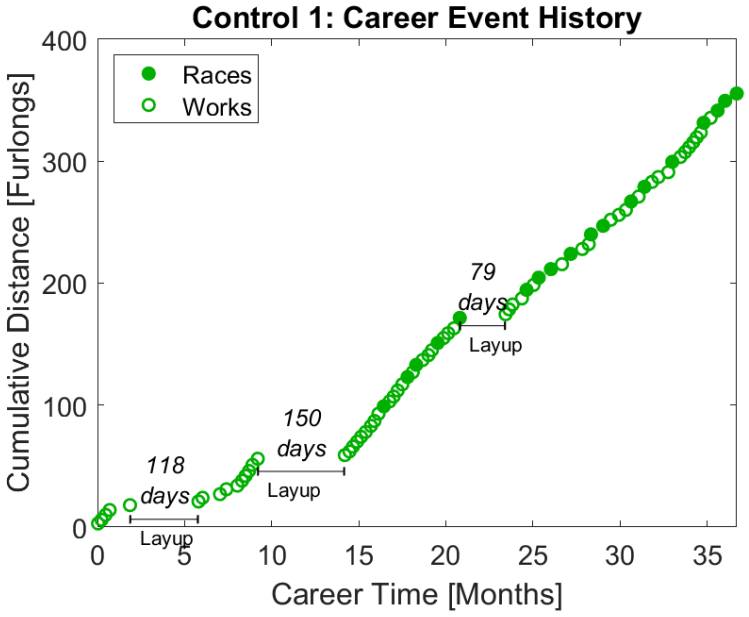
Races (filled circles), officially timed high-speed works (open circles), layups (line with endcaps, periods of time greater than 60 days in length without a race or timed work), and time of death (X) are illustrated over time (Career Time in months). With each event (race or work), the number of furlongs the horse exercised in that event is added to the number of furlongs exercised in all previous events.

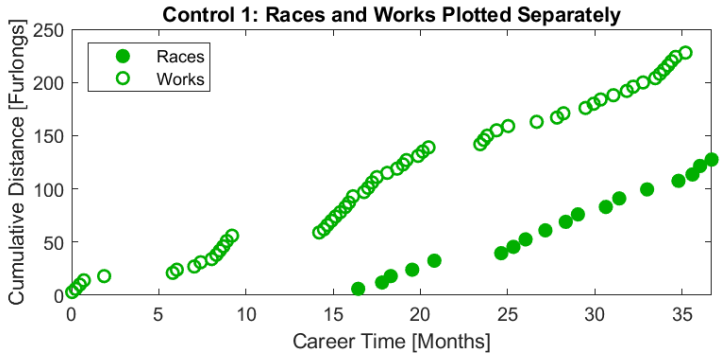
Case Horse High Speed Exercise History



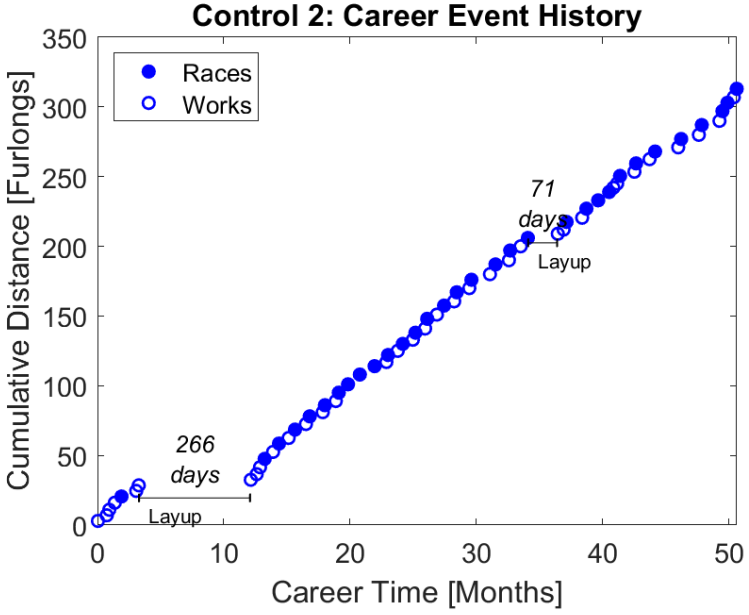


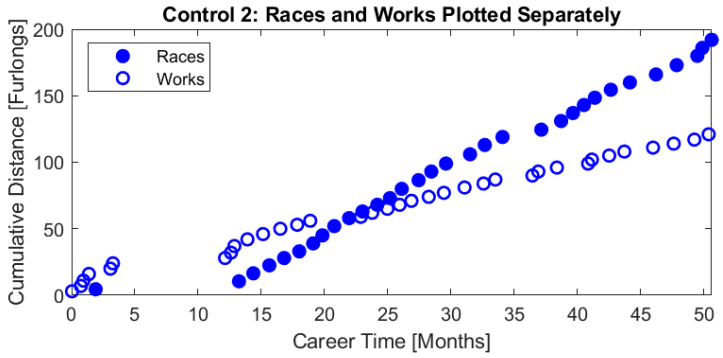
Control 1 High Speed Exercise History



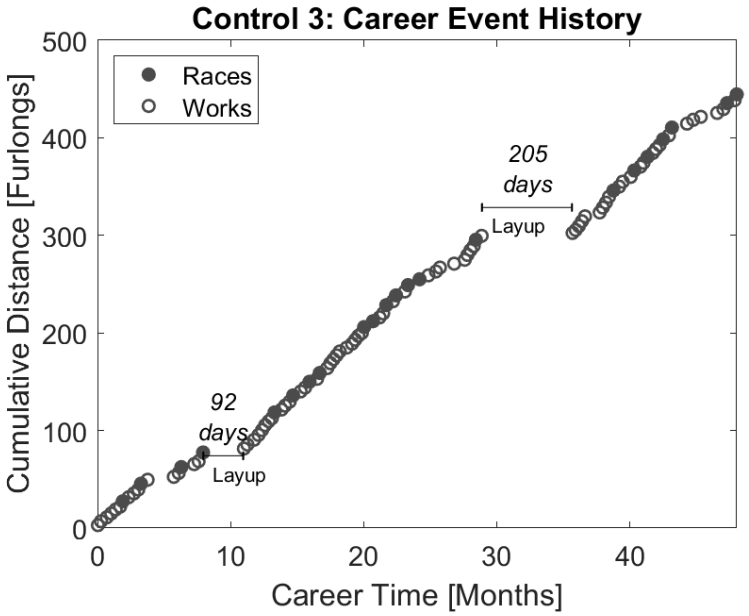


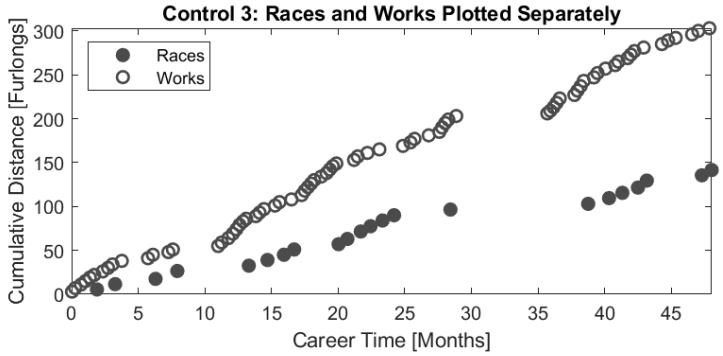
Control 2 High Speed Exercise History



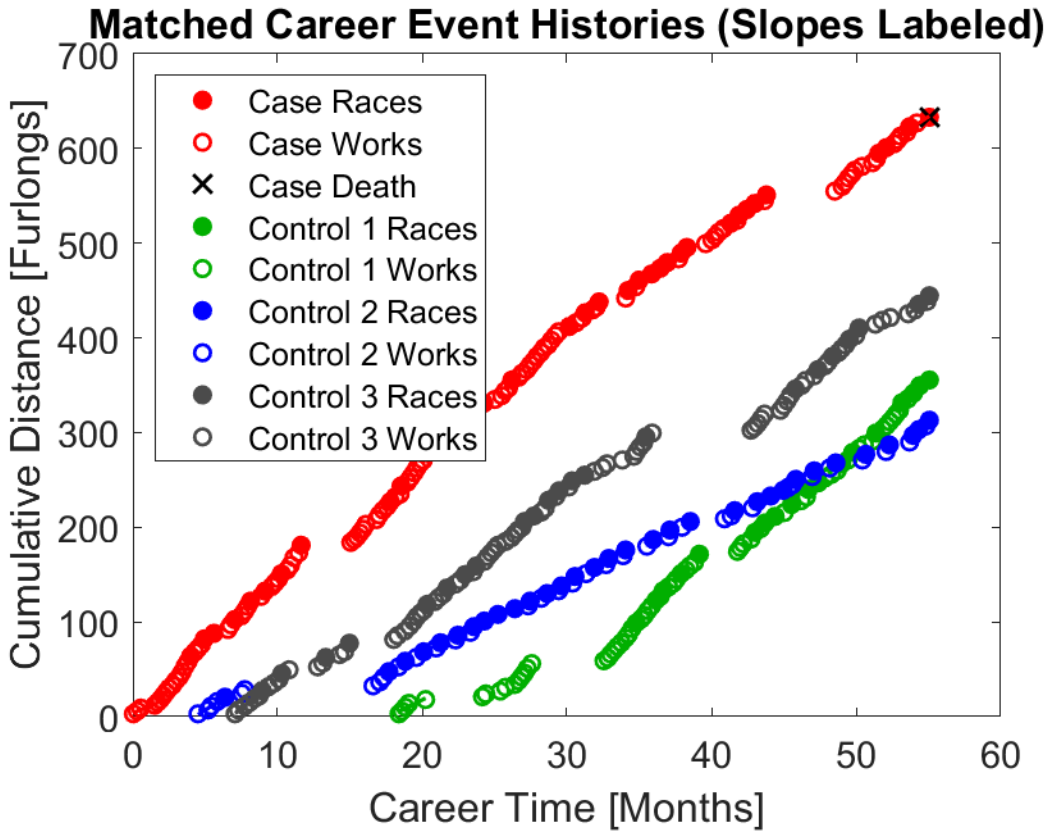


Control 3 High Speed Exercise History

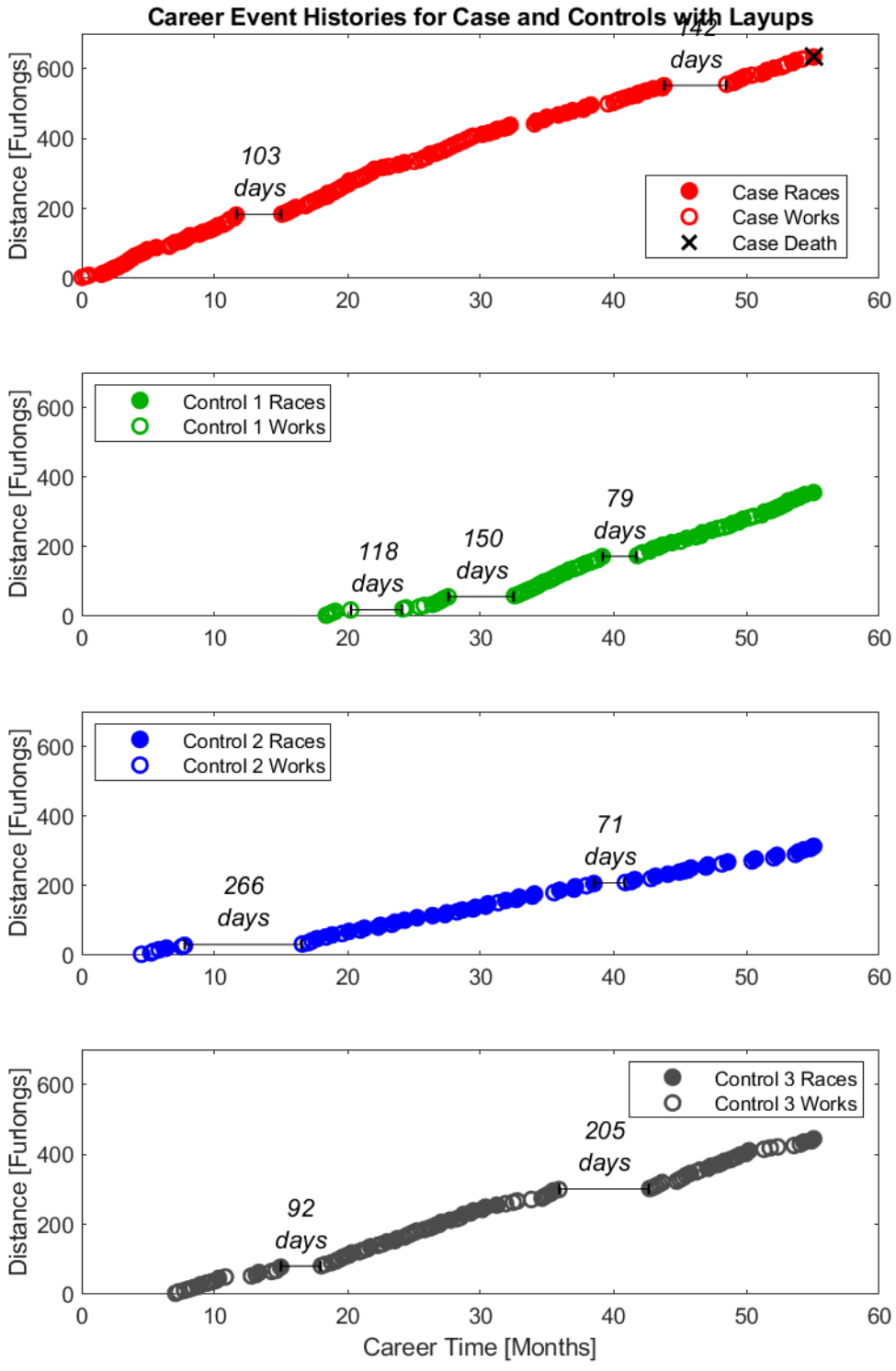


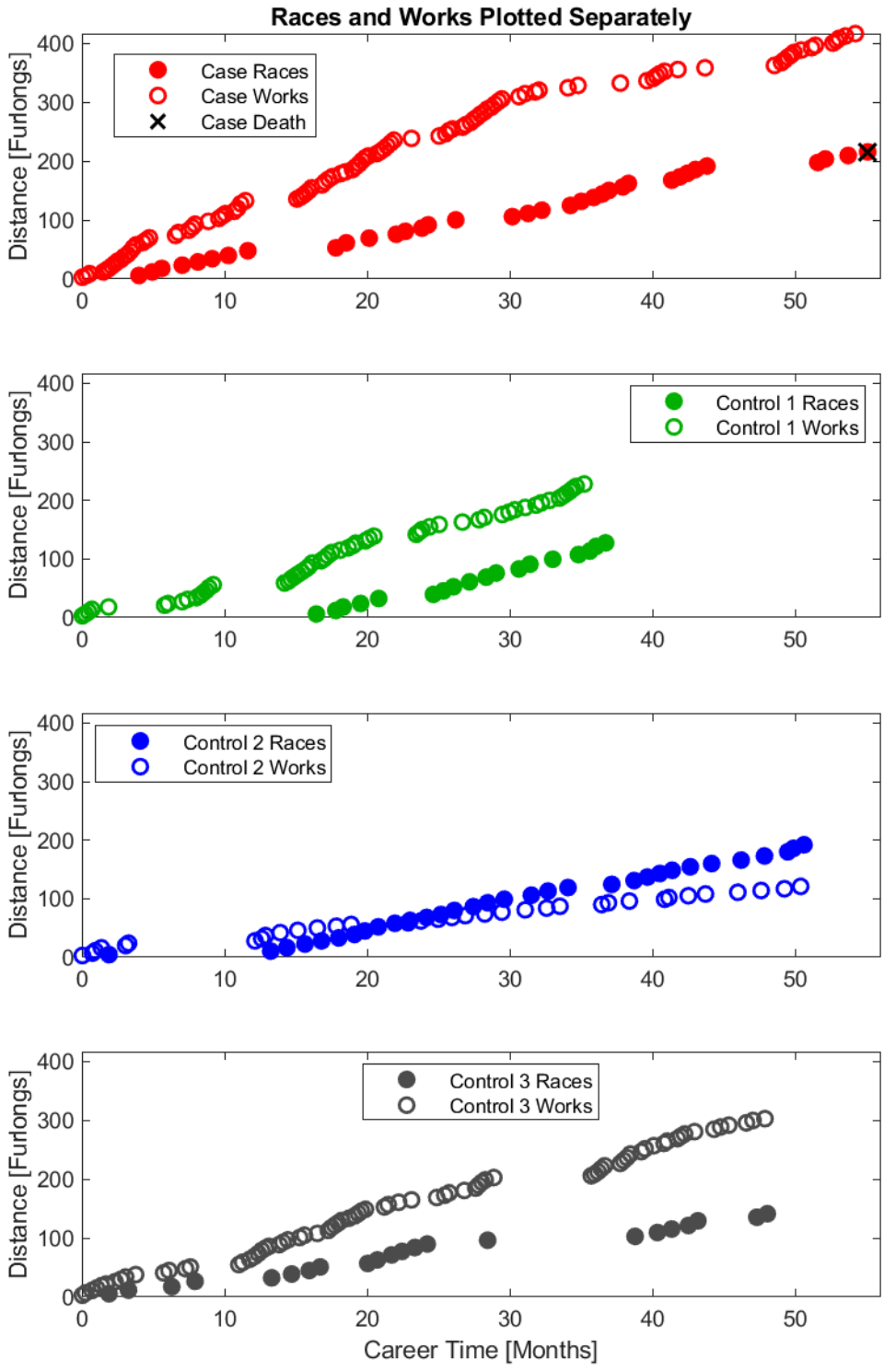


Part 2: Case and Control Horses Plotted Together



Case and Control Horses' exercise event histories are plotted on the same axes. The plots are aligned by the match date (equal to the date of death of Case Horse). Lines segments indicate specific rates of exercise at the start of career, end of career (for Case Horse), and match date (for Control Horses). Event rates are calculated as the slopes of the plots over 2 to 5 events not spanning a layup period, in units of furlongs per month.


Career Event Histories for Case and Controls with Layups
Distance [Furlongs]
Career Time [Months]
103 days
142 days
Case Races
Case Works
Case Death
Control 1 Races
Control 1 Works
118 days
150 days
79 days
Control 2 Races
Control 2 Works
266 days
71 days
Control 3 Races
Control 3 Works
92 days
205 days


Races and Works Plotted Separately
Case Races
Case Works
Case Death
Control 1 Races
Control 1 Works
Control 2 Races
Control 2 Works
Control 3 Races
Control 3 Works
Distance [Furlongs]
Career Time [Months]
0
100
200
300
400
10
20
30
40
50

Part 3: Case Horse's Event History

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
5/26/2023	R	6.0	CD	Dirt	Fast		4U	Clm40000	0	7
4/30/2023	W	4.0	OP	Dirt	Good	:48.80				
4/15/2023	R	6.0	OP	Dirt	Fast		4U	Str30000cnd	4500	3
4/9/2023	W	4.0	OP	Dirt	Fast	:49.80				
3/27/2023	W	4.0	OP	Dirt	Fast	:50.60				
3/21/2023	W	4.0	OP	Dirt	Fast	:50.20				
3/14/2023	W	4.0	OP	Dirt	Fast	:48.00				
2/26/2023	R	6.0	OP	Dirt	Sloppy		4U	Clm30000 (30-25)cnd	3700	3
2/10/2023	R	6.0	OP	Dirt	Good		4U	Clm30000 (30-25)	563	5
2/5/2023	W	4.0	OP	Dirt	Fast	:49.20				
1/28/2023	W	4.0	OP	Dirt	Fast	:49.00				
1/6/2023	W	4.0	IND	Dirt	Fast	:49.60				
12/22/2022	W	4.0	IND	Dirt	Fast	:49.60				
12/16/2022	W	4.0	IND	Dirt	Good	:51.00				
12/9/2022	W	5.0	IND	Dirt	Fast	01:03.2				
12/2/2022	W	4.0	IND	Dirt	Fast	:49.40				
11/26/2022	W	5.0	IND	Dirt	Fast	01:03.0				
11/11/2022	W	4.0	IND	Dirt	Fast	:51.00				
6/22/2022	R	6.0	CD	Dirt	Fast		4U	Clm32000	12400	2
6/18/2022	W	3.0	CDT	Dirt	Fast	:37.80				
5/29/2022	R	6.5	CD	Dirt	Fast		4U	Str20000cnd	990	7
5/12/2022	R	6.0	CD	Dirt	Fast		4U	Clm25000	31360	1
4/26/2022	R	5.5	IND	Dirt	Fast		3U	SOC 25000 - N	330	5
4/22/2022	W	3.0	IND	Dirt	Fast	:38.80				
4/9/2022	R	5.5	HAW	Dirt	Good		3U	Aoc32500nw2/x	2200	4
3/25/2022	W	4.0	IND	Dirt	Good	:52.60				
3/15/2022	W	4.0	IND	Dirt	Fast	:50.60				
3/8/2022	W	4.0	IND	Dirt	Muddy	:52.80				
3/1/2022	W	4.0	IND	Dirt	Fast	:49.20				

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
2/16/2022	W	4.0	IND	Dirt	Fast	:56.80				
1/8/2022	R	6.0	TP	AllWthr	Fast		4U	Aoc40000nw2$/x	102	10
12/27/2021	R	6.0	HAW	Dirt	Good		3U	Aoc32500nw2$/x	14400	1
12/22/2021	W	4.0	CDT	Dirt	Fast	:50.20				
11/28/2021	R	6.0	CD	Dirt	Fast		3U	Clm40000	1020	8
11/14/2021	R	6.0	CD	Dirt	Good		3U	Str20000	990	6
10/27/2021	R	6.5	KEE	Dirt	Fast		3U	Str20000	2300	4
10/1/2021	R	7.0	CD	Dirt	Fast		3U	Str20000cnd	990	6
9/24/2021	W	4.0	CDT	Dirt	Fast	:52.20				
9/8/2021	R	8.0	KD	Turf	Firm		3U	Clm20000-c	1000	6
9/3/2021	W	4.0	ELP	Dirt	Fast	:48.40				
7/10/2021	R	5.5	ELP	Dirt	Fast		3U	Aoc40000nw2$/x	1590	5
7/4/2021	W	3.0	ELP	Dirt	Fast	:36.20				
6/26/2021	W	3.0	CD	Dirt	Fast	:37.00				
6/11/2021	R	5.5	CD	Turf	Good		3U	Aoc62500nw2$/x	1364	7
6/5/2021	W	5.0	CD	Dirt	Fast	01:01.4				
5/23/2021	W	4.0	CD	Dirt	Fast	:50.40				
5/9/2021	R	5.5	CD	Dirt	Sloppy		4U	Clm50000	6330	3
4/17/2021	W	4.0	TAM	Dirt	Fast	:49.20				
4/10/2021	W	5.0	TAM	Dirt	Fast	01:01.8				
4/2/2021	W	5.0	TAM	Dirt	Fast	01:02.2				
3/26/2021	W	3.0	TAM	Dirt	Fast	:37.20				
3/18/2021	W	5.0	TAM	Dirt	Fast	01:00.2				
3/11/2021	W	4.0	TAM	Dirt	Fast	:49.40				
3/3/2021	W	5.0	TAM	Dirt	Fast	01:02.2				
2/24/2021	W	4.0	TAM	Dirt	Fast	:49.20				
2/17/2021	W	5.0	TAM	Dirt	Fast	01:01.4				
2/10/2021	W	4.0	TAM	Dirt	Fast	:48.40				
1/31/2021	W	4.0	TAM	Dirt	Fast	:48.40				

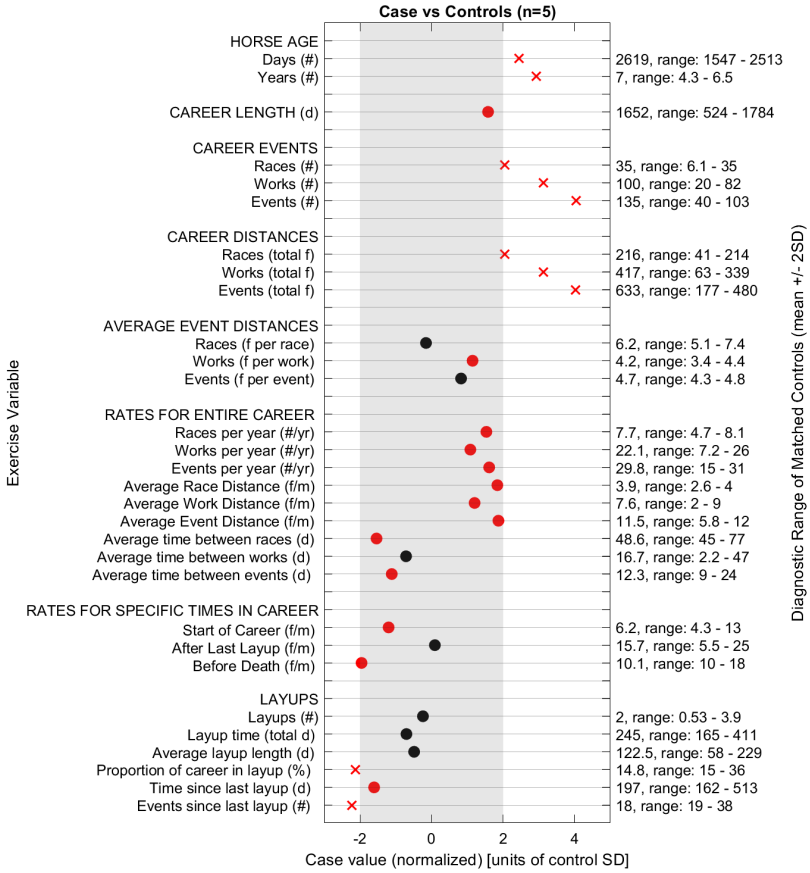
Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
1/24/2021	W	3.0	TAM	Dirt	Fast	:37.20				
1/10/2021	R	8.5	TAM	Turf	Firm		4U	Aoc75000cnd-N	250	6
1/3/2021	W	3.0	TAM	Dirt	Fast	:37.40				
12/27/2020	W	5.0	TAM	Dirt	Fast	01:03.0				
12/20/2020	W	4.0	TAM	Dirt	Fast	:49.40				
12/6/2020	W	4.0	TAM	Dirt	Fast	:50.80				
11/13/2020	R	5.5	LRL	Dirt	Fast		3U	Aoc50000nw3/x-N	1880	5
10/31/2020	R	5.5	LRL	Dirt	Fast		3U	Aoc35000nw2/x-N	25650	1
10/9/2020	W	3.0	FAI	All Weather Training	Fast	:37.00				
9/26/2020	R	5.0	PIM	Dirt	Sloppy		3U	Aoc35000nw2/x-N	2700	4
9/7/2020	R	6.5	KD	Turf	Firm		3U	Aoc62500nw2/x-N	5500	4
9/2/2020	W	5.0	CD	Dirt	Sloppy	01:00.8				
8/26/2020	W	5.0	CD	Dirt	Fast	01:01.2				
8/19/2020	W	5.0	CD	Dirt	Fast	01:03.0				
8/12/2020	W	4.0	CD	Dirt	Fast	:49.20				
8/5/2020	W	4.0	CD	Dirt	Fast	:47.20				
7/28/2020	W	4.0	CD	Dirt	Fast	:51.80				
7/12/2020	R	8.0	KEE	Turf	Good		3U	Alw79000nw2$x	527	6
7/10/2020	W	3.0	CD	Dirt	Fast	:38.40				
7/4/2020	W	5.0	CD	Dirt	Fast	01:01.2				
6/27/2020	W	5.0	CD	Dirt	Fast	01:01.6				
6/21/2020	W	5.0	CD	Dirt	Fast	01:00.2				
6/14/2020	W	5.0	CD	Dirt	Fast	01:01.4				
6/7/2020	W	4.0	CD	Dirt	Fast	:49.40				
5/25/2020	R	8.5	CD	Turf	Firm		3U	Aoc62500nw2$x-N	885	6
5/23/2020	W	3.0	CD	Dirt	Fast	:36.20				

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
5/13/2020	W	5.0	GHT	Dirt	Fast	01:03.8				
5/3/2020	R	5.0	TAM	Turf	Firm		4U	Aoc32000nw2/ x-N	210	5
4/26/2020	W	4.0	TAM	Dirt	Fast	:48.80				
4/18/2020	W	5.0	GHT	Dirt	Fast	01:03.4				
4/10/2020	W	5.0	GHT	Dirt	Fast	01:03.8				
4/4/2020	W	5.0	GHT	Dirt	Fast	01:03.2				
3/13/2020	W	5.0	FG	Dirt	Fast	01:02.8				
3/7/2020	W	4.0	FG	Dirt	Fast	:50.20				
3/1/2020	W	4.0	FG	Dirt	Fast	:49.60				
2/24/2020	W	3.0	FG	Dirt	Fast	:37.20				
2/18/2020	W	3.0	FG	Dirt	Fast	:37.20				
2/11/2020	W	3.0	FG	Dirt	Fast	:36.60				
10/31/2019	R	8.0	LRL	Dirt	Sloppy		3U	Aoc35000nw2/ x-N	9450	2
10/26/2019	W	5.0	FAI	All Weather Training	Fast	01:01.4				
10/16/2019	W	8.0	FAI	All Weather Training	Fast	01:46.4				
10/9/2019	W	5.0	FAI	All Weather Training	Fast	01:01.4				
10/2/2019	W	4.0	FAI	All Weather Training	Fast	:50.60				
9/20/2019	R	5.5	LRL	Turf	Firm		3U	Aoc35000nw2/ x-N	3825	3
9/14/2019	W	4.0	FAI	All Weather Training	Fast	:49.60				
9/7/2019	W	4.0	FAI	All Weather Training	Fast	:47.20				

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
8/31/2019	W	5.0	FAI	All Weather Training	Fast	01:01.6				
8/17/2019	R	5.5	CNL	Turf	Firm		3U	Alw60000nw1/x	36000	1
8/9/2019	W	5.0	FAI	All Weather Training	Fast	01:01.4				
7/18/2019	R	5.5	LRL	Dirt	Fast		3U	Msw	22800	1
7/12/2019	W	5.0	FAI	All Weather Training	Fast	01:01.4				
7/6/2019	W	5.0	FAI	All Weather Training	Fast	01:01.4				
6/29/2019	W	4.0	FAI	Dirt	Fast	:51.00				
6/15/2019	R	5.5	LRL	Dirt	Fast		3U	Msw	4400	3
6/7/2019	W	5.0	FAI	Dirt	Fast	01:01.8				
6/1/2019	W	4.0	FAI	All Weather Training	Fast	:50.00				
5/3/2019	R	6.0	OP	Dirt	Fast		3U	Msw	4500	4
4/13/2019	R	6.0	OP	Dirt	Sloppy		3	Msw	20000	2
4/7/2019	W	4.0	OP	Dirt	Sloppy	:52.00				
3/31/2019	W	4.0	OP	Dirt	Fast	:52.20				
3/24/2019	W	4.0	FG	Dirt	Fast	:51.40				
3/16/2019	R	6.0	FG	Dirt	Muddy		3	Msw	1290	5
3/10/2019	W	5.0	FG	Dirt	Fast	:59.60				
3/4/2019	W	6.0	FG	Dirt	Fast	01:17.0				
2/26/2019	W	5.0	FG	Dirt	Good	01:01.0				
2/20/2019	W	4.0	FG	Dirt	Sloppy	:48.80				
2/13/2019	W	5.0	FG	Dirt	Wet Fast	01:01.0				
2/6/2019	W	3.0	FG	Dirt	Fast	:36.60				
1/30/2019	W	4.0	FG	Dirt	Fast	:49.60				

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
1/24/2019	W	4.0	FG	Dirt	Fast	:50.00				
1/18/2019	W	4.0	FG	Dirt	Fast	:48.20				
1/12/2019	W	3.0	FG	Dirt	Fast	:37.60				
1/6/2019	W	3.0	FG	Dirt	Fast	:36.80				
12/31/2018	W	3.0	FG	Dirt	Sloppy	:37.20				
12/2/2018	W	3.0	FG	Dirt	Fast	:36.20				
11/25/2018	W	3.0	FG	Dirt	Fast	:38.40				
11/17/2018	W	3.0	FAI	All Weather Training	Fast	:36.40				

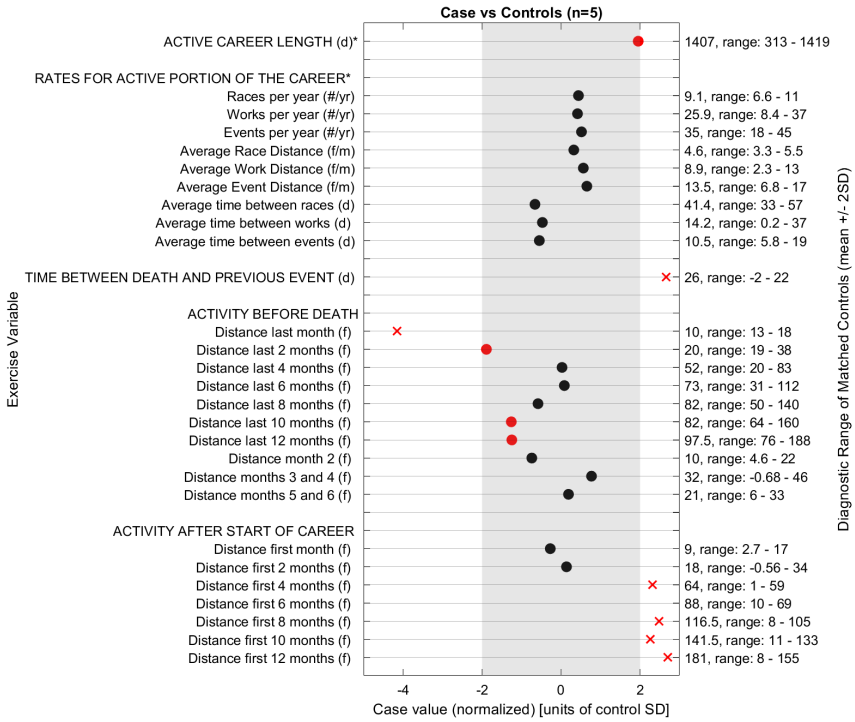
Part 4: Comparison of Exercise Variables between Case Horse and 5 Control Horses (5+ year old, male, Thoroughbred)



Case Horse values are indicated by black or red symbols: circles indicate values considered normal for 95% of 5+ year old, male, Thoroughbreds (n=5) (gray region) (black and red indicate within 1 and 2 SD, respectively, of mean value of controls), X's indicate values outside of the normal range. Two and 3 year old case horses are also matched to control horses by the quarter in which the case horse died (Jan-Mar, Apr-Jun, Jul-Sep,Oct-Dec). Variables that are not calculable are not plotted (e.g. time between races for a horse with zero events). f=furlongs; yr=year; m=month; d=days.

^Rates are calculated over 2 to 5 events.

*Active Career Length is the career length excluding the time during layups.



Case Horse values are indicated by black or red symbols: circles indicate values considered normal for 95% of 5+ year old, male, Thoroughbreds (n=5) (gray region) (black and red indicate within 1 and 2 SD, respectively, of mean value of controls), X's indicate values outside of the normal range. Two and 3 year old case horses are also matched to control horses by the quarter in which the case horse died (Jan-Mar, Apr-Jun, Jul-Sep,Oct-Dec). Variables that are not calculable are not plotted (e.g. time between races for a horse with zero events). f=furlongs; yr=year; m=month; d=days.

^Rates are calculated over 2 to 5 events.

*Active Career Length is the career length excluding the time during layups.

Exercise History Report (Full)

J.D. Wheat Veterinary Orthopedic Research Laboratory

This report summarizes the high speed exercise history for Case Horse. There are four parts to this report:

Part 1 is a graph that depicts the races and officially recorded high speed workouts for Case Horse over the horse's career. The graph is useful for visually assessing features of a horse's career like: career length, periods of layup, and exercise consistency. If Case Horse had zero recorded high-speed exercise events, this graph is not produced. Event histories for three breed, sex, age, and event-matched control horses are also plotted.

Part 2 includes graphs which illustrate Case Horse's exercise history alongside that of Control Horses. These graphs are useful for visually comparing periods of layup and specific rates of exercise in the horses' exercise histories.

Part 3 is a chronological listing of races and officially timed works beginning with the most recent event (race or work).

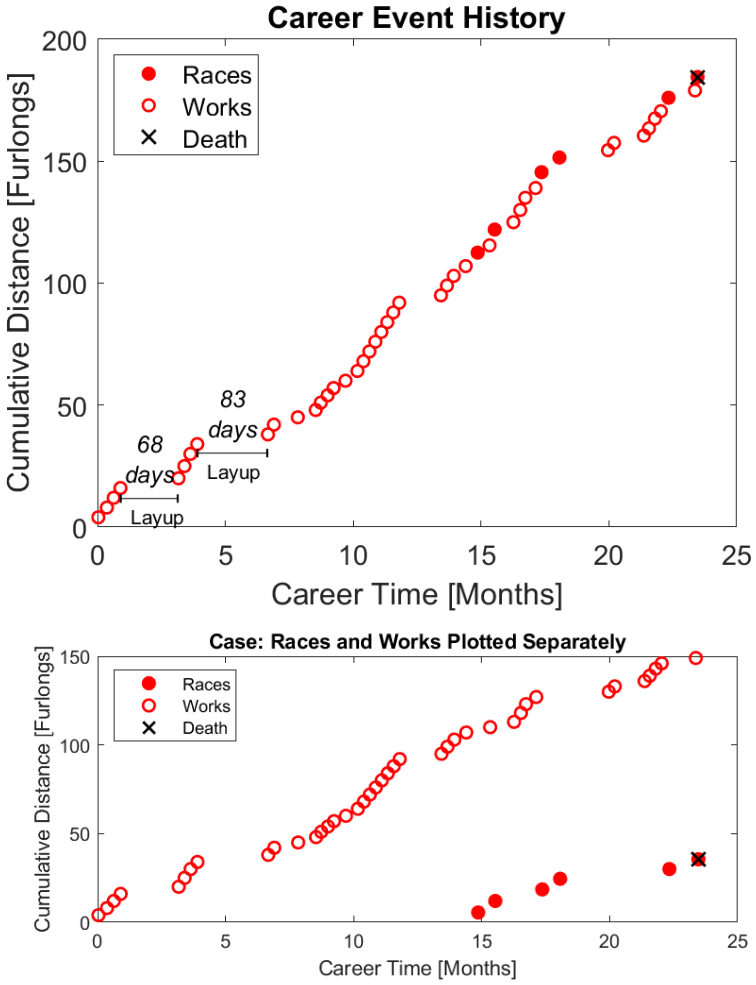
Part 4 is a chart that allows comparison of exercise variables between Case Horse and other racehorses of similar age, sex, and breed that did not die at the same time from an injury. Similar to comparing the results of a blood test to a range of normal values, the values for Case Horse can be assessed in the context of a normal range for 95% of a sample of similar racehorses that did not die during the same time as Case Horse.

Table of Contents

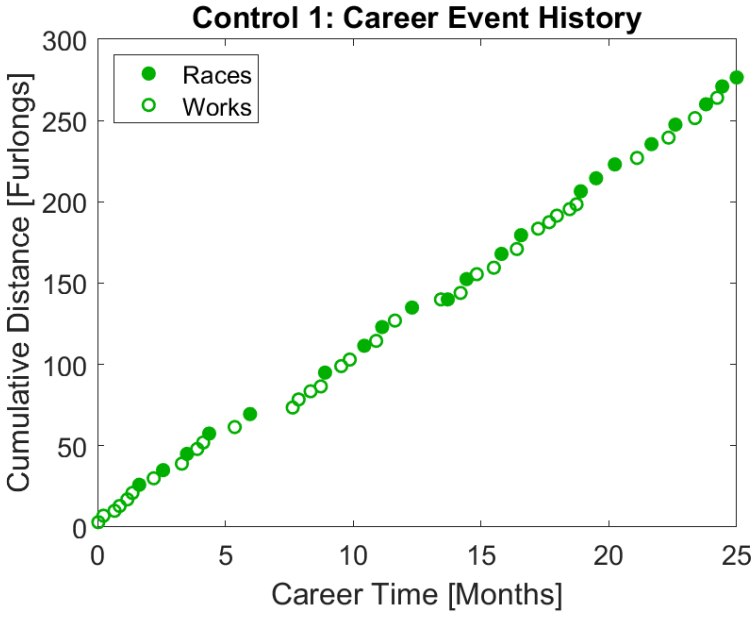
Part 1: Graphical Representation of Individual High-Speed Exercise Histories

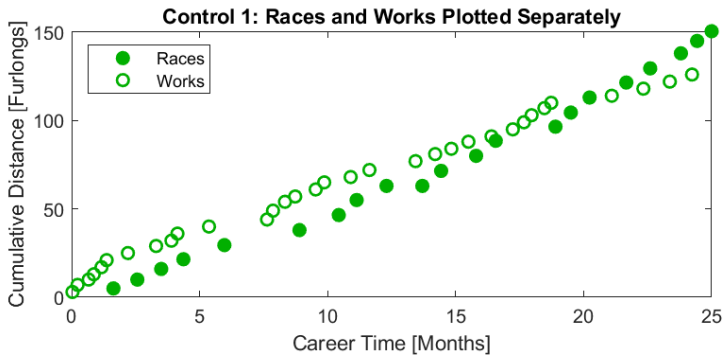
Races (filled circles), officially timed high-speed works (open circles), layups (line with endcaps, periods of time greater than 60 days in length without a race or timed work), and time of death (X) are illustrated over time (Career Time in months). With each event (race or work), the number of furlongs the horse exercised in that event is added to the number of furlongs exercised in all previous events.

Case Horse High Speed Exercise History

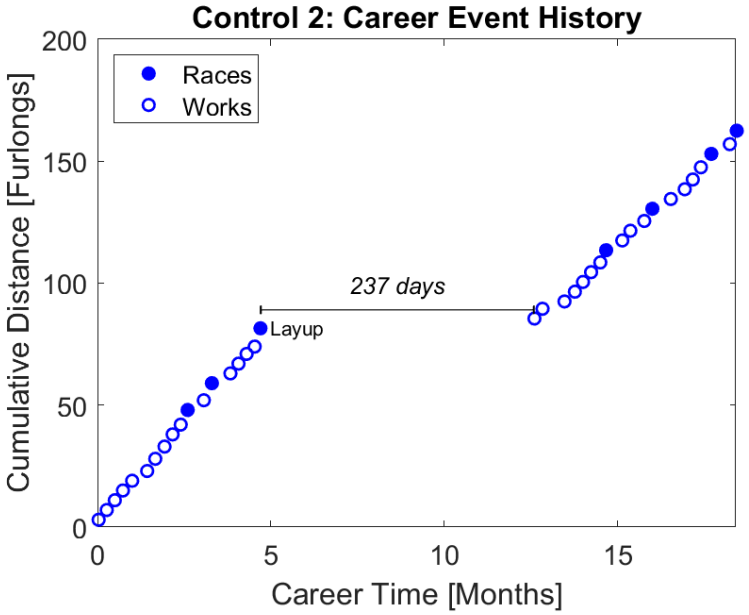


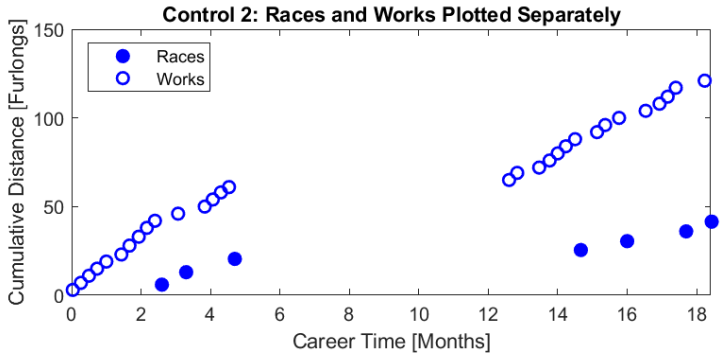
Control 1 High Speed Exercise History



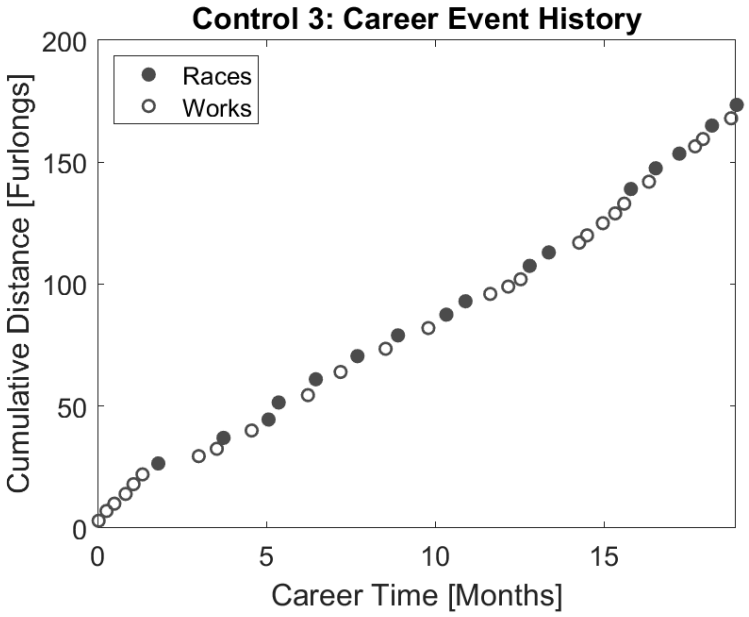


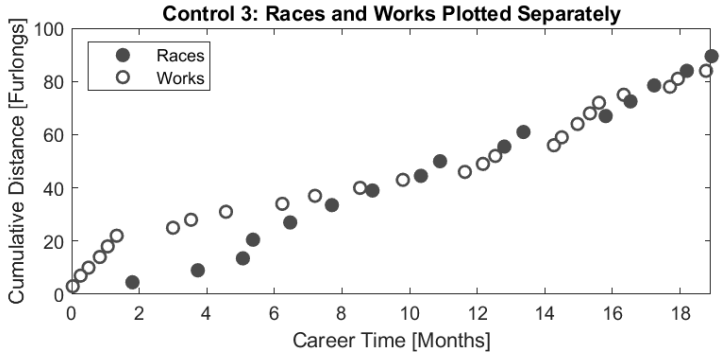
Control 2 High Speed Exercise History



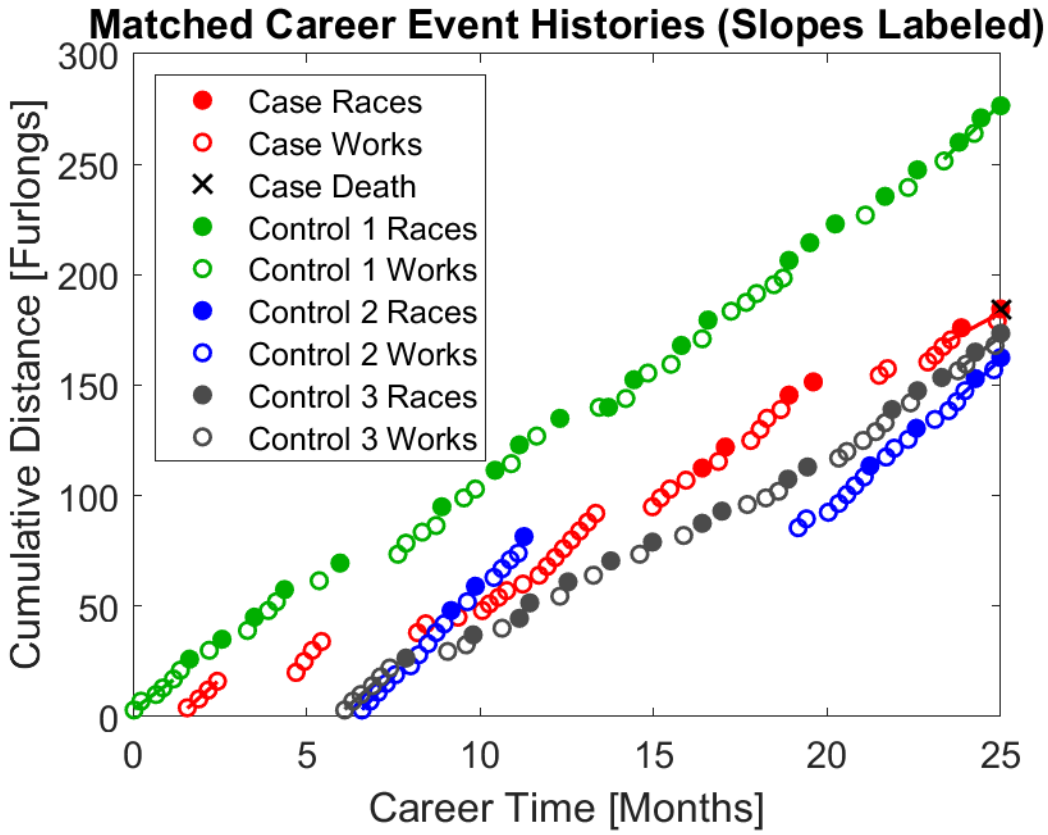


Control 3 High Speed Exercise History

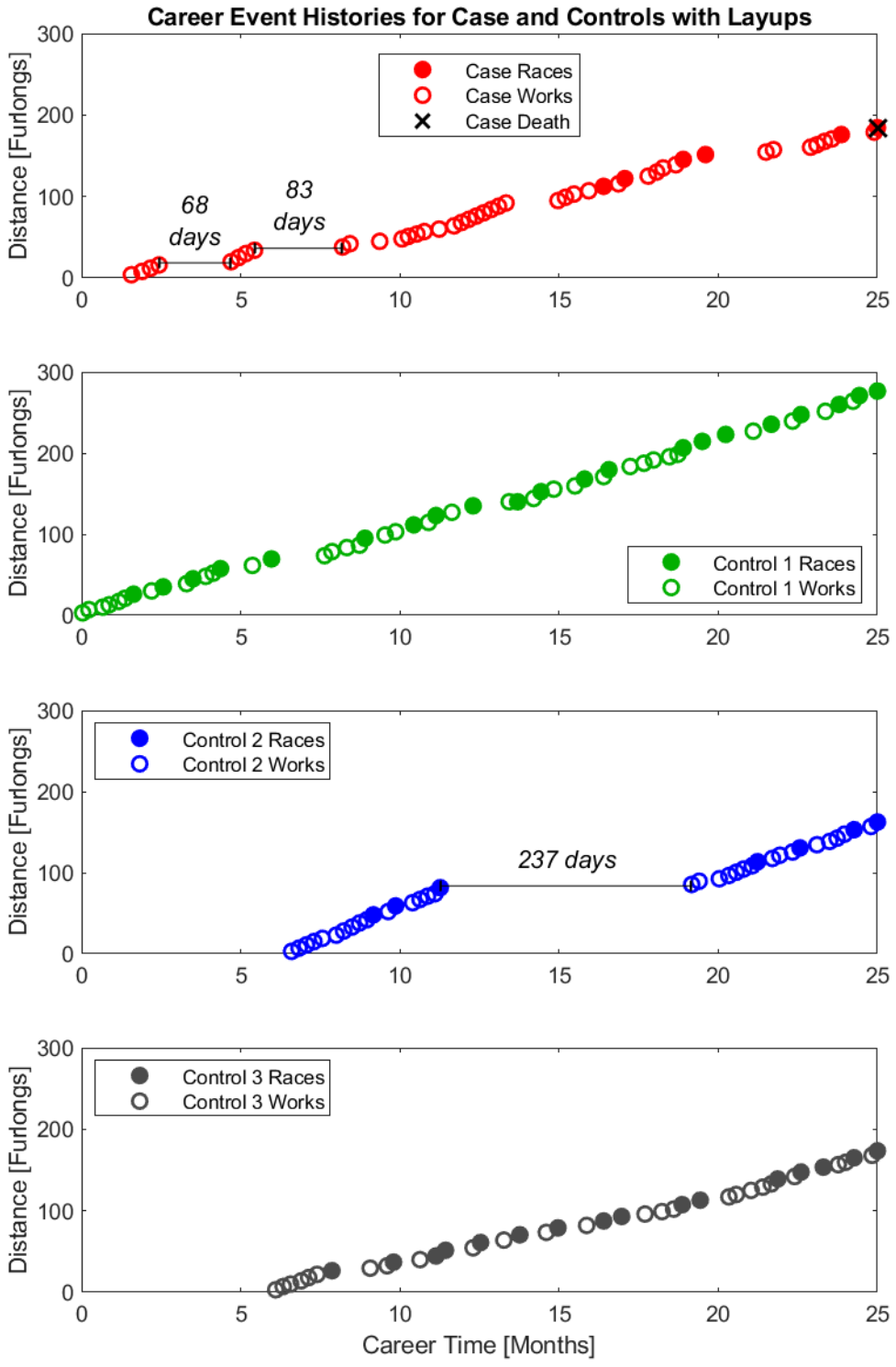


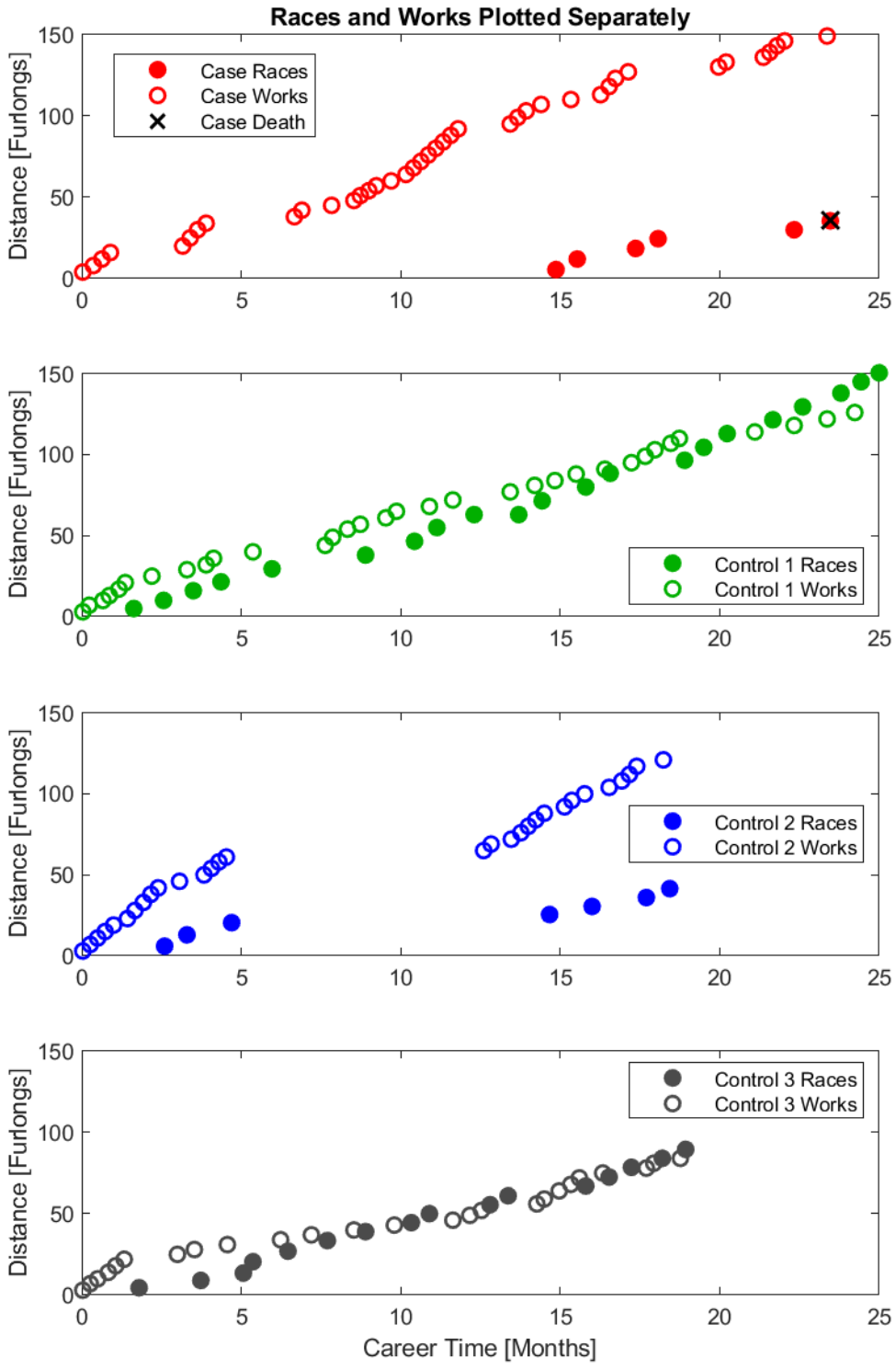


Part 2: Case and Control Horses Plotted Together



Case and Control Horses' exercise event histories are plotted on the same axes. The plots are aligned by the match date (equal to the date of death of Case Horse). Lines segments indicate specific rates of exercise at the start of career, end of career (for Case Horse), and match date (for Control Horses). Event rates are calculated as the slopes of the plots over 2 to 5 events not spanning a layup period, in units of furlongs per month.


Career Event Histories for Case and Controls with Layups
Distance [Furlongs]
Case Races
Case Works
Case Death
68 days
83 days
Control 1 Races
Control 1 Works
Control 2 Races
Control 2 Works
237 days
Control 3 Races
Control 3 Works
Career Time [Months]

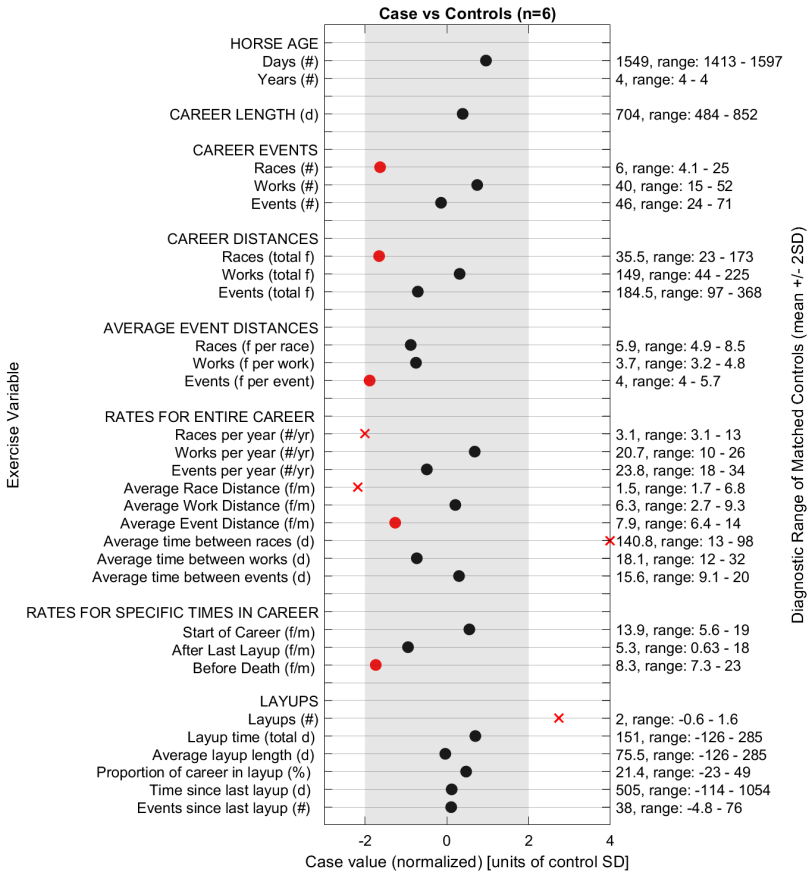

Races and Works Plotted Separately
Distance [Furlongs]
Case Races
Case Works
Case Death
Control 1 Races
Control 1 Works
Control 2 Races
Control 2 Works
Control 3 Races
Control 3 Works
Career Time [Months]

Part 3: Case Horse's Event History

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
4/29/2023	R	5.5	CD	Turf	Firm		3U / FM	Aoc80000nw2$/ x-N	0	8
4/26/2023	W	3.0	KEE	Dirt	Fast	:39.80				
3/26/2023	R	5.5	GP	AllWthr	Fast		3U / FM	Aoc25000nw1$/ x-N	43200	1
3/17/2023	W	3.0	PMM	Dirt	Fast	:37.35				
3/10/2023	W	4.0	PMM	Dirt	Fast	:51.85				
3/3/2023	W	3.0	PMM	Dirt	Fast	:38.45				
2/25/2023	W	3.0	PMM	Dirt	Fast	:38.20				
1/21/2023	W	3.0	PMM	Dirt	Fast	:37.65				
1/14/2023	W	3.0	PMM	Dirt	Fast	:36.00				
11/18/2022	R	6.0	CD	Dirt	Fast		3U / FM	Msw	69000	1
10/28/2022	R	6.5	KEE	Dirt	Fast		3U / FM	Msw	19250	2
10/21/2022	W	4.0	KEE	Dirt	Fast	:49.20				
10/9/2022	W	5.0	GP	Dirt	Fast	01:00.1				
10/3/2022	W	5.0	GP	Dirt	Fast	:58.63				
9/25/2022	W	3.0	GP	Dirt	Fast	:36.95				
9/3/2022	R	6.5	KD	Turf	Firm		3U / FM	Msw	1200	11
8/28/2022	W	3.0	SAR	Dirt	Fast	:35.83				
8/14/2022	R	5.5	SAR	Turf	Firm		3U / FM	Msw	21000	2
7/31/2022	W	4.0	SAR	Turf	Firm	:49.23				
7/17/2022	W	4.0	SAR	Turf	Firm	:49.01				
7/9/2022	W	4.0	PMM	Dirt	Fast	:49.50				
7/2/2022	W	3.0	PMM	Dirt	Fast	:38.05				
5/14/2022	W	4.0	PMM	Dirt	Fast	:46.15				
5/7/2022	W	4.0	PMM	Dirt	Fast	:47.70				
4/30/2022	W	4.0	PMM	Dirt	Fast	:48.25				
4/23/2022	W	4.0	PMM	Dirt	Fast	:48.65				
4/16/2022	W	4.0	PMM	Dirt	Fast	:48.95				

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
4/9/2022	W	4.0	PMM	Dirt	Fast	:48.30				
4/2/2022	W	4.0	PMM	Dirt	Fast	:48.05				
3/26/2022	W	4.0	PMM	Dirt	Fast	:47.90				
3/12/2022	W	3.0	PMM	Dirt	Fast	:35.05				
2/26/2022	W	3.0	PMM	Dirt	Fast	:38.45				
2/19/2022	W	3.0	PMM	Dirt	Fast	:36.30				
2/11/2022	W	3.0	PMM	Dirt	Fast	:36.60				
2/5/2022	W	3.0	PMM	Dirt	Fast	:37.35				
1/15/2022	W	3.0	PMM	Dirt	Fast	:38.45				
12/18/2021	W	4.0	TP	AllWthr	Fast	:48.00				
12/11/2021	W	4.0	TP	AllWthr	Fast	:48.40				
9/19/2021	W	4.0	TP	AllWthr	Fast	:49.40				
9/11/2021	W	5.0	TP	AllWthr	Fast	01:04.0				
9/4/2021	W	5.0	TP	AllWthr	Fast	01:01.0				
8/28/2021	W	4.0	TP	AllWthr	Fast	:52.20				
6/21/2021	W	4.0	KEE	Dirt	Fast	:48.40				
6/13/2021	W	4.0	KEE	Dirt	Fast	:50.80				
6/5/2021	W	4.0	KEE	Dirt	Fast	:48.40				
5/26/2021	W	4.0	KEE	Dirt	Fast	:49.00				

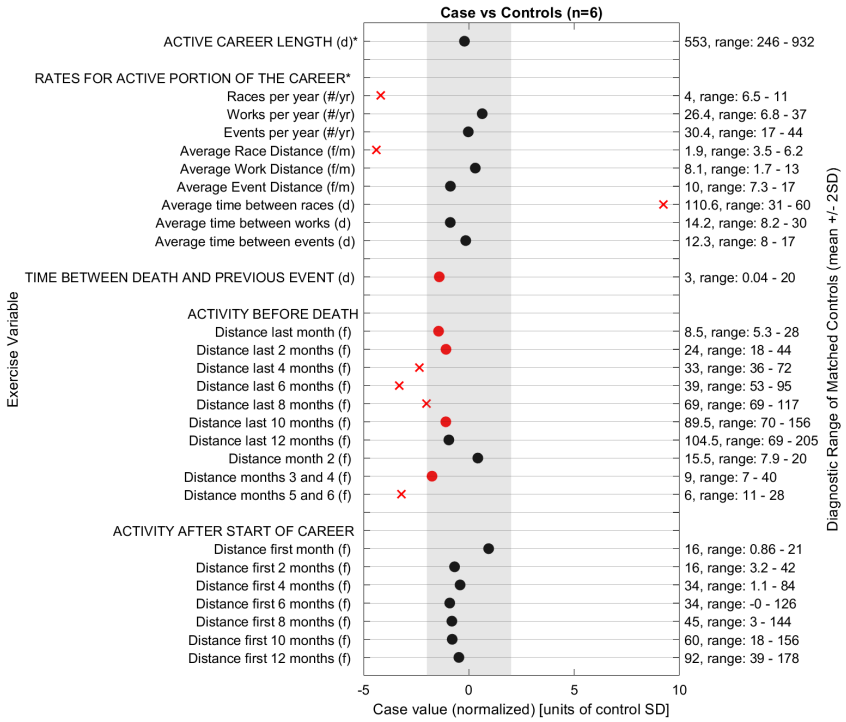
Part 4: Comparison of Exercise Variables between Case Horse and 6 Control Horses (4 year old, female, Thoroughbred)



Case Horse values are indicated by black or red symbols: circles indicate values considered normal for 95% of 4 year old, female, Thoroughbreds (n=6) (gray region) (black and red indicate within 1 and 2 SD, respectively, of mean value of controls), X's indicate values outside of the normal range. Two and 3 year old case horses are also matched to control horses by the quarter in which the case horse died (Jan-Mar, Apr-Jun, Jul-Sep,Oct-Dec). Variables that are not calculable are not plotted (e.g. time between races for a horse with zero events). f=furlongs; yr=year; m=month; d=days.

^Rates are calculated over 2 to 5 events.

*Active Career Length is the career length excluding the time during layups.



Case Horse values are indicated by black or red symbols: circles indicate values considered normal for 95% of 4 year old, female, Thoroughbreds (n=6) (gray region) (black and red indicate within 1 and 2 SD, respectively, of mean value of controls), X's indicate values outside of the normal range. Two and 3 year old case horses are also matched to control horses by the quarter in which the case horse died (Jan-Mar, Apr-Jun, Jul-Sep,Oct-Dec). Variables that are not calculable are not plotted (e.g. time between races for a horse with zero events). f=furlongs; yr=year; m=month; d=days.

^Rates are calculated over 2 to 5 events.

*Active Career Length is the career length excluding the time during layups.

Exercise History Report (Full)

J.D. Wheat Veterinary Orthopedic Research Laboratory

This report summarizes the high speed exercise history for Case Horse. There are four parts to this report:

Part 1 is a graph that depicts the races and officially recorded high speed workouts for Case Horse over the horse's career. The graph is useful for visually assessing features of a horse's career like: career length, periods of layup, and exercise consistency. If Case Horse had zero recorded high-speed exercise events, this graph is not produced. Event histories for three breed, sex, age, and event-matched control horses are also plotted.

Part 2 includes graphs which illustrate Case Horse's exercise history alongside that of Control Horses. These graphs are useful for visually comparing periods of layup and specific rates of exercise in the horses' exercise histories.

Part 3 is a chronological listing of races and officially timed works beginning with the most recent event (race or work).

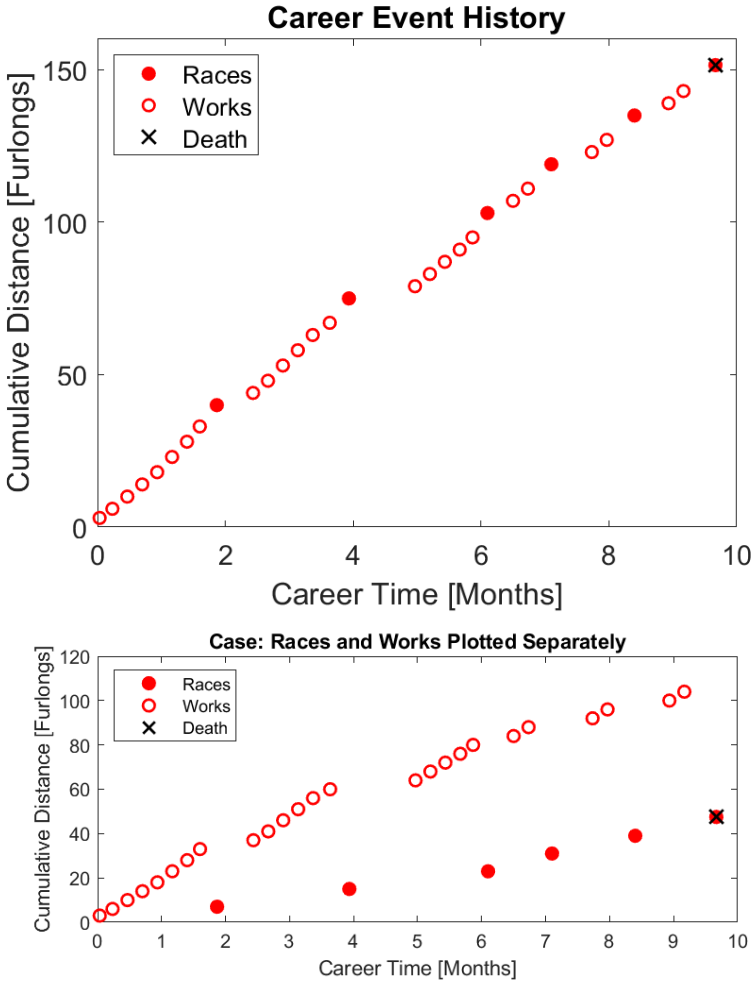
Part 4 is a chart that allows comparison of exercise variables between Case Horse and other racehorses of similar age, sex, and breed that did not die at the same time from an injury. Similar to comparing the results of a blood test to a range of normal values, the values for Case Horse can be assessed in the context of a normal range for 95% of a sample of similar racehorses that did not die during the same time as Case Horse.

Table of Contents

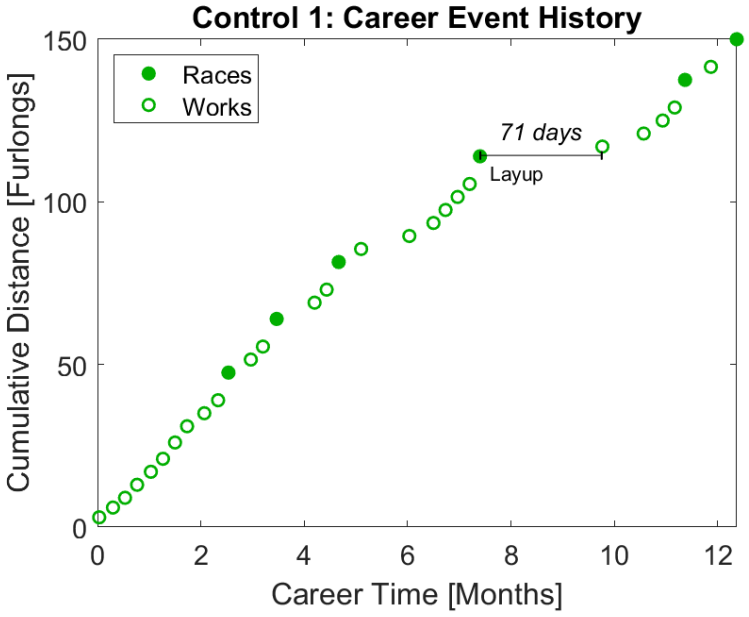
Part 1: Graphical Representation of Individual High-Speed Exercise Histories

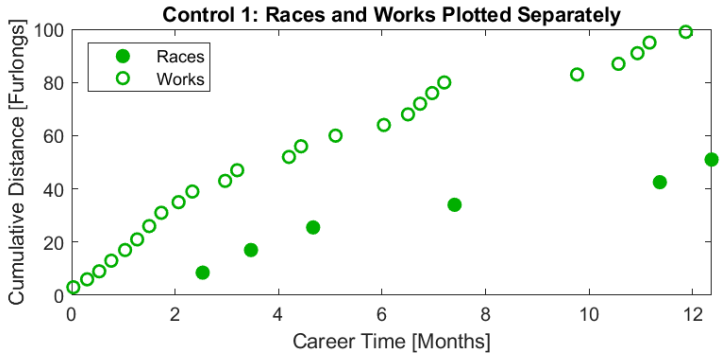
Races (filled circles), officially timed high-speed works (open circles), layups (line with endcaps, periods of time greater than 60 days in length without a race or timed work), and time of death (X) are illustrated over time (Career Time in months). With each event (race or work), the number of furlongs the horse exercised in that event is added to the number of furlongs exercised in all previous events.

Case Horse High Speed Exercise History

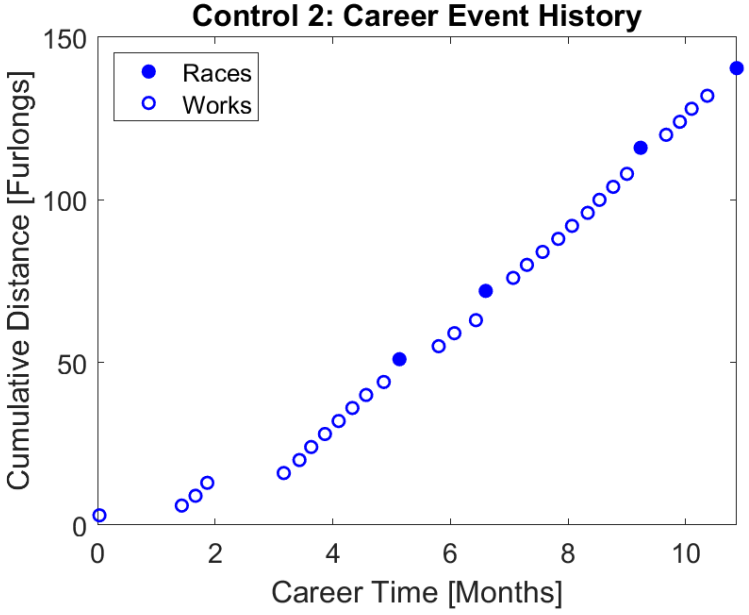


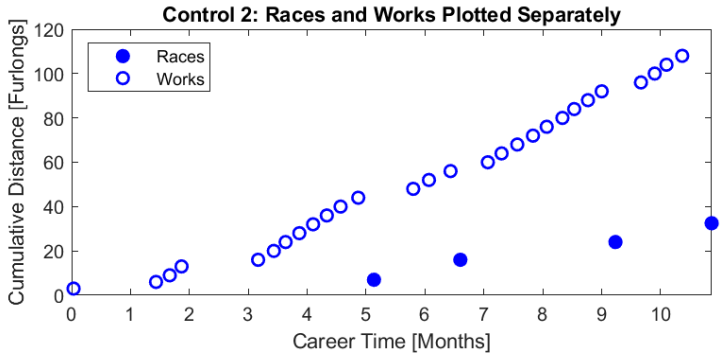
Control 1 High Speed Exercise History



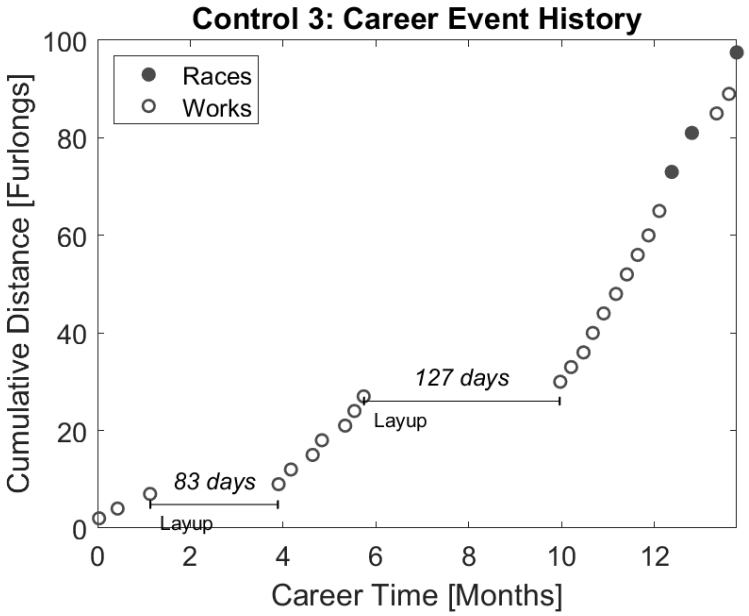


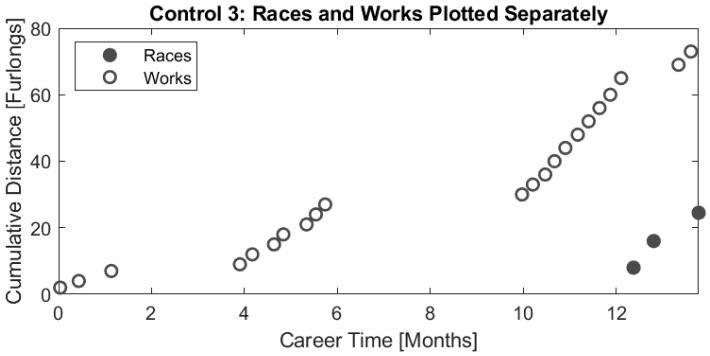
Control 2 High Speed Exercise History



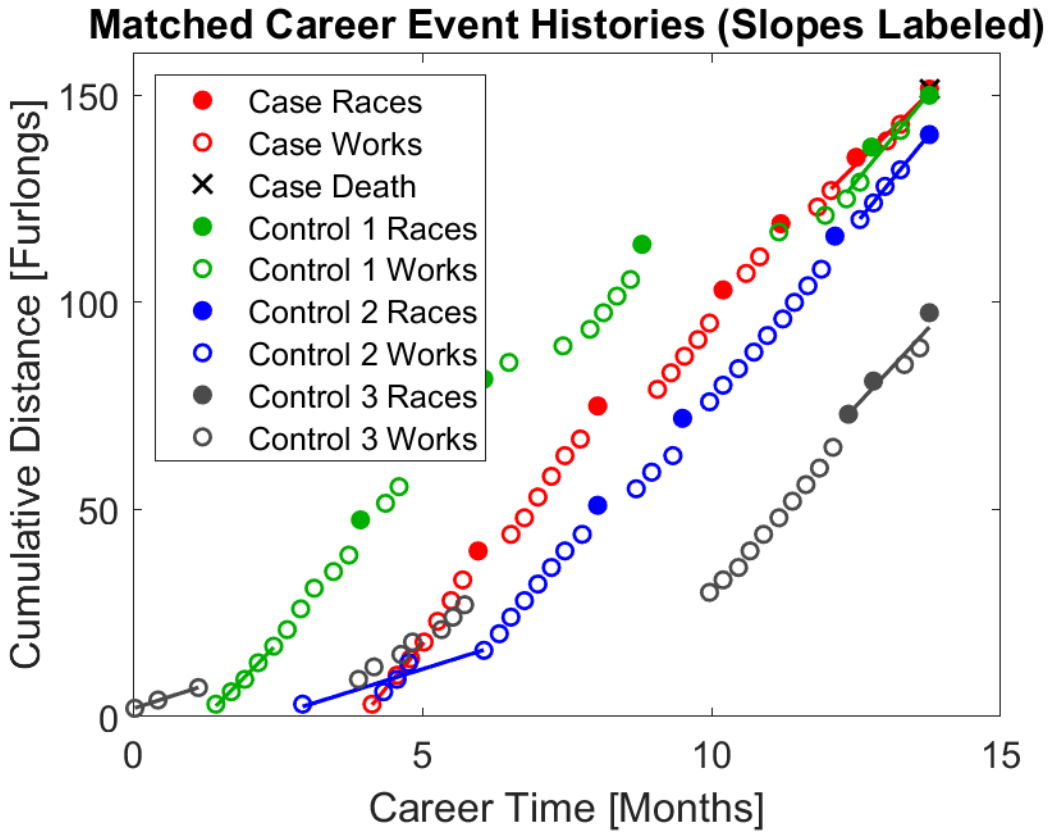


Control 3 High Speed Exercise History

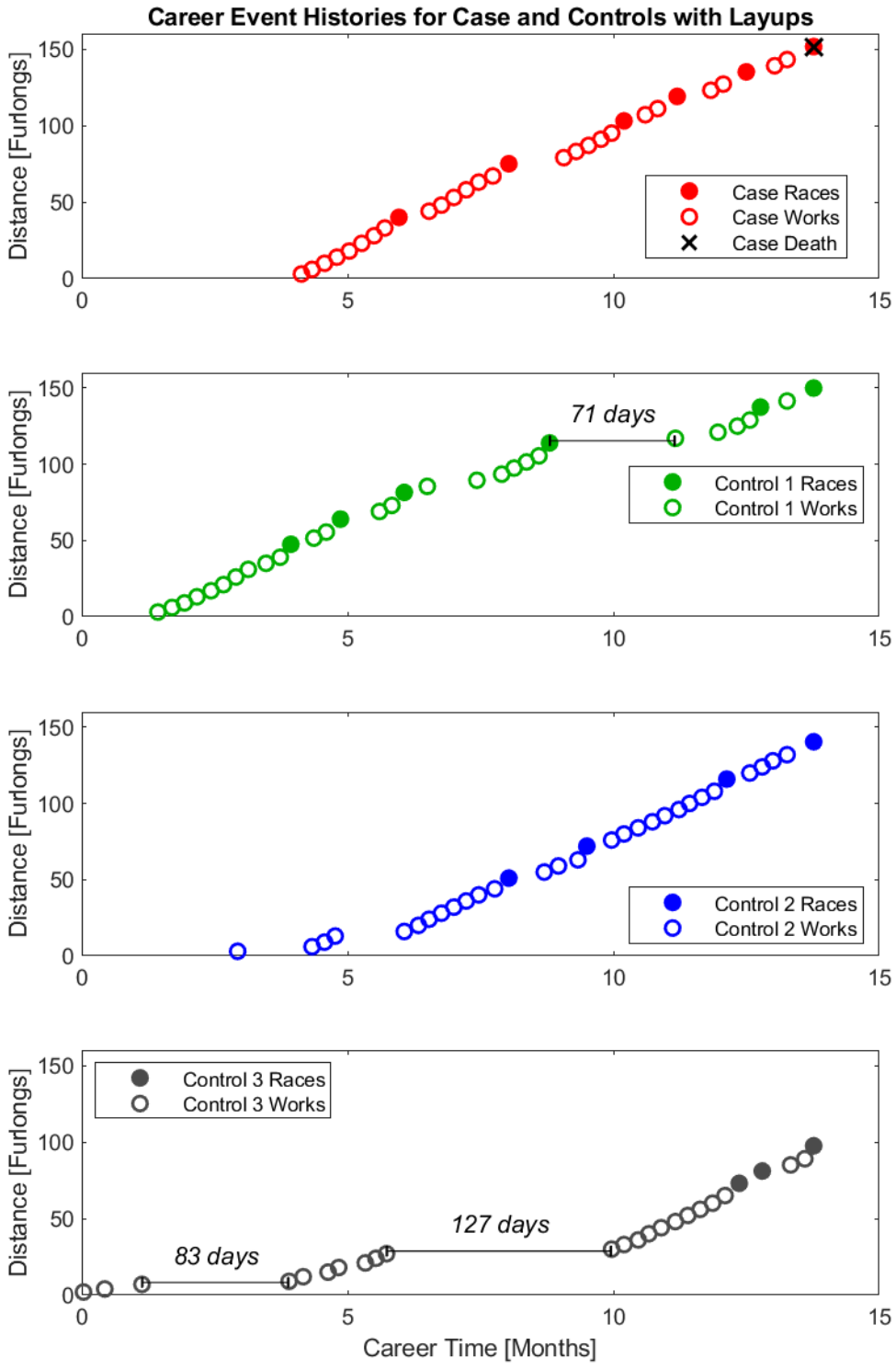


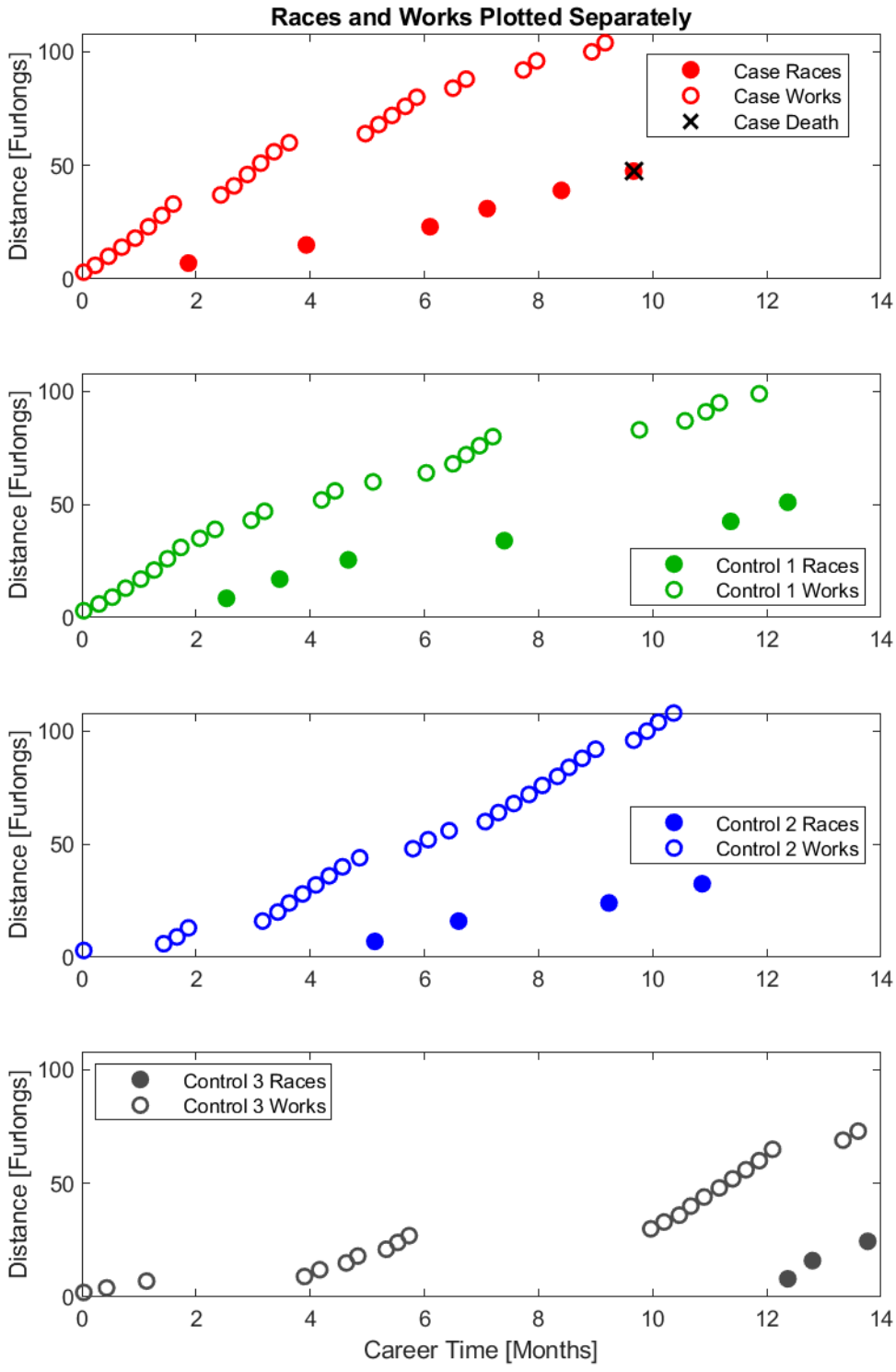


Part 2: Case and Control Horses Plotted Together



Case and Control Horses' exercise event histories are plotted on the same axes. The plots are aligned by the match date (equal to the date of death of Case Horse). Lines segments indicate specific rates of exercise at the start of career, end of career (for Case Horse), and match date (for Control Horses). Event rates are calculated as the slopes of the plots over 2 to 5 events not spanning a layup period, in units of furlongs per month.

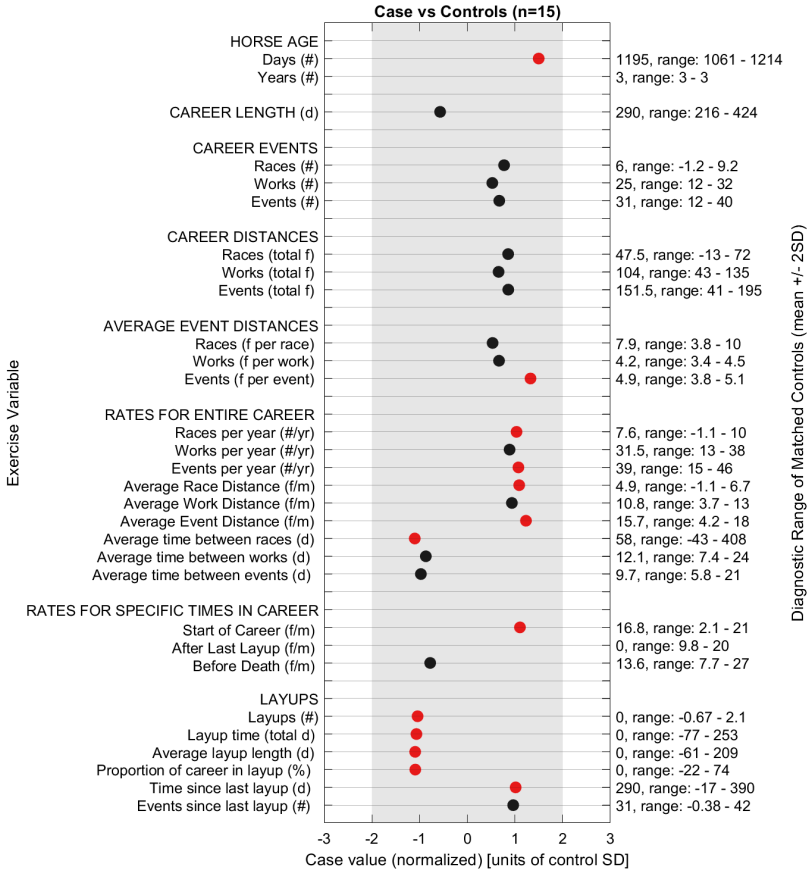

Career Event Histories for Case and Controls with Layups
Distance [Furlongs]
Career Time [Months]
Case Races
Case Works
Case Death
Control 1 Races
Control 1 Works
71 days
Control 2 Races
Control 2 Works
Control 3 Races
Control 3 Works
83 days
127 days


Races and Works Plotted Separately
Distance [Furlongs]
Case Races
Case Works
Case Death
Control 1 Races
Control 1 Works
Control 2 Races
Control 2 Works
Control 3 Races
Control 3 Works
Career Time [Months]

Part 3: Case Horse's Event History

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
5/14/2023	R	8.5	CD	Dirt	Good		3U	Mcl50000	898	10
4/29/2023	W	4.0	GP	Dirt	Fast	:48.26				
4/22/2023	W	4.0	GP	Dirt	Fast	:47.85				
4/6/2023	R	8.0	GP	Turf	Firm		3	Mcl35000	5600	2
3/24/2023	W	4.0	GP	Dirt	Fast	:51.06				
3/17/2023	W	4.0	GP	Dirt	Fast	:49.94				
2/26/2023	R	8.0	GP	Turf	Firm		3	Mcl25000	2520	3
2/15/2023	W	4.0	GP	Dirt	Fast	:47.31				
2/8/2023	W	4.0	GP	Dirt	Fast	:49.26				
1/27/2023	R	8.0	GP	Turf	Firm		3	Moc50000cnd	430	7
1/20/2023	W	4.0	GP	Dirt	Fast	:48.48				
1/14/2023	W	4.0	GP	Dirt	Fast	:49.70				
1/7/2023	W	4.0	GP	Dirt	Fast	:49.60				
12/31/2022	W	4.0	GP	Dirt	Fast	:50.37				
12/24/2022	W	4.0	GP	Dirt	Fast	:51.65				
11/23/2022	R	8.0	CD	Dirt	Fast		2	Mcl50000	900	6
11/14/2022	W	4.0	CD	Dirt	Fast	:48.40				
11/6/2022	W	5.0	CD	Dirt	Fast	01:02.8				
10/30/2022	W	5.0	CD	Dirt	Fast	01:03.2				
10/23/2022	W	5.0	CD	Dirt	Fast	01:01.2				
10/16/2022	W	4.0	CD	Dirt	Fast	:51.20				
10/9/2022	W	4.0	CD	Dirt	Fast	:49.20				
9/22/2022	R	7.0	CD	Dirt	Fast		2	Msw	1273	10
9/14/2022	W	5.0	CD	Dirt	Fast	:59.80				
9/8/2022	W	5.0	CD	Dirt	Fast	01:01.4				
9/1/2022	W	5.0	CD	Dirt	Fast	01:01.4				
8/25/2022	W	4.0	CD	Dirt	Fast	:49.20				
8/18/2022	W	4.0	CD	Dirt	Fast	:48.00				
8/11/2022	W	4.0	CD	Dirt	Fast	:48.20				
8/4/2022	W	3.0	CD	Dirt	Fast	:36.80				
7/29/2022	W	3.0	CD	Dirt	Fast	:38.40				

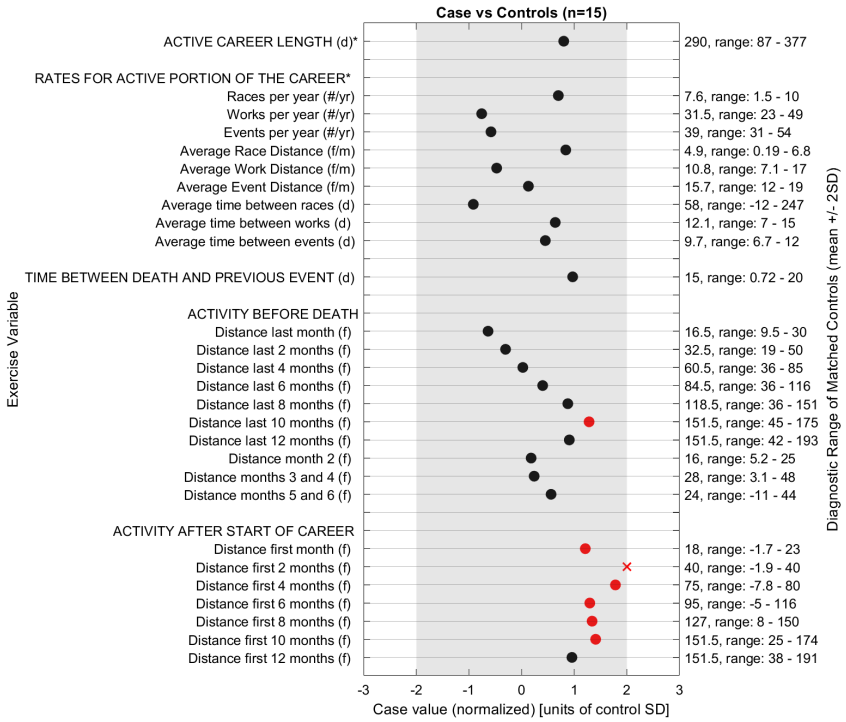
Part 4: Comparison of Exercise Variables between Case Horse and 15 Control Horses (3 year old, male, Thoroughbred)



Case Horse values are indicated by black or red symbols: circles indicate values considered normal for 95% of 3 year old, male, Thoroughbreds (n=15) (gray region) (black and red indicate within 1 and 2 SD, respectively, of mean value of controls), X's indicate values outside of the normal range. Two and 3 year old case horses are also matched to control horses by the quarter in which the case horse died (Jan-Mar, Apr-Jun, Jul-Sep,Oct-Dec). Variables that are not calculable are not plotted (e.g. time between races for a horse with zero events). f=furlongs; yr=year; m=month; d=days.

^Rates are calculated over 2 to 5 events.

*Active Career Length is the career length excluding the time during layups.



Case Horse values are indicated by black or red symbols: circles indicate values considered normal for 95% of 3 year old, male, Thoroughbreds (n=15) (gray region) (black and red indicate within 1 and 2 SD, respectively, of mean value of controls), X's indicate values outside of the normal range. Two and 3 year old case horses are also matched to control horses by the quarter in which the case horse died (Jan-Mar, Apr-Jun, Jul-Sep,Oct-Dec). Variables that are not calculable are not plotted (e.g. time between races for a horse with zero events). f=furlongs; yr=year; m=month; d=days.

^Rates are calculated over 2 to 5 events.

*Active Career Length is the career length excluding the time during layups.

Exercise History Report (Full)

J.D. Wheat Veterinary Orthopedic Research Laboratory

This report summarizes the high speed exercise history for Case Horse. There are four parts to this report:

Part 1 is a graph that depicts the races and officially recorded high speed workouts for Case Horse over the horse's career. The graph is useful for visually assessing features of a horse's career like: career length, periods of layup, and exercise consistency. If Case Horse had zero recorded high-speed exercise events, this graph is not produced. Event histories for three breed, sex, age, and event-matched control horses are also plotted.

Part 2 includes graphs which illustrate Case Horse's exercise history alongside that of Control Horses. These graphs are useful for visually comparing periods of layup and specific rates of exercise in the horses' exercise histories.

Part 3 is a chronological listing of races and officially timed works beginning with the most recent event (race or work).

Part 4 is a chart that allows comparison of exercise variables between Case Horse and other racehorses of similar age, sex, and breed that did not die at the same time from an injury. Similar to comparing the results of a blood test to a range of normal values, the values for Case Horse can be assessed in the context of a normal range for 95% of a sample of similar racehorses that did not die during the same time as Case Horse.

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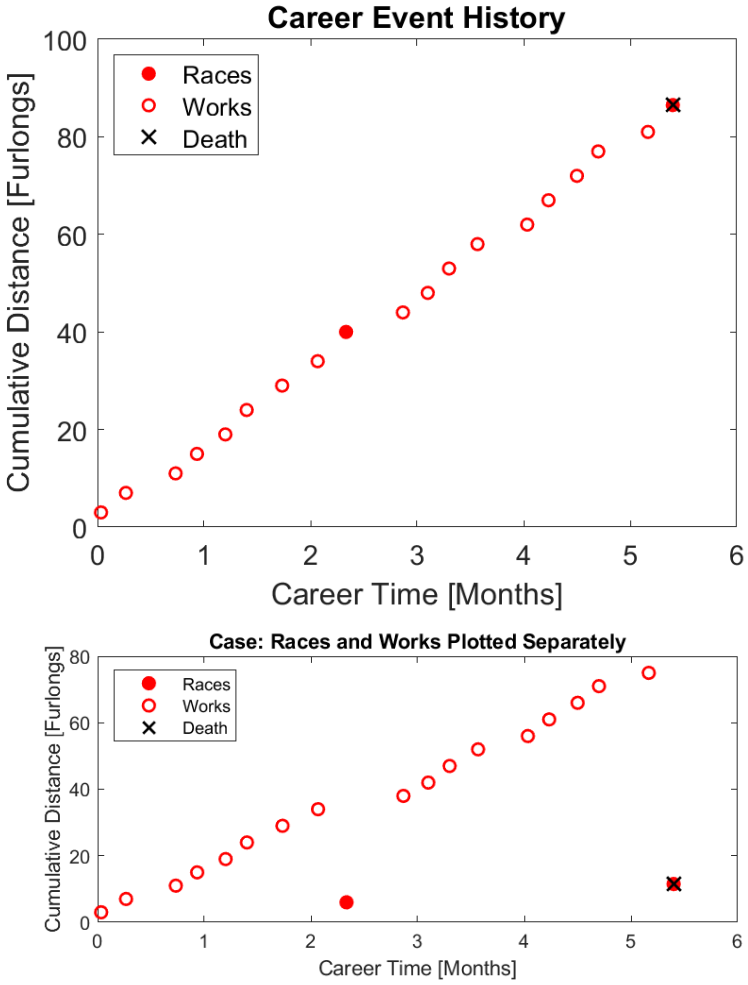
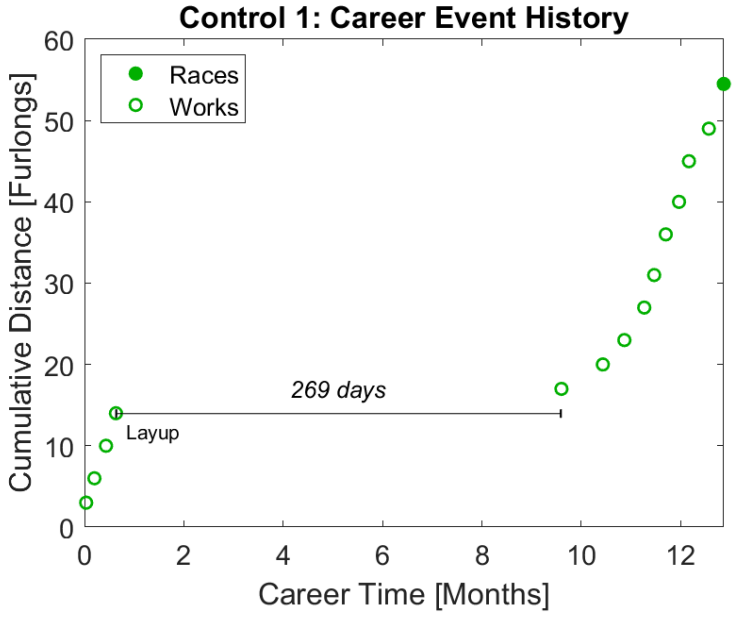
Part 1: Graphical Representation of Individual High-Speed Exercise Histories

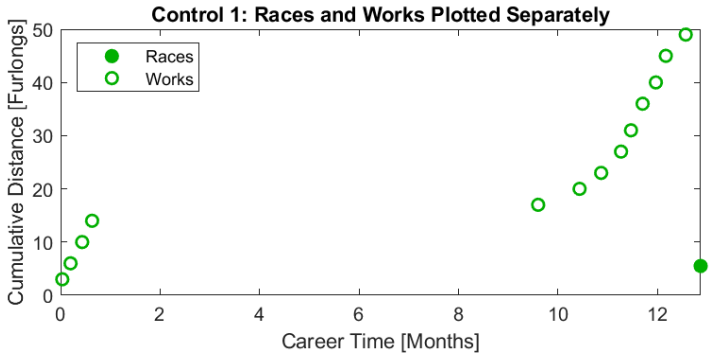
Races (filled circles), officially timed high-speed works (open circles), layups (line with endcaps, periods of time greater than 60 days in length without a race or timed work), and time of death (X) are illustrated over time (Career Time in months). With each event (race or work), the number of furlongs the horse exercised in that event is added to the number of furlongs exercised in all previous events.

Case Horse High Speed Exercise History

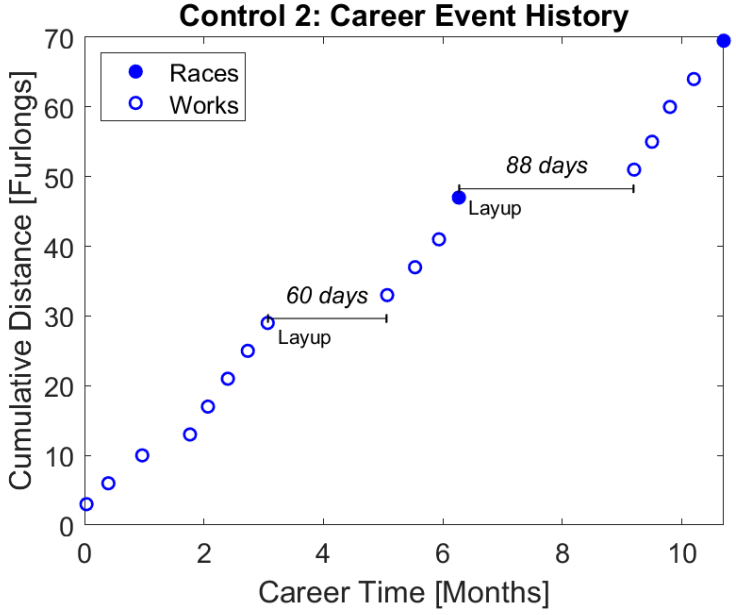


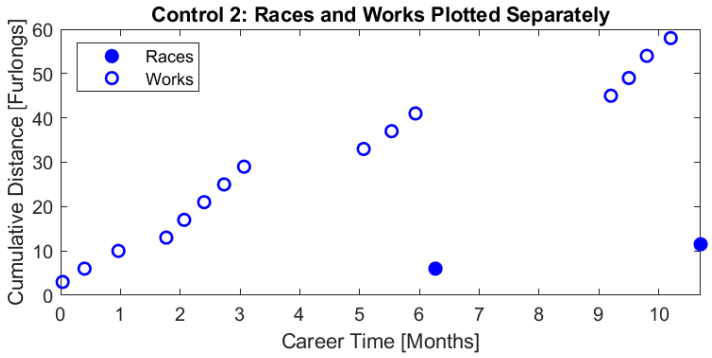
Control 1 High Speed Exercise History



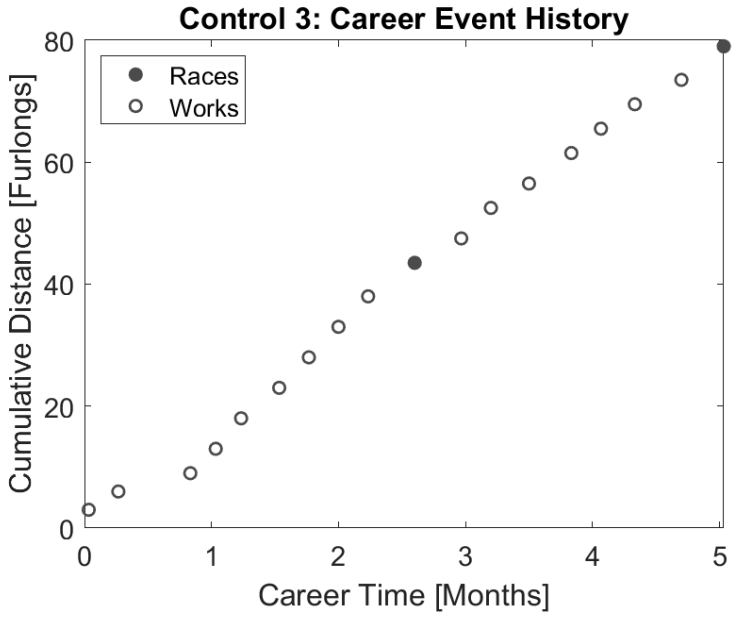


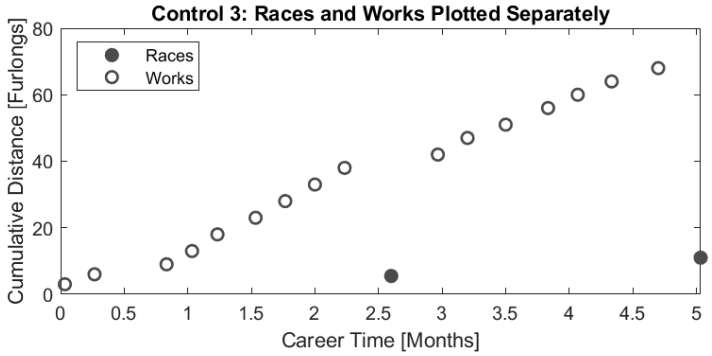
Control 2 High Speed Exercise History



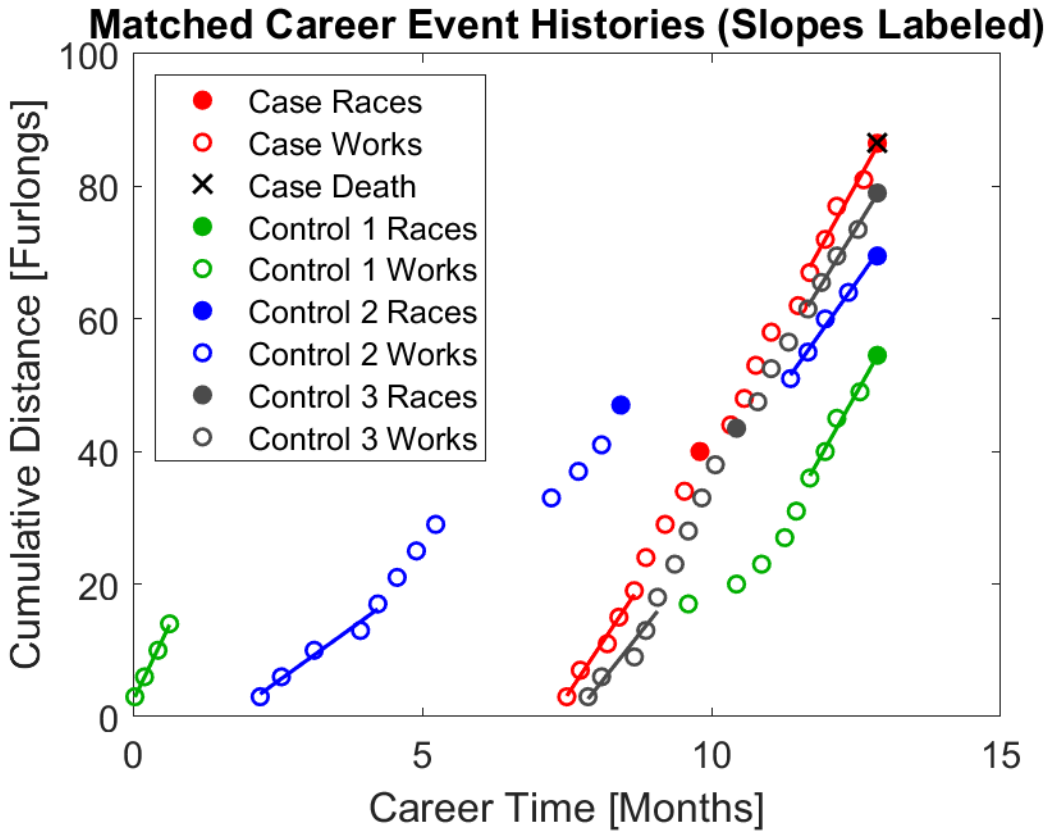


Control 3 High Speed Exercise History

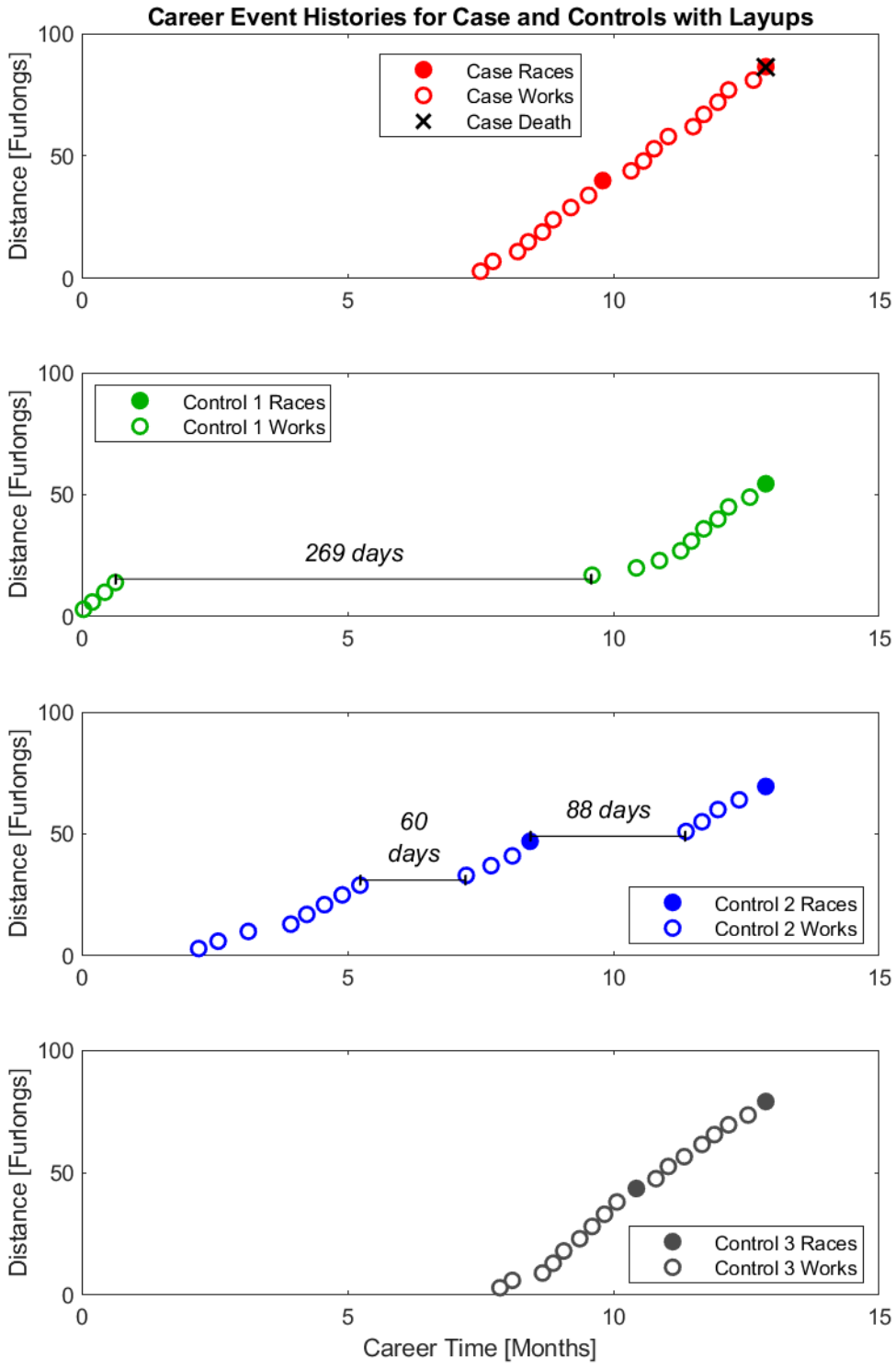


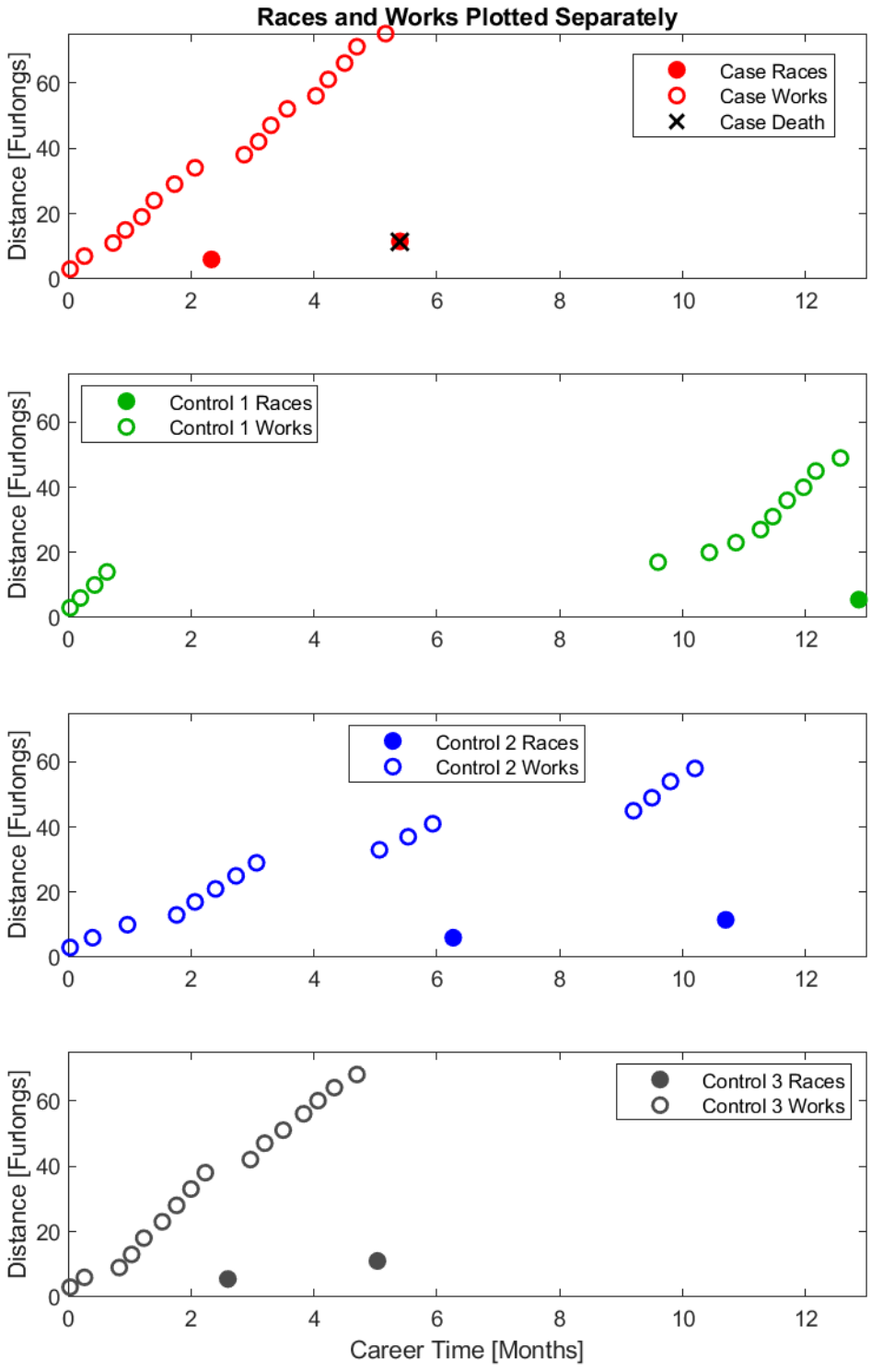


Part 2: Case and Control Horses Plotted Together



Case and Control Horses' exercise event histories are plotted on the same axes. The plots are aligned by the match date (equal to the date of death of Case Horse). Lines segments indicate specific rates of exercise at the start of career, end of career (for Case Horse), and match date (for Control Horses). Event rates are calculated as the slopes of the plots over 2 to 5 events not spanning a layup period, in units of furlongs per month.

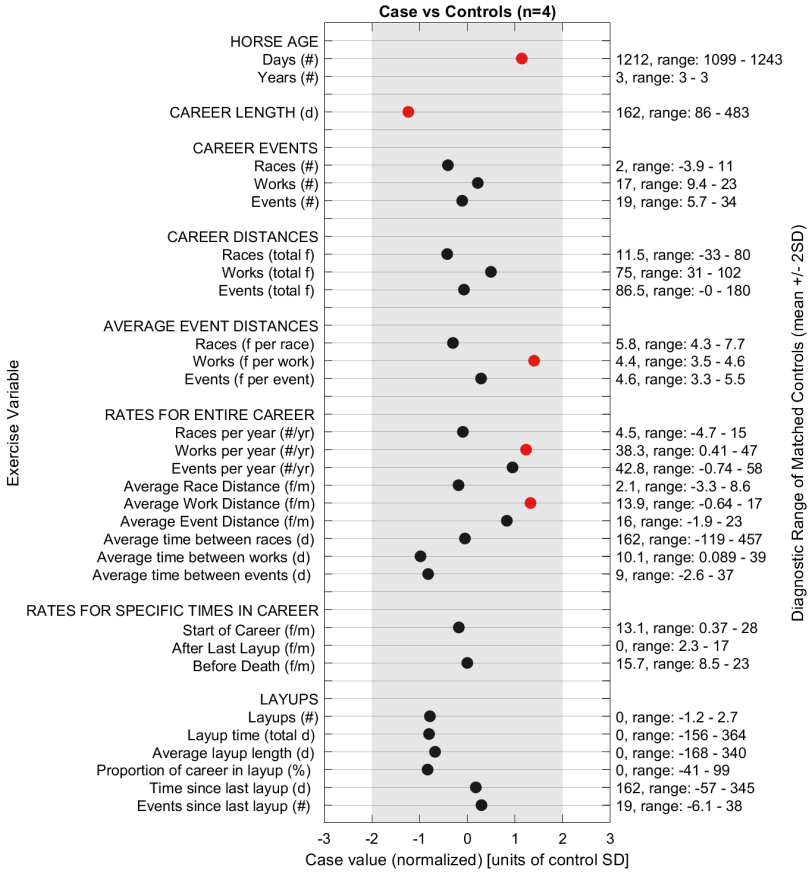

Career Event Histories for Case and Controls with Layups
Distance [Furlongs]
Case Races
Case Works
Case Death
Control 1 Races
Control 1 Works
269 days
60
days
88 days
Control 2 Races
Control 2 Works
Control 3 Races
Control 3 Works
Career Time [Months]


Races and Works Plotted Separately
Distance [Furlongs]
Case Races
Case Works
Case Death
Control 1 Races
Control 1 Works
Control 2 Races
Control 2 Works
Control 3 Races
Control 3 Works
Career Time [Months]

Part 3: Case Horse's Event History

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
5/20/2023	R	5.5	CD	Dirt	Fast		3U / FM	Msw	6000	4
5/13/2023	W	4.0	CD	Dirt	Fast	:48.80				
4/29/2023	W	5.0	CD	Dirt	Fast	01:02.2				
4/23/2023	W	5.0	CD	Dirt	Fast	01:02.4				
4/15/2023	W	5.0	CD	Dirt	Fast	01:01.4				
4/9/2023	W	4.0	CD	Dirt	Fast	:49.80				
3/26/2023	W	5.0	CDT	Dirt	Fast	01:01.6				
3/18/2023	W	5.0	CDT	Dirt	Fast	01:02.8				
3/12/2023	W	4.0	CDT	Dirt	Fast	:49.60				
3/5/2023	W	4.0	CDT	Dirt	Fast	:49.80				
2/17/2023	R	6.0	AQU	Dirt	Sloppy		3 /F	Msw	3200	5
2/9/2023	W	5.0	CDT	Dirt	Fast	01:01.4				
1/30/2023	W	5.0	CDT	Dirt	Fast	01:00.6				
1/20/2023	W	5.0	CDT	Dirt	Fast	01:03.2				
1/14/2023	W	4.0	CDT	Dirt	Fast	:48.20				
1/6/2023	W	4.0	CDT	Dirt	Fast	:50.00				
12/31/2022	W	4.0	CDT	Dirt	Muddy	:50.60				
12/17/2022	W	4.0	CD	Dirt	Fast	:50.00				
12/10/2022	W	3.0	CD	Dirt	Good	:37.20				

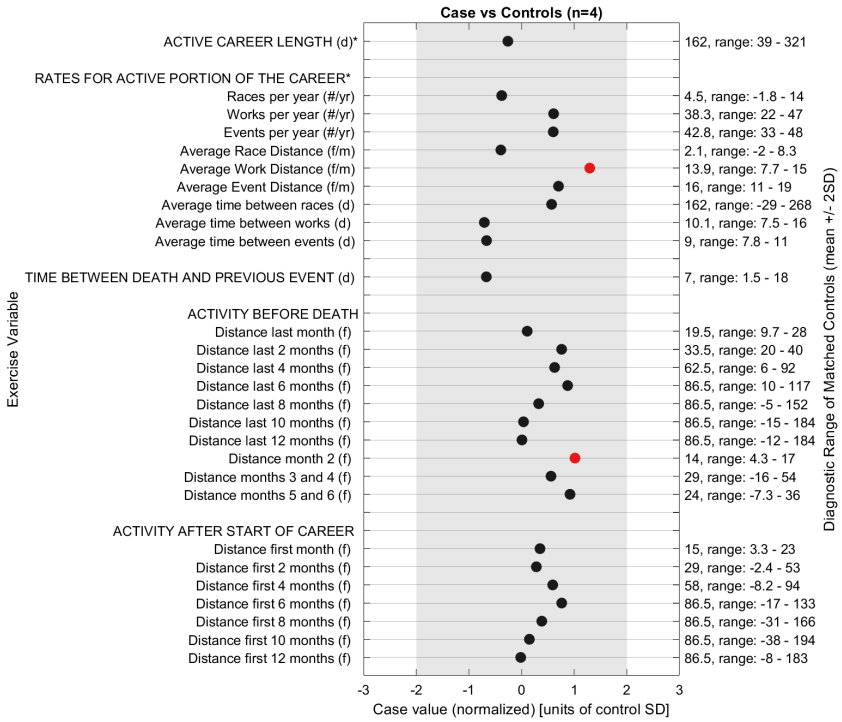
Part 4: Comparison of Exercise Variables between Case Horse and 4 Control Horses (3 year old, female, Thoroughbred)



Case Horse values are indicated by black or red symbols: circles indicate values considered normal for 95% of 3 year old, female, Thoroughbreds (n=4) (gray region) (black and red indicate within 1 and 2 SD, respectively, of mean value of controls), X's indicate values outside of the normal range. Two and 3 year old case horses are also matched to control horses by the quarter in which the case horse died (Jan-Mar, Apr-Jun, Jul-Sep,Oct-Dec). Variables that are not calculable are not plotted (e.g. time between races for a horse with zero events). f=furlongs; yr=year; m=month; d=days.

^Rates are calculated over 2 to 5 events.

*Active Career Length is the career length excluding the time during layups.



Case Horse values are indicated by black or red symbols: circles indicate values considered normal for 95% of 3 year old, female, Thoroughbreds (n=4) (gray region) (black and red indicate within 1 and 2 SD, respectively, of mean value of controls), X's indicate values outside of the normal range. Two and 3 year old case horses are also matched to control horses by the quarter in which the case horse died (Jan-Mar, Apr-Jun, Jul-Sep,Oct-Dec). Variables that are not calculable are not plotted (e.g. time between races for a horse with zero events). f=furlongs; yr=year; m=month; d=days.

^Rates are calculated over 2 to 5 events.

*Active Career Length is the career length excluding the time during layups.

Exercise History Report (Full)

J.D. Wheat Veterinary Orthopedic Research Laboratory

This report summarizes the high speed exercise history for Case Horse. There are four parts to this report:

Part 1 is a graph that depicts the races and officially recorded high speed workouts for Case Horse over the horse's career. The graph is useful for visually assessing features of a horse's career like: career length, periods of layup, and exercise consistency. If Case Horse had zero recorded high-speed exercise events, this graph is not produced. Event histories for three breed, sex, age, and event-matched control horses are also plotted.

Part 2 includes graphs which illustrate Case Horse's exercise history alongside that of Control Horses. These graphs are useful for visually comparing periods of layup and specific rates of exercise in the horses' exercise histories.

Part 3 is a chronological listing of races and officially timed works beginning with the most recent event (race or work).

Part 4 is a chart that allows comparison of exercise variables between Case Horse and other racehorses of similar age, sex, and breed that did not die at the same time from an injury. Similar to comparing the results of a blood test to a range of normal values, the values for Case Horse can be assessed in the context of a normal range for 95% of a sample of similar racehorses that did not die during the same time as Case Horse.

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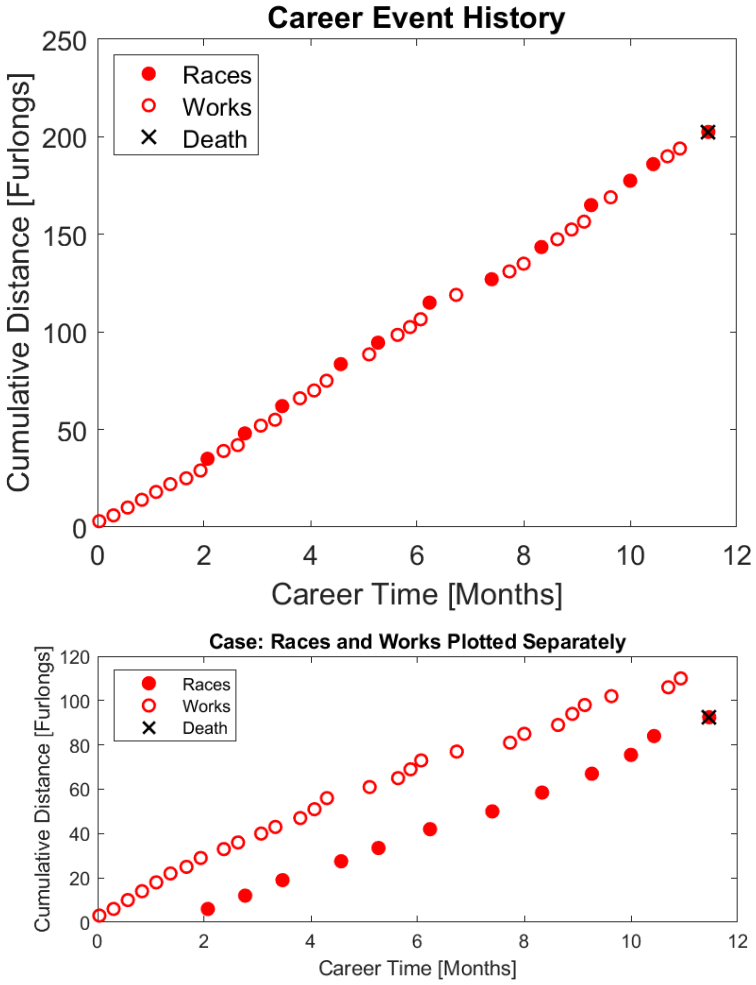
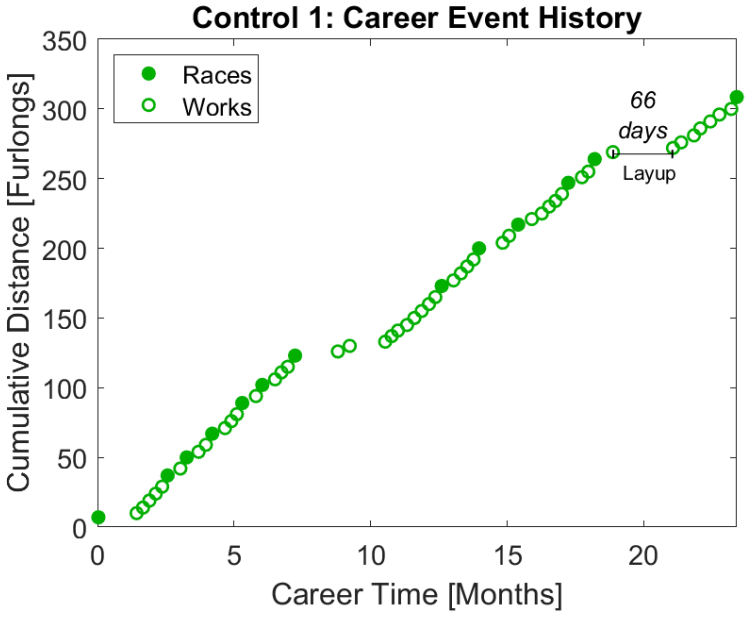
Part 1: Graphical Representation of Individual High-Speed Exercise Histories

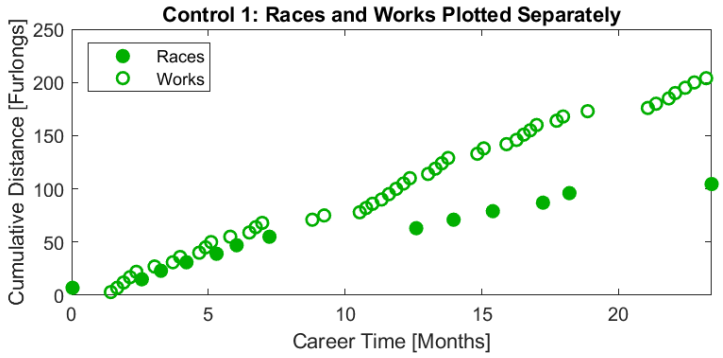
Races (filled circles), officially timed high-speed works (open circles), layups (line with endcaps, periods of time greater than 60 days in length without a race or timed work), and time of death (X) are illustrated over time (Career Time in months). With each event (race or work), the number of furlongs the horse exercised in that event is added to the number of furlongs exercised in all previous events.

Case Horse High Speed Exercise History

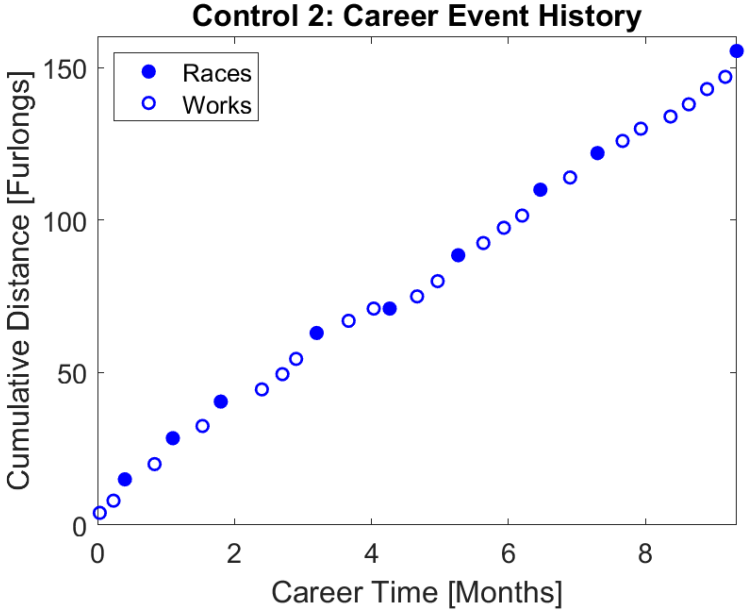


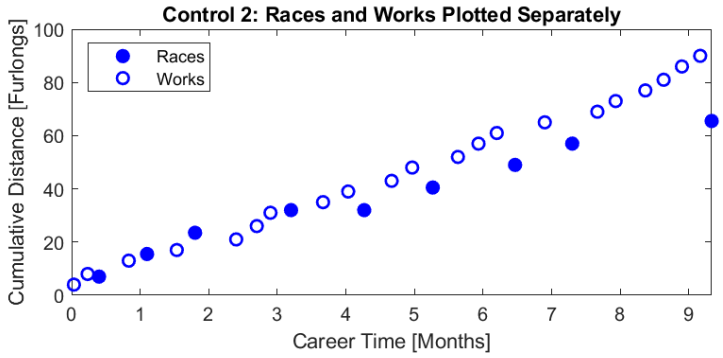
Control 1 High Speed Exercise History



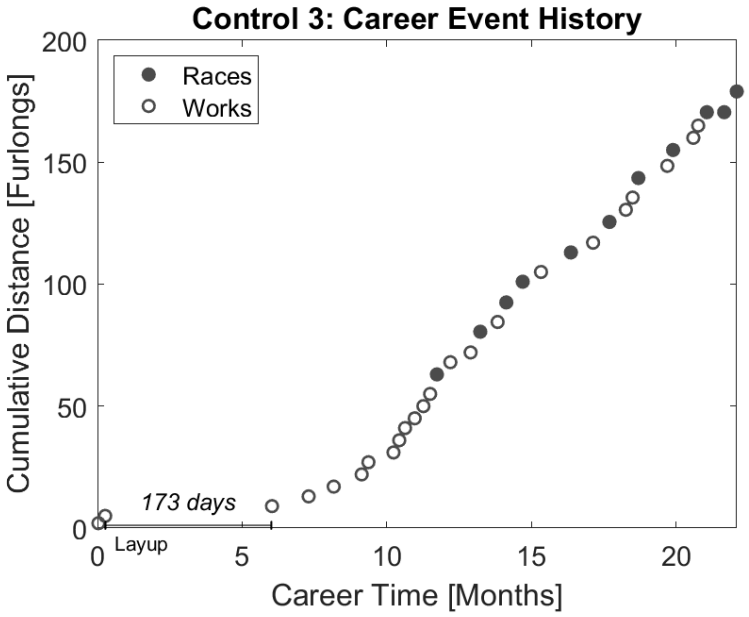


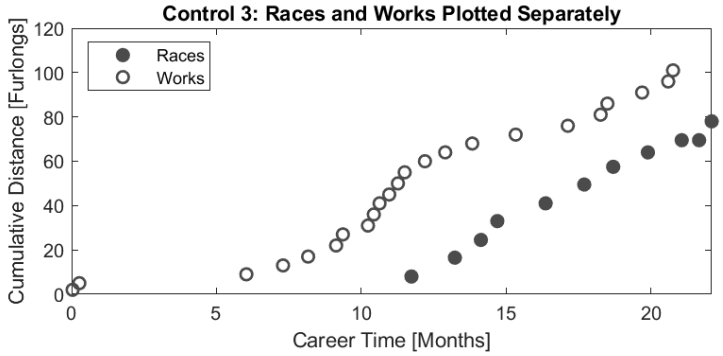
Control 2 High Speed Exercise History



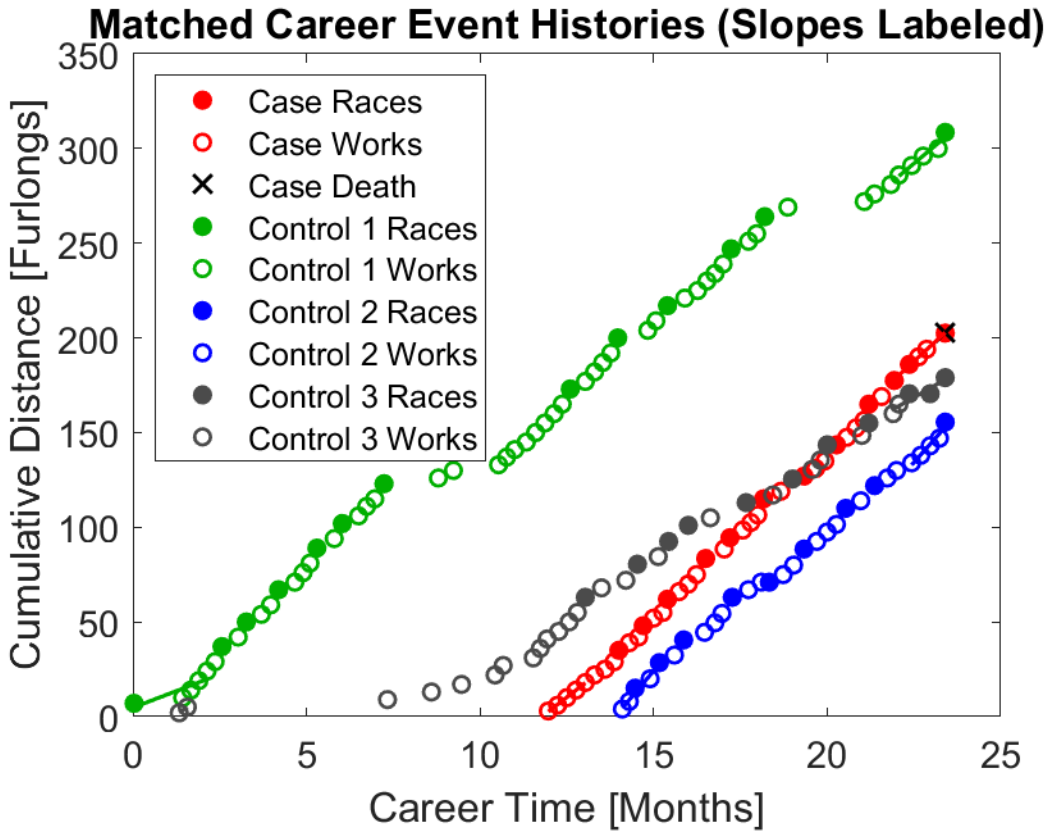


Control 3 High Speed Exercise History

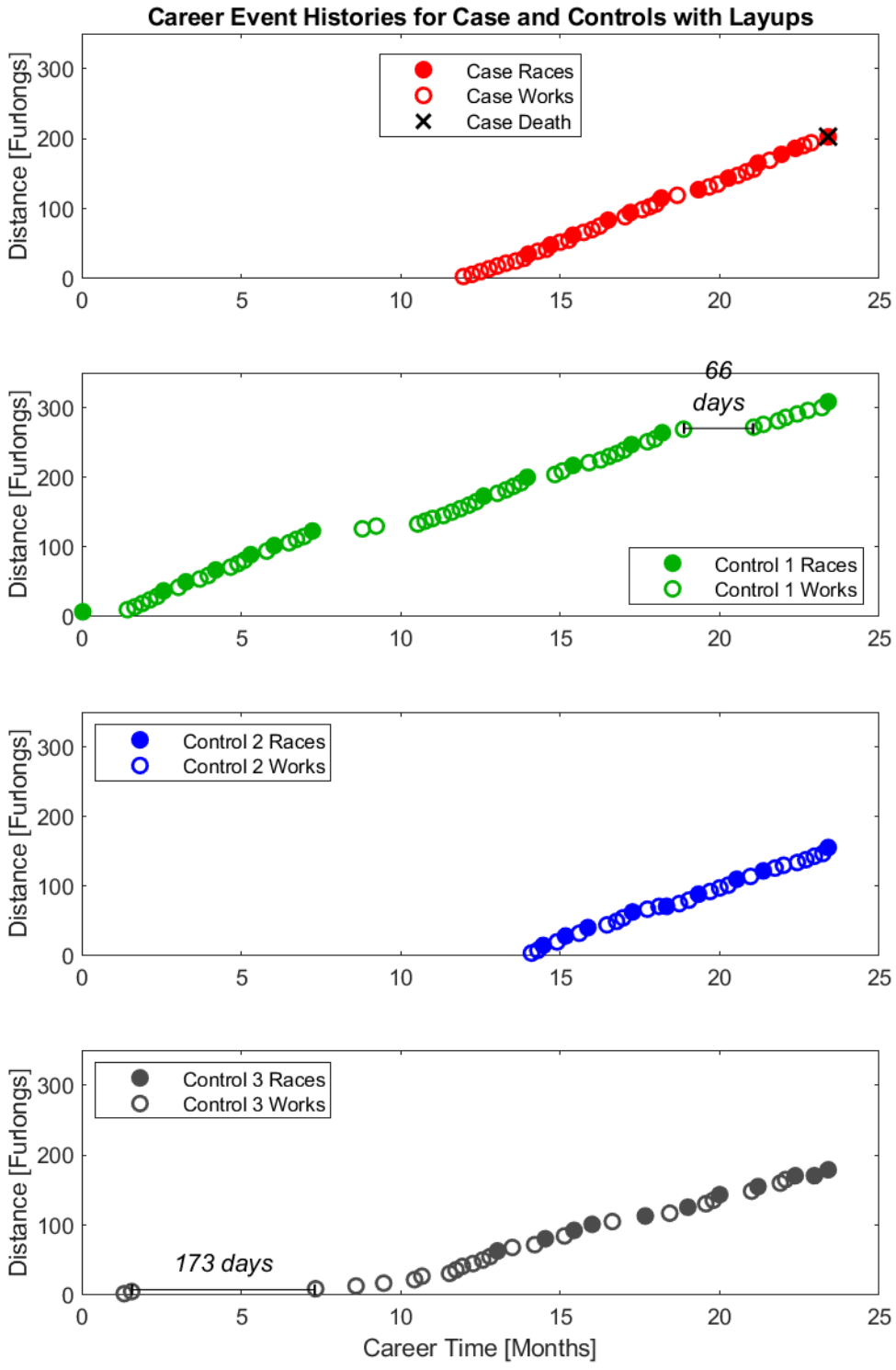


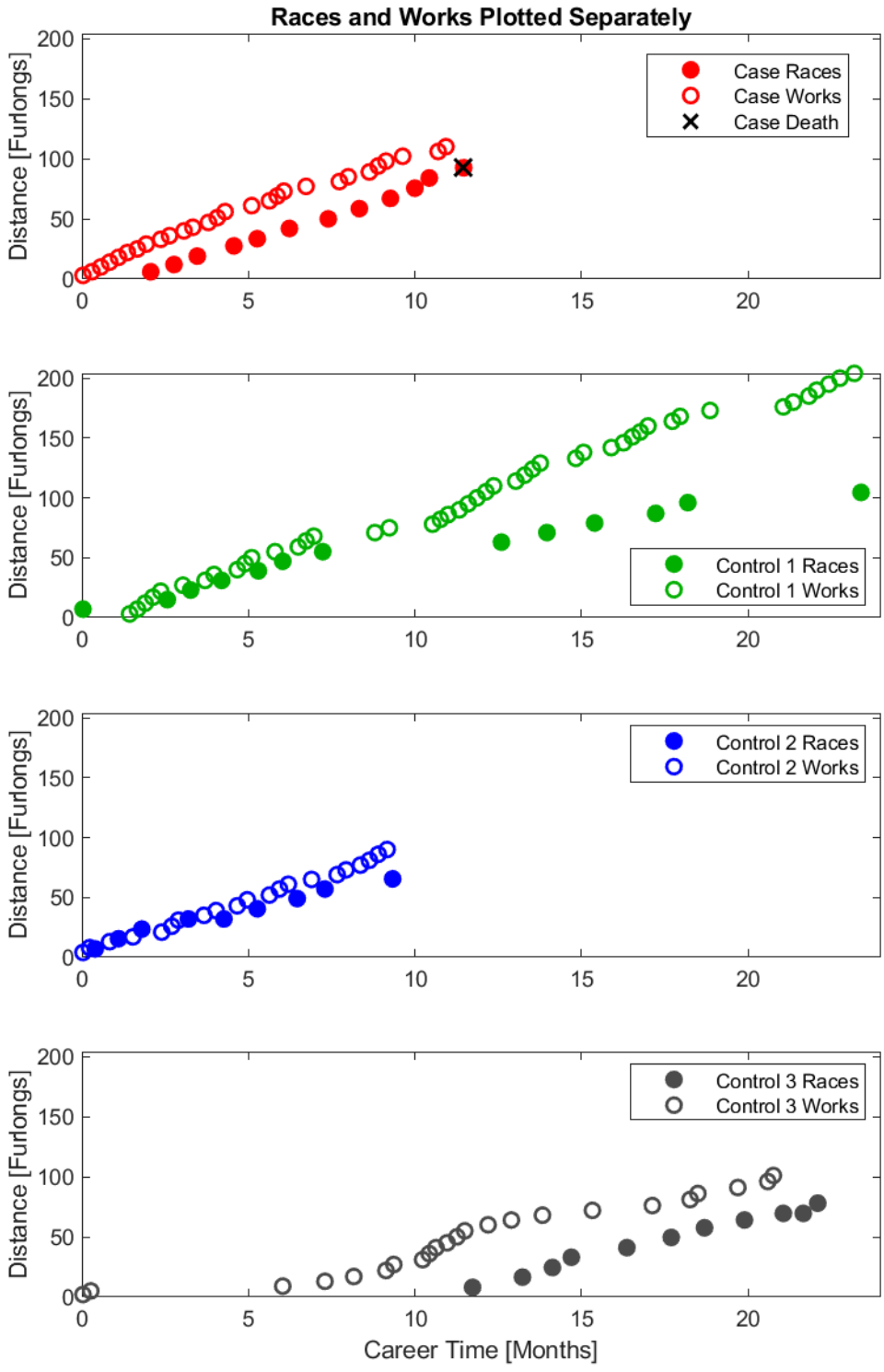


Part 2: Case and Control Horses Plotted Together



Case and Control Horses' exercise event histories are plotted on the same axes. The plots are aligned by the match date (equal to the date of death of Case Horse). Lines segments indicate specific rates of exercise at the start of career, end of career (for Case Horse), and match date (for Control Horses). Event rates are calculated as the slopes of the plots over 2 to 5 events not spanning a layup period, in units of furlongs per month.


Career Event Histories for Case and Controls with Layups
Case Races
Case Works
Case Death
Distance [Furlongs]
66
days
Control 1 Races
Control 1 Works
Control 2 Races
Control 2 Works
Control 3 Races
Control 3 Works
173 days
Career Time [Months]

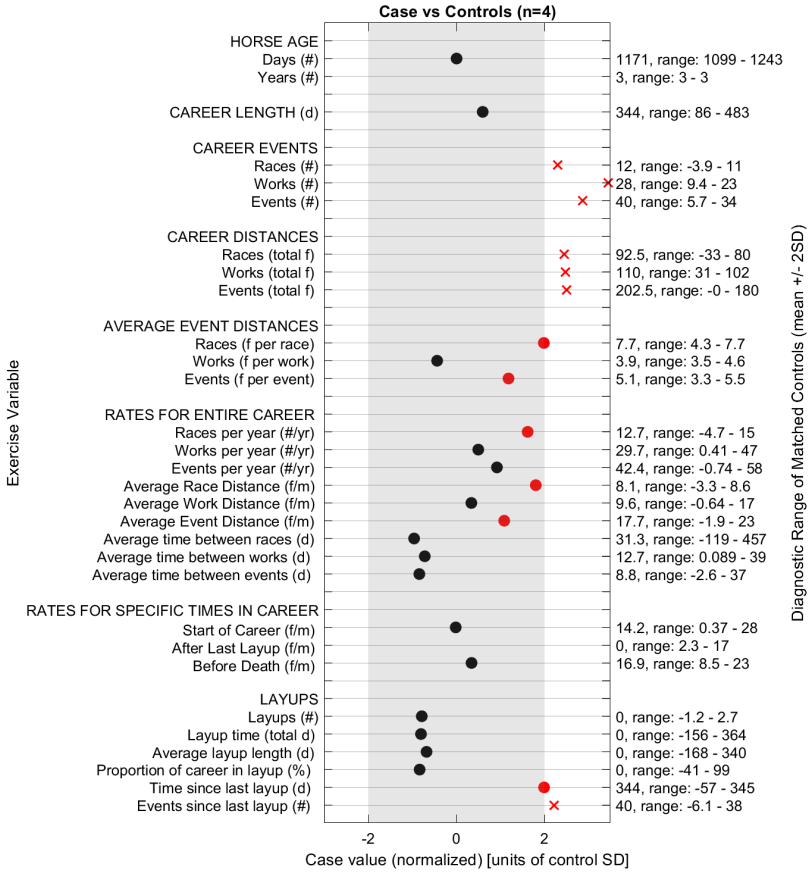

Races and Works Plotted Separately
Distance [Furlongs]
Career Time [Months]
Case Races
Case Works
Case Death
Control 1 Races
Control 1 Works
Control 2 Races
Control 2 Works
Control 3 Races
Control 3 Works

Part 3: Case Horse's Event History

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
5/2/2023	R	8.5	CD	Turf	Firm		3U / FM	Alw127000nw20 L	0	8
4/16/2023	W	4.0	OP	Dirt	Fast	:47.60				
4/9/2023	W	4.0	OP	Dirt	Fast	:48.00				
4/1/2023	R	8.5	OP	Dirt	Fast		3 /F	FantasyG3 -600k	9000	8
3/19/2023	R	8.5	OP	Dirt	Fast		3 /F	Aoc100000cnd-N	20800	2
3/8/2023	W	4.0	OP	Dirt	Good	:48.20				
2/25/2023	R	8.5	OP	Dirt	Sloppy		3 /F	HoneybeeG3 -300k	4500	7
2/21/2023	W	4.0	OP	Dirt	Fast	:50.20				
2/14/2023	W	5.0	OP	Dirt	Fast	01:01.6				
2/6/2023	W	4.0	OP	Dirt	Fast	:48.60				
1/28/2023	R	8.5	OP	Dirt	Wet Fast		3 /F	MWashngtnL -200k	9700	4
1/18/2023	W	4.0	OP	Dirt	Fast	:50.60				
1/10/2023	W	4.0	OP	Dirt	Fast	:48.60				
12/31/2022	R	8.0	OP	Dirt	Fast		2 /F	YearsEndB -150k	13875	3
12/11/2022	W	4.0	OP	Dirt	Muddy	:48.80				
11/26/2022	R	8.5	CD	Dirt	Fast		2 /F	GoldnRodG2 -400k	0	8
11/21/2022	W	4.0	CD	Dirt	Fast	:48.80				
11/15/2022	W	4.0	CD	Dirt	Fast	:49.40				
11/8/2022	W	4.0	CD	Dirt	Fast	:46.80				
10/28/2022	R	6.0	KEE	Dirt	Fast		2 /F	MyrtlwoodB -200k	9375	4
10/23/2022	W	5.0	CD	Dirt	Fast	01:01.4				
10/7/2022	R	8.5	KEE	Dirt	Fast		2 /F	AlcibiadG1 -500k	6250	10
9/29/2022	W	5.0	CD	Dirt	Fast	01:00.2				
9/22/2022	W	4.0	CD	Dirt	Fast	:47.40				

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
9/14/2022	W	4.0	CD	Dirt	Fast	:48.60				
9/4/2022	R	7.0	SAR	Dirt	Fast		2 /F	Msw	57750	1
8/31/2022	W	3.0	SAR	Dirt training	Muddy	:35.77				
8/23/2022	W	4.0	SAR	Dirt training	Muddy	:49.69				
8/14/2022	R	6.0	SAR	Dirt	Fast		2 /F	Msw	12600	3
8/10/2022	W	3.0	SAR	Dirt training	Fast	:34.74				
8/2/2022	W	4.0	SAR	Dirt training	Fast	:49.22				
7/24/2022	R	6.0	SAR	Dirt	Fast		2 /F	Msw	6300	4
7/20/2022	W	4.0	SAR	Dirt training	Muddy	:48.96				
7/12/2022	W	3.0	SAR	Dirt training	Fast	:38.05				
7/3/2022	W	4.0	CD	Dirt	Fast	:48.60				
6/25/2022	W	4.0	CD	Dirt	Fast	:48.40				
6/17/2022	W	4.0	CD	Dirt	Fast	:48.80				
6/9/2022	W	4.0	CD	Dirt	Fast	:47.40				
6/1/2022	W	3.0	CD	Dirt	Fast	:37.20				
5/24/2022	W	3.0	CD	Dirt	Fast	:36.80				

Part 4: Comparison of Exercise Variables between Case Horse and 4 Control Horses (3 year old, female, Thoroughbred)



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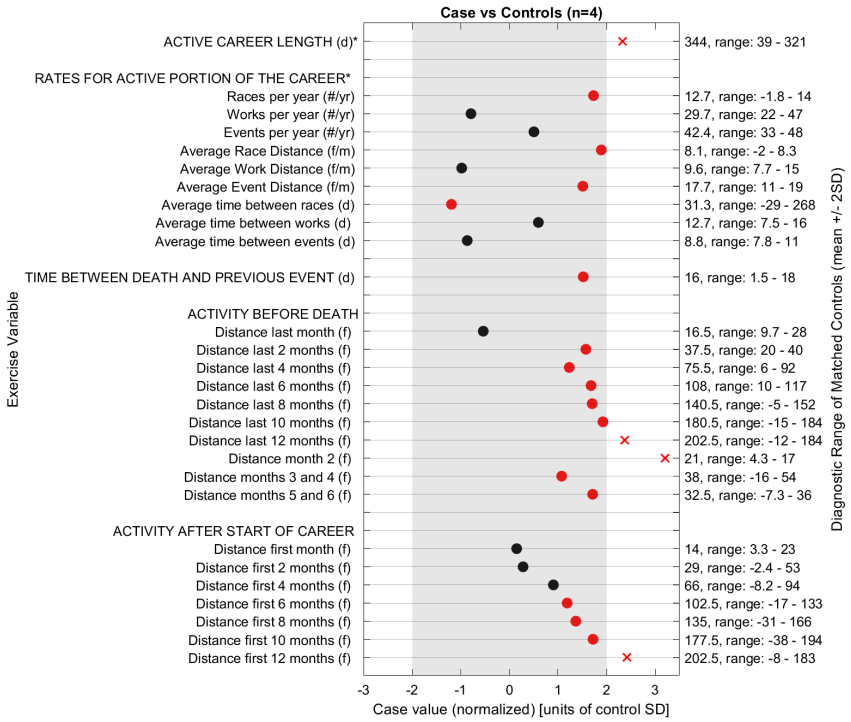

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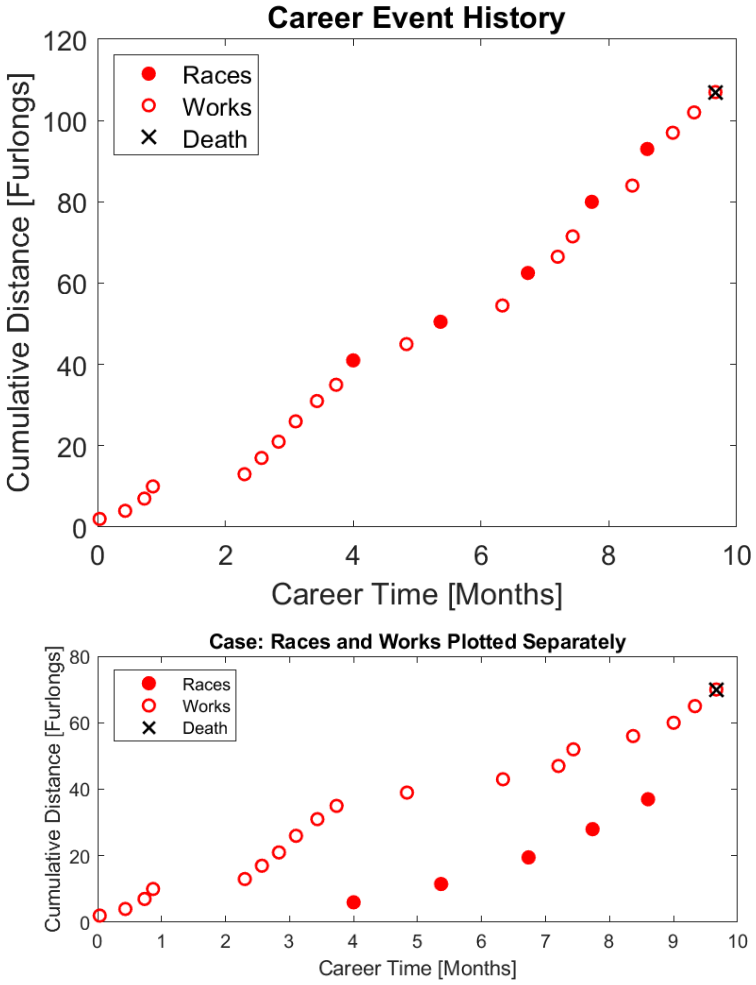

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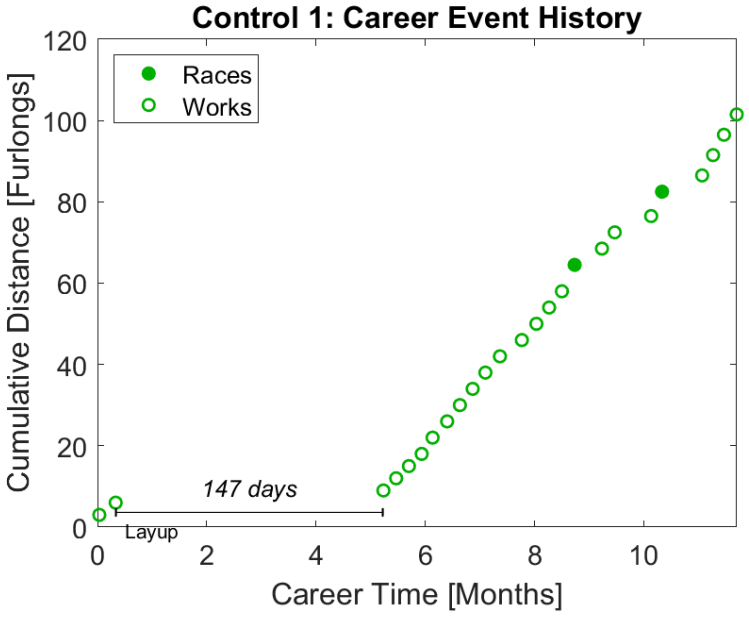
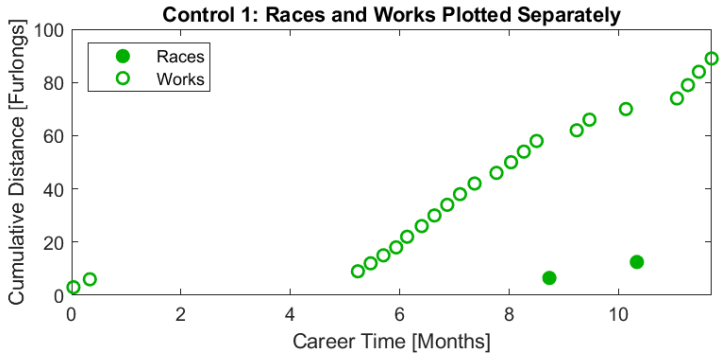
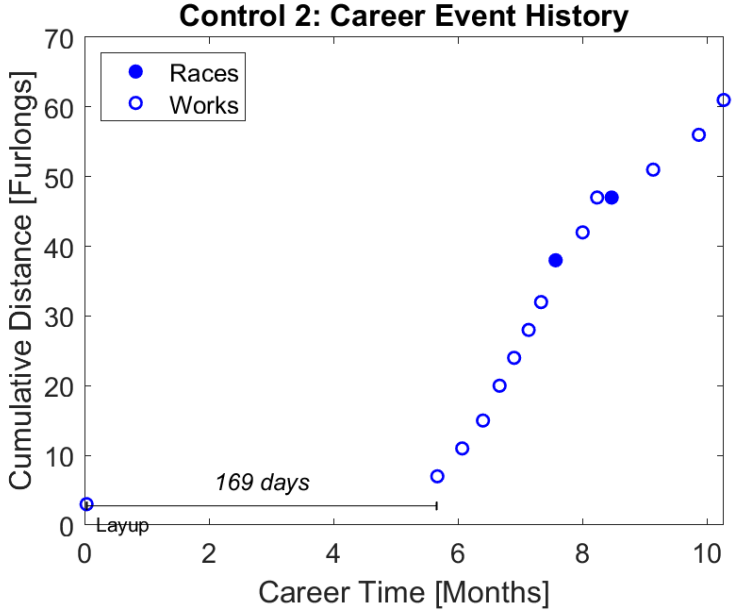
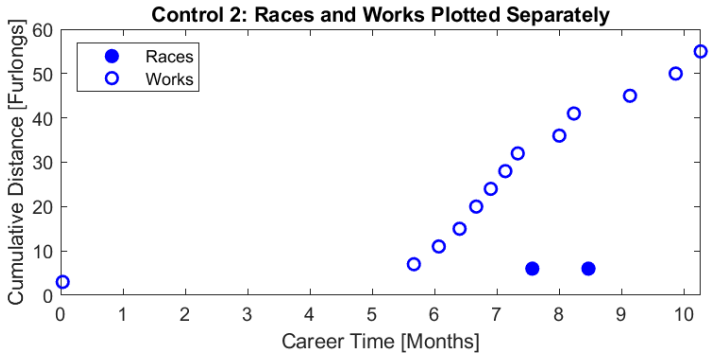


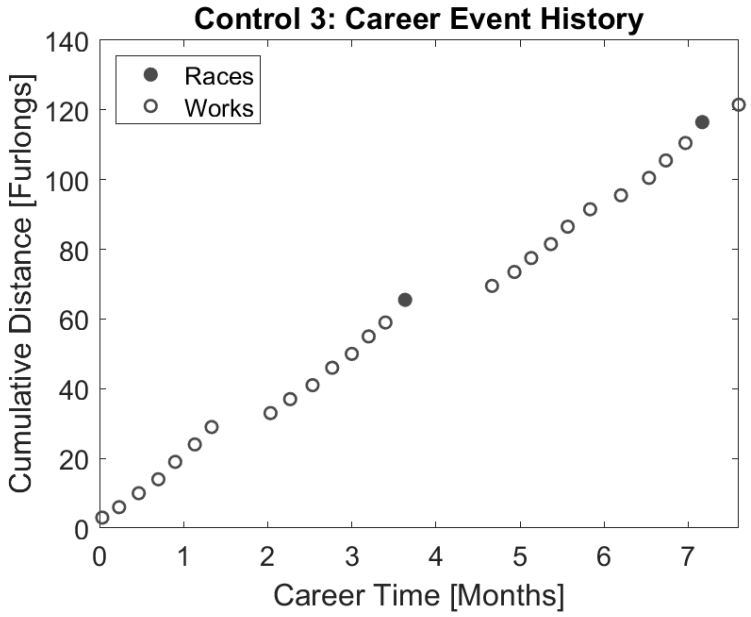


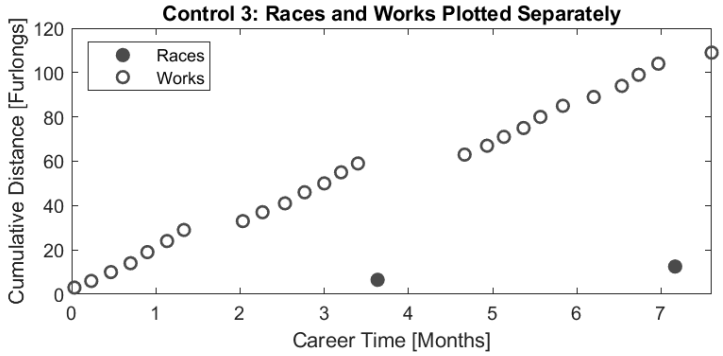
Control 2 High Speed Exercise History





Control 3 High Speed Exercise History





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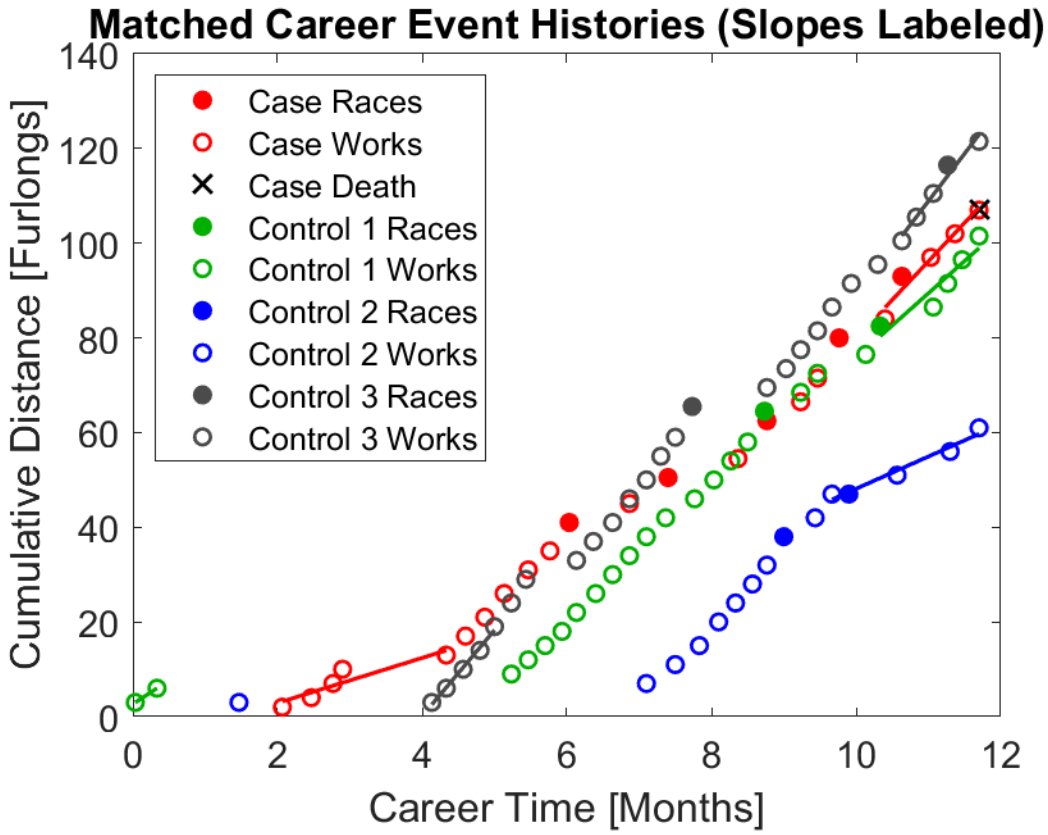

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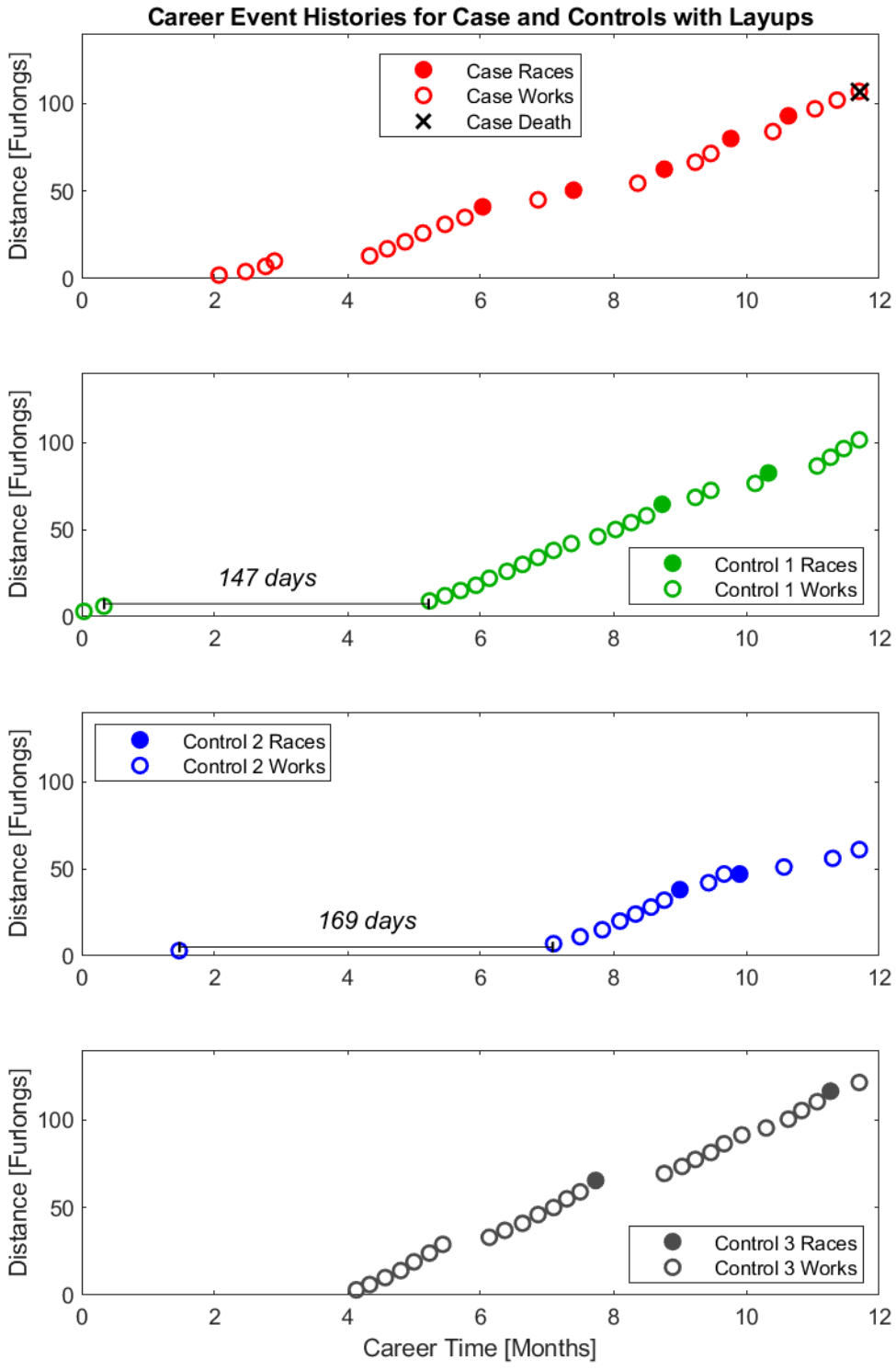
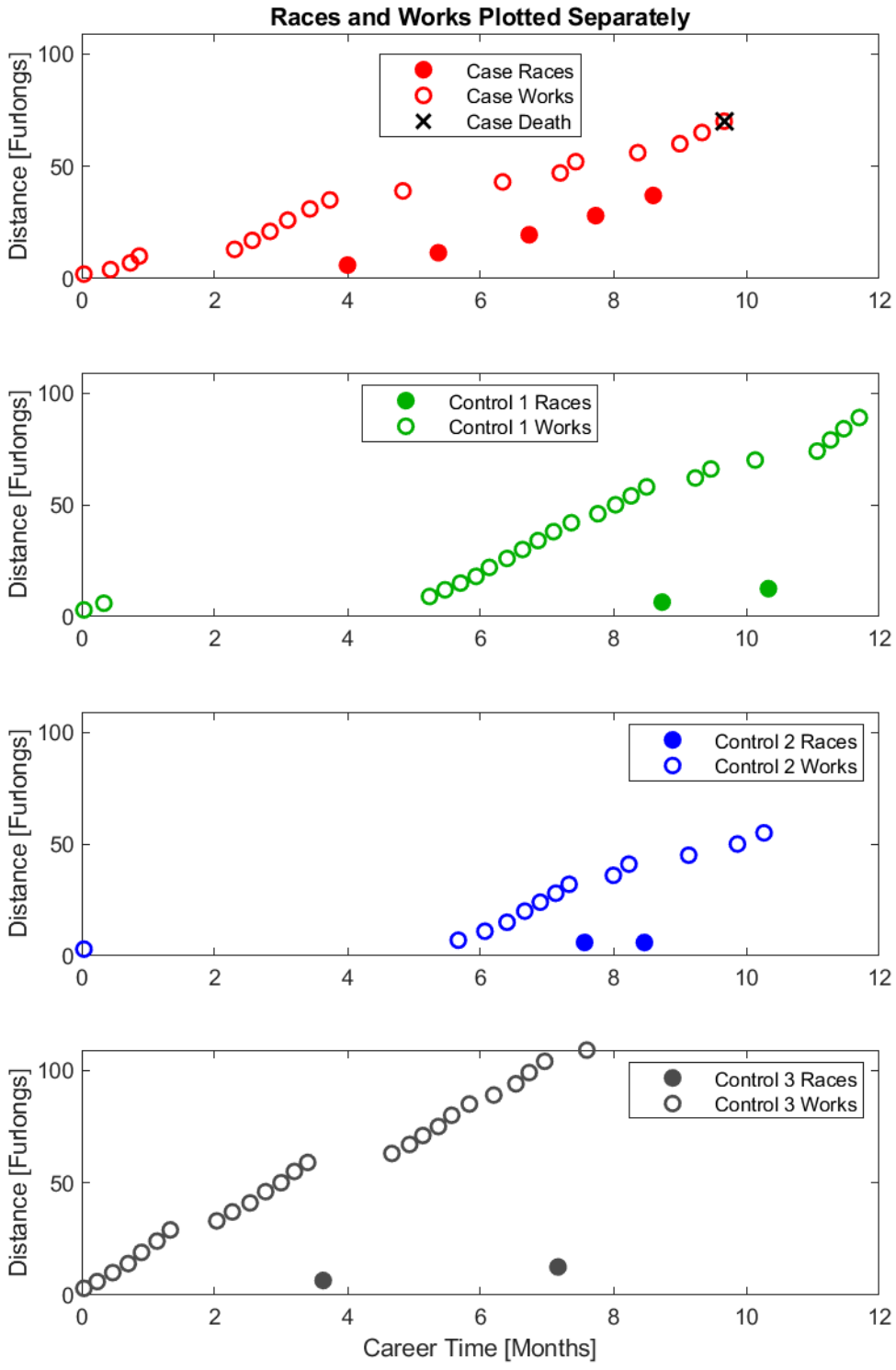
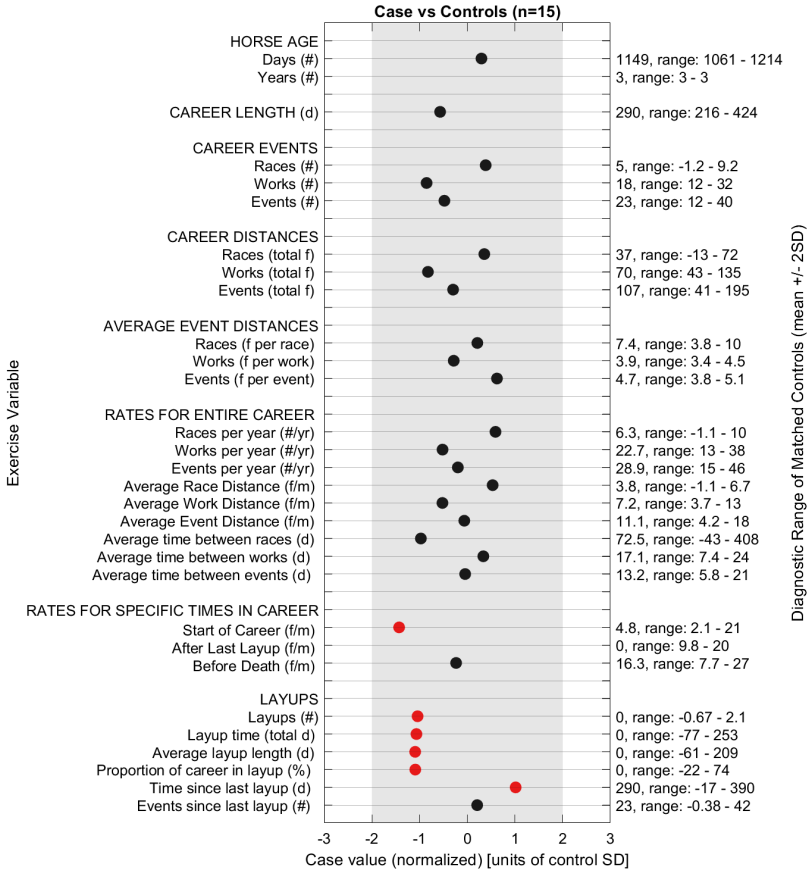

Career Event Histories for Case and Controls with Layups
Case Races
Case Works
Case Death
Distance [Furlongs]
147 days
Control 1 Races
Control 1 Works
169 days
Control 2 Races
Control 2 Works
Control 3 Races
Control 3 Works
Career Time [Months]


Races and Works Plotted Separately
Distance [Furlongs]
Case Races
Case Works
Case Death
Control 1 Races
Control 1 Works
Control 2 Races
Control 2 Works
Control 3 Races
Control 3 Works
Career Time [Months]

Part 3: Case Horse's Event History

Date	Race/ Work	Fur-longs	Track	Surface	Track Cond.	Time	Age/ Sex	Race Class	Earn-ings	Finish
4/27/2023	W	5.0	CD	Dirt	Fast	01:01.4				
4/17/2023	W	5.0	CD	Dirt	Fast	01:00.0				
4/7/2023	W	4.0	SUN	Dirt	Fast	:49.44				
3/26/2023	R	9.0	SUN	Dirt	Fast		3	SunDrbyG3 -600k	356400	1
3/19/2023	W	4.0	SUN	Dirt	Fast	:47.50				
2/28/2023	R	8.5	SUN	Dirt	Fast		3	MineBrDbyB -100k	10000	3
2/19/2023	W	5.0	SUN	Dirt	Fast	01:02.5				
2/12/2023	W	4.0	SUN	Dirt	Fast	:49.04				
1/29/2023	R	8.0	SUN	Dirt	Fast		3	RAllsnDbyB -100k	0	9
1/17/2023	W	4.0	SUN	Dirt	Fast	:47.21				
12/19/2022	R	5.5	ZIA	Dirt	Fast		2	Alw36000nw2/ L	21600	1
12/3/2022	W	4.0	ZIA	Dirt	Fast	:50.40				
11/8/2022	R	6.0	ZIA	Dirt	Fast		2	Msw	17400	1
10/31/2022	W	4.0	ZIA	Dirt	Fast	:46.40				
10/22/2022	W	5.0	ZIA	Dirt	Fast	01:01.6				
10/12/2022	W	5.0	ZIA	Dirt	Fast	01:01.6				
10/4/2022	W	4.0	ZIA	Dirt	Fast	:49.00				
9/26/2022	W	4.0	ZIA	Dirt	Fast	:47.20				
9/18/2022	W	3.0	ZIA	Dirt	Fast	:35.00				
8/6/2022	W	3.0	RUI	Dirt	Fast	:38.42				
8/2/2022	W	3.0	RUI	Dirt	Fast	:36.10				
7/24/2022	W	2.0	RUI	Dirt	Fast	:24.06				
7/12/2022	W	2.0	RUI	Dirt	Fast	:24.73				

Part 4: Comparison of Exercise Variables between Case Horse and 15 Control Horses (3 year old, male, Thoroughbred)



Case Horse values are indicated by black or red symbols: circles indicate values considered normal for 95% of 3 year old, male, Thoroughbreds (n=15) (gray region) (black and red indicate within 1 and 2 SD, respectively, of mean value of controls), X's indicate values outside of the normal range. Two and 3 year old case horses are also matched to control horses by the quarter in which the case horse died (Jan-Mar, Apr-Jun, Jul-Sep,Oct-Dec). Variables that are not calculable are not plotted (e.g. time between races for a horse with zero events). f=furlongs; yr=year; m=month; d=days.

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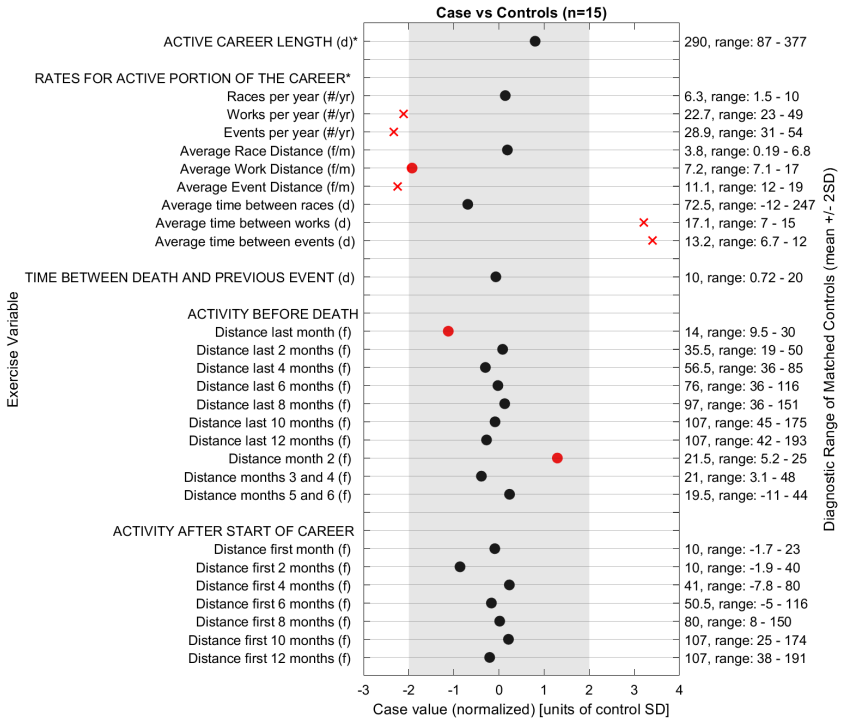

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