Risk Factors in FEI Endurance Rides 2010-2016

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Project overview

Fédération Equestre Internationale

- Direct collaboration (FEI-funded) between the University of Glasgow and the FEI.
- Complete Endurance database from 2010-2016 available for study.
- Data set: 97,462 horse starts in 5,874 events across all nine Region Groups.

Project goals

Horse welfare goals

Quantifying risk factors at horse-, rider-, and ride-level.

Through regulation and education, reduce the risks of serious injury.

Allow for extra veterinary attention for horses in high-risk categories, based on past and real-time data during rides.

Academic goals

Large-scale epidemiological study of Endurance riding on an unprecedented scale

Completeness of data set allows detailed investigation of both known and new risk factors.

Predictive models built using many more risk factors than ever previously available.

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- Of 97,462 horse starts during the time period covered:
  - 35,891 (36.8%) were eliminated at a vet gate (mostly due to a “Failure to Qualify” [FTQ], a small minority for other reasons such as disqualification.)

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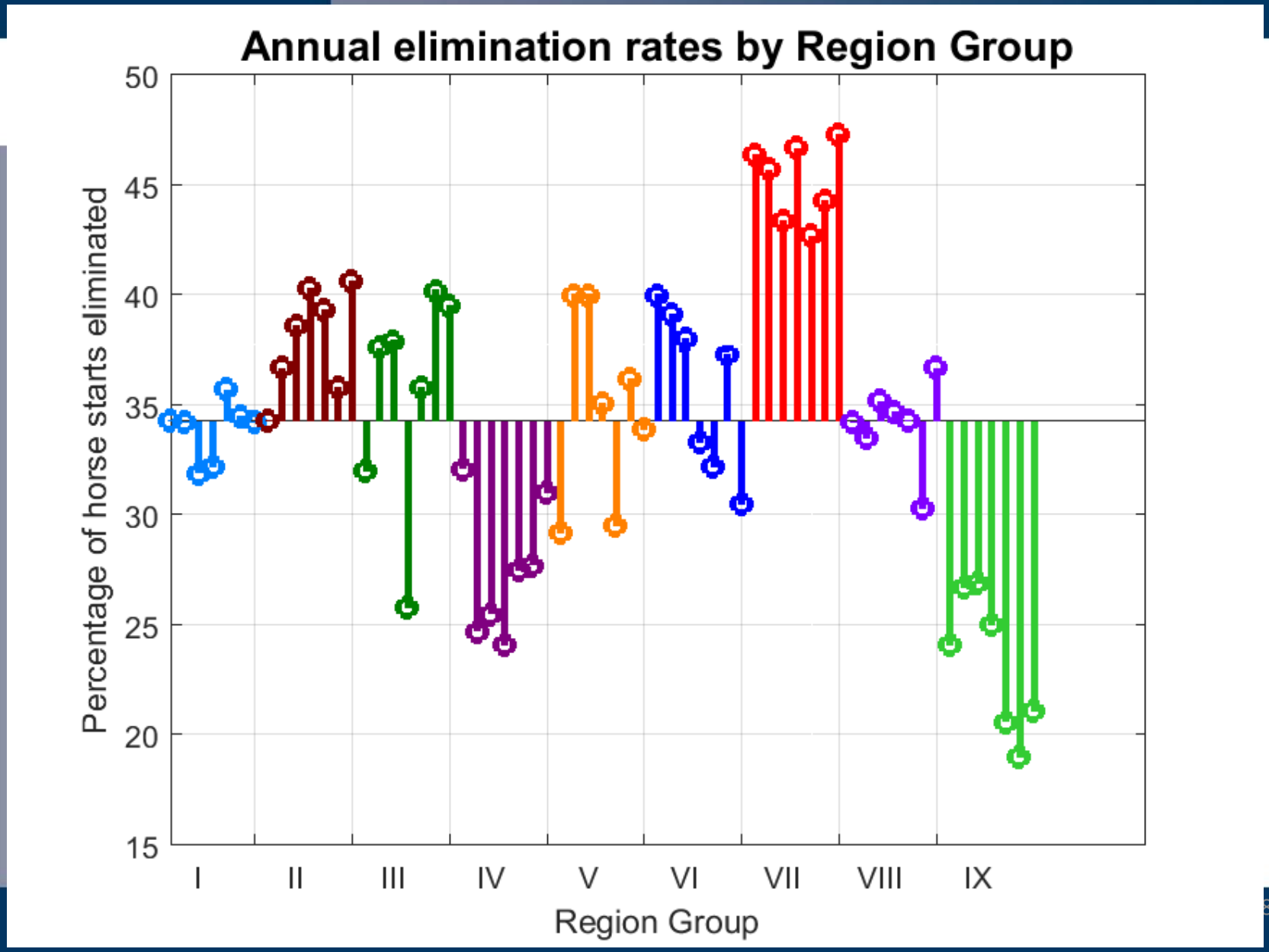
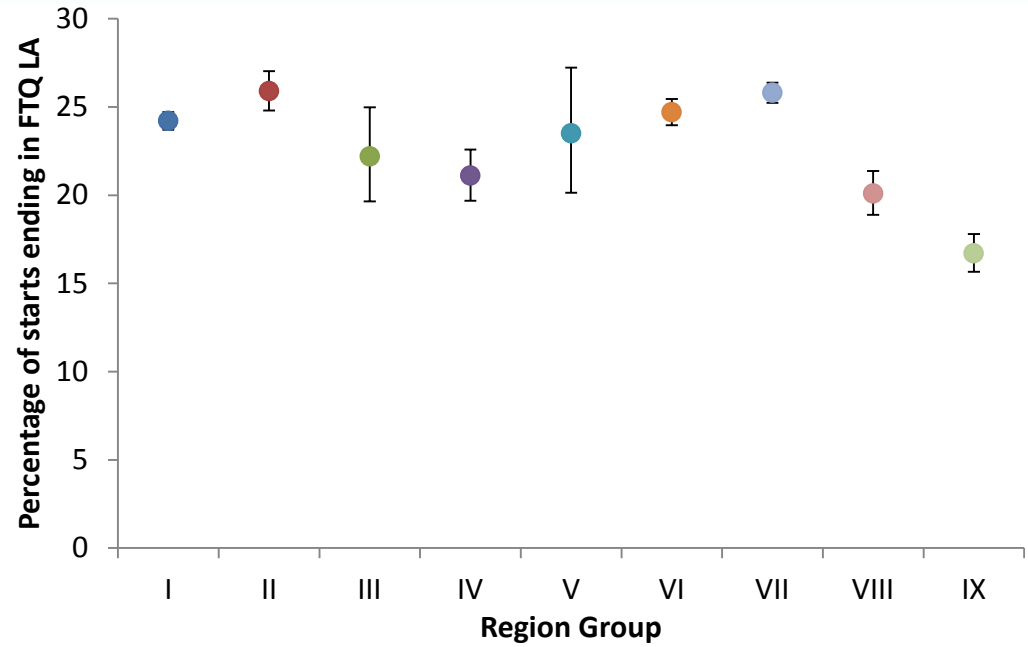
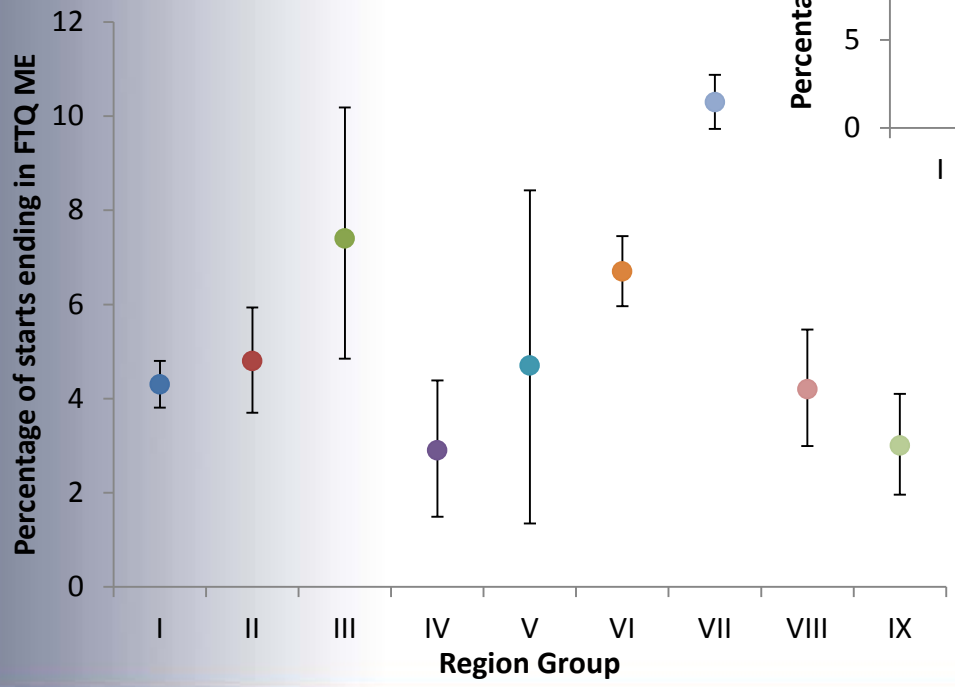
  - 35,891 (36.8%) were eliminated at a vet gate (mostly due to a "Failure to Qualify" [FTQ], a small minority for other reasons such as disqualification.)
- Two sub-categories of FTQ outcome:
  - FTQ due to Lameness (FTQ LA)
  - FTQ due to Metabolic problems (FTQ ME)

Annual elimination rates



FTQ LA and FTQ ME by Region Group





Epidemiological Study

- Three negative outcomes modelled for:
  - Failure to Qualify (any reason): FTQ
  - FTQ due to Lameness: FTQ LA
  - FTQ due to Metabolic problems: FTQ LA

- 27 potential risk factors modelled so far: ongoing study investigating more.

Outline of results

1. Horse-, Rider-, and Ride-level risk factors
   - *Risk factors applicable to every horse in the data set*
2. Average riding speeds
   - *New risk factors involving riding speeds*
3. Mandatory rest periods
   - *Risk factors applicable to returning horses*
   - *New risk factor based on rest time between rides*

Risk factors

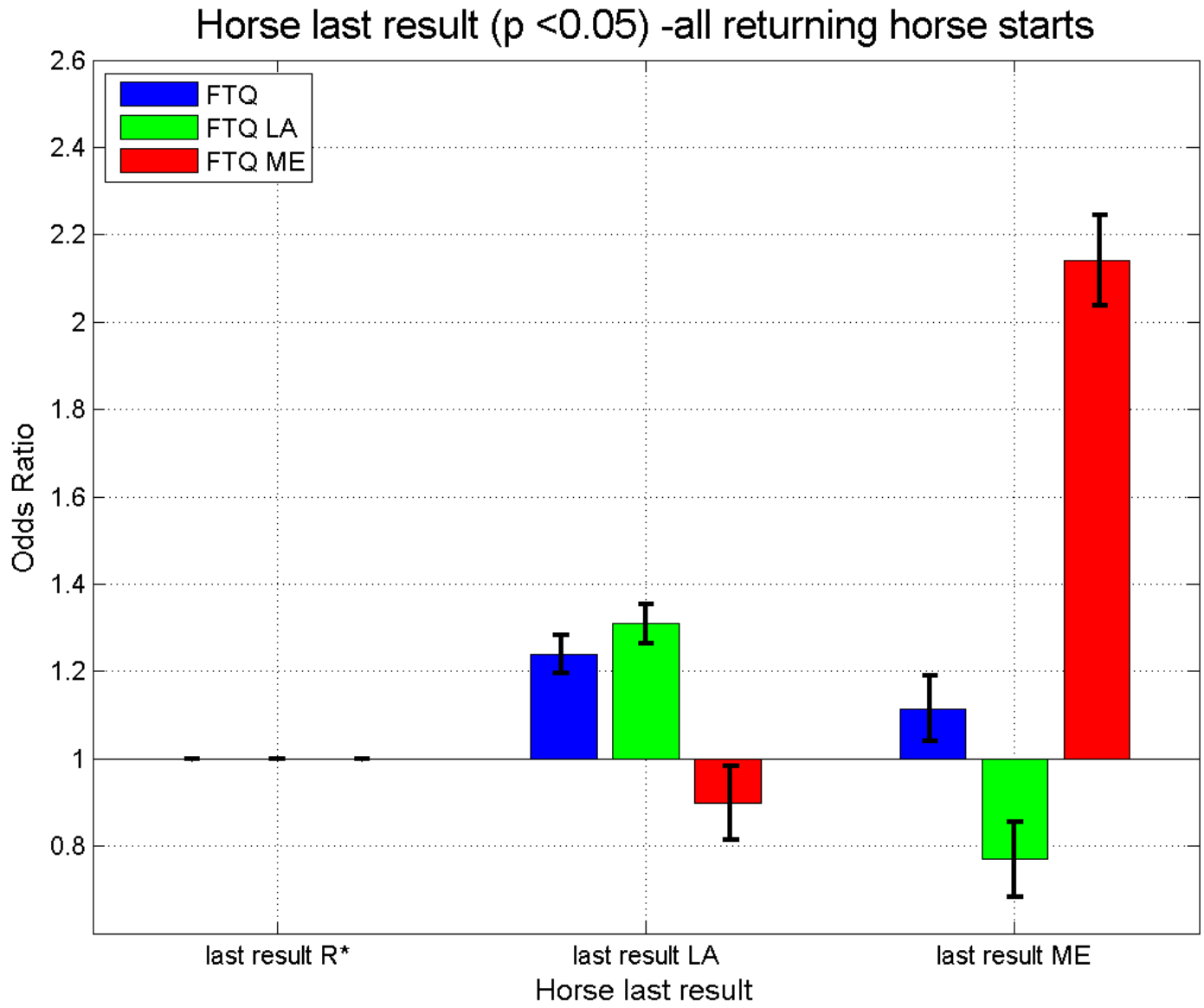
- Identified risk factors at Rider-level:
  - Male rider (25% increased risk)
  - Rider has one or more previous FTQ MEs (10%)
- Identified risk factors at Ride-level:
  - Region Group (various differences)
  - Ride distance – 120km (20-30%)
  - Year (various different years)
  - Field size – 30+ or 60+ (20%)

Risk factors

- Identified risk factors at Horse level:
  - Entire males (12%)
  - Age – over 12 yr. old (13%)
  - Average riding speed in different loops (see later)

- For returning horses:
  - Rest time relative to Mandatory Rest Period
  - Result in previous ride
  - Recent intensity of ride schedule

Example: Outcome in previous ride

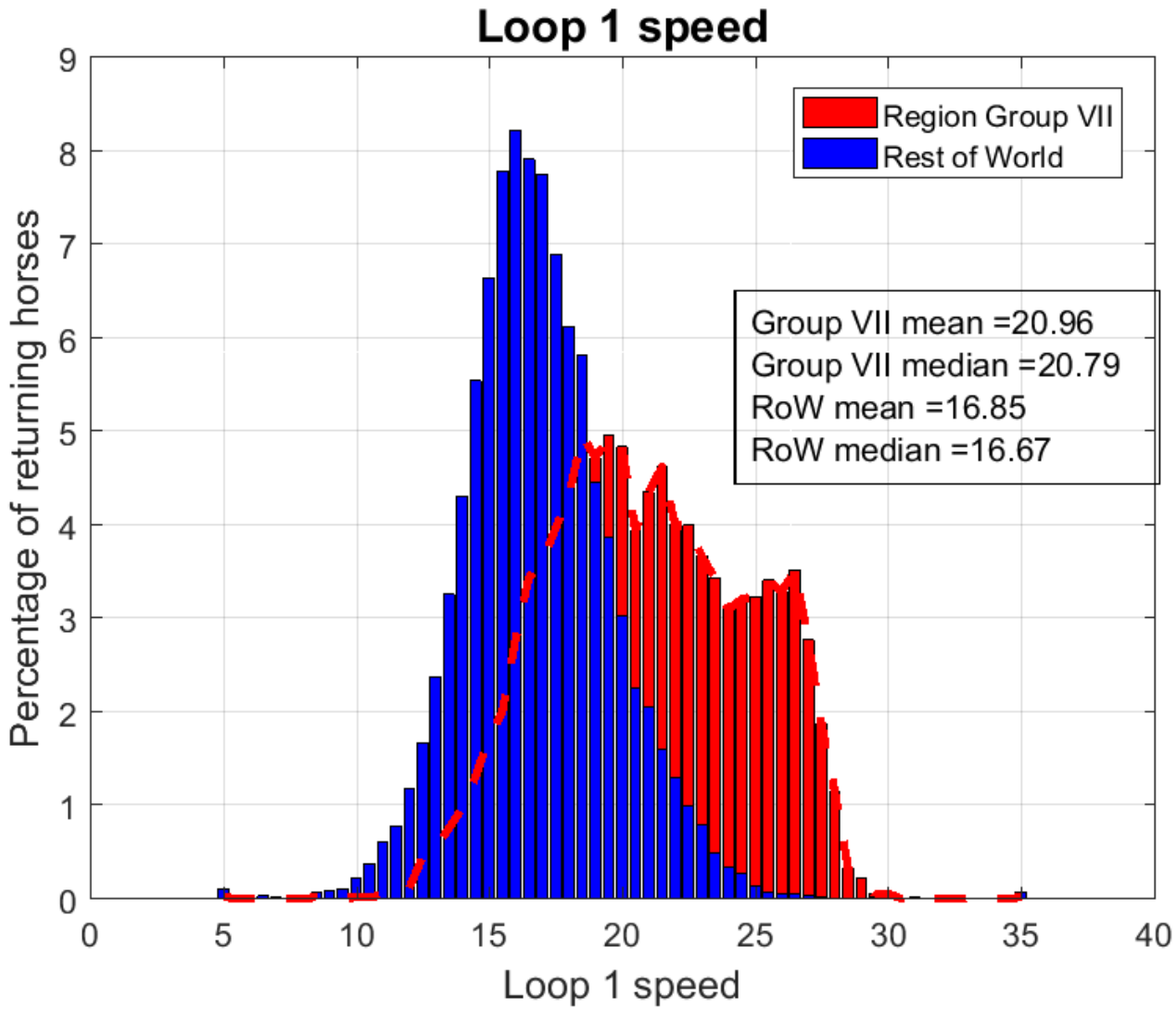


Average Riding Speeds

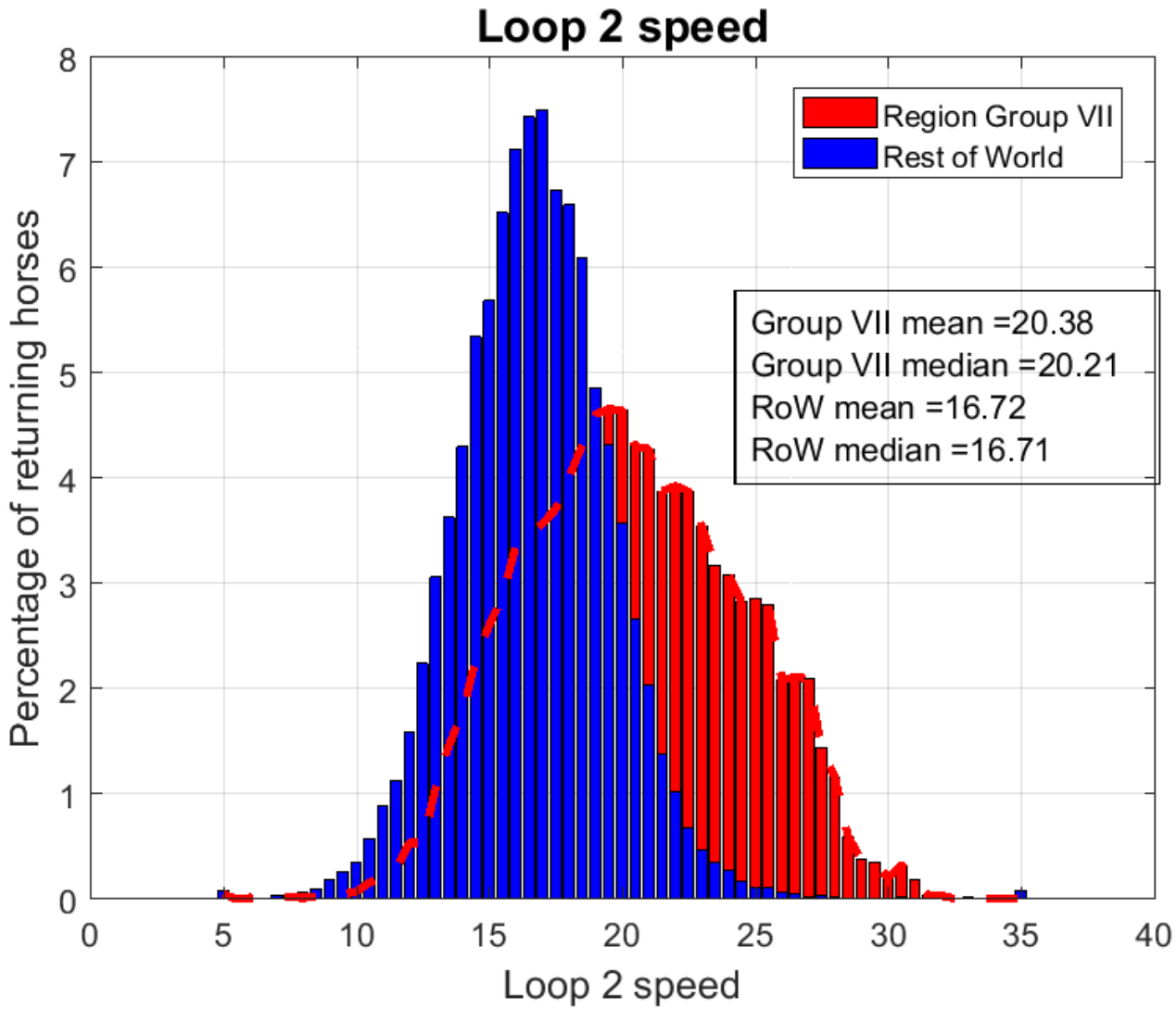
Average riding speeds

- New risk factors: average riding speeds in each individual loop, and for the entire ride.
- High riding speeds have previously been postulated as a potential explanation for the high elimination rates in Endurance riding.
- Big differences between Region Group VII and the rest of the World.

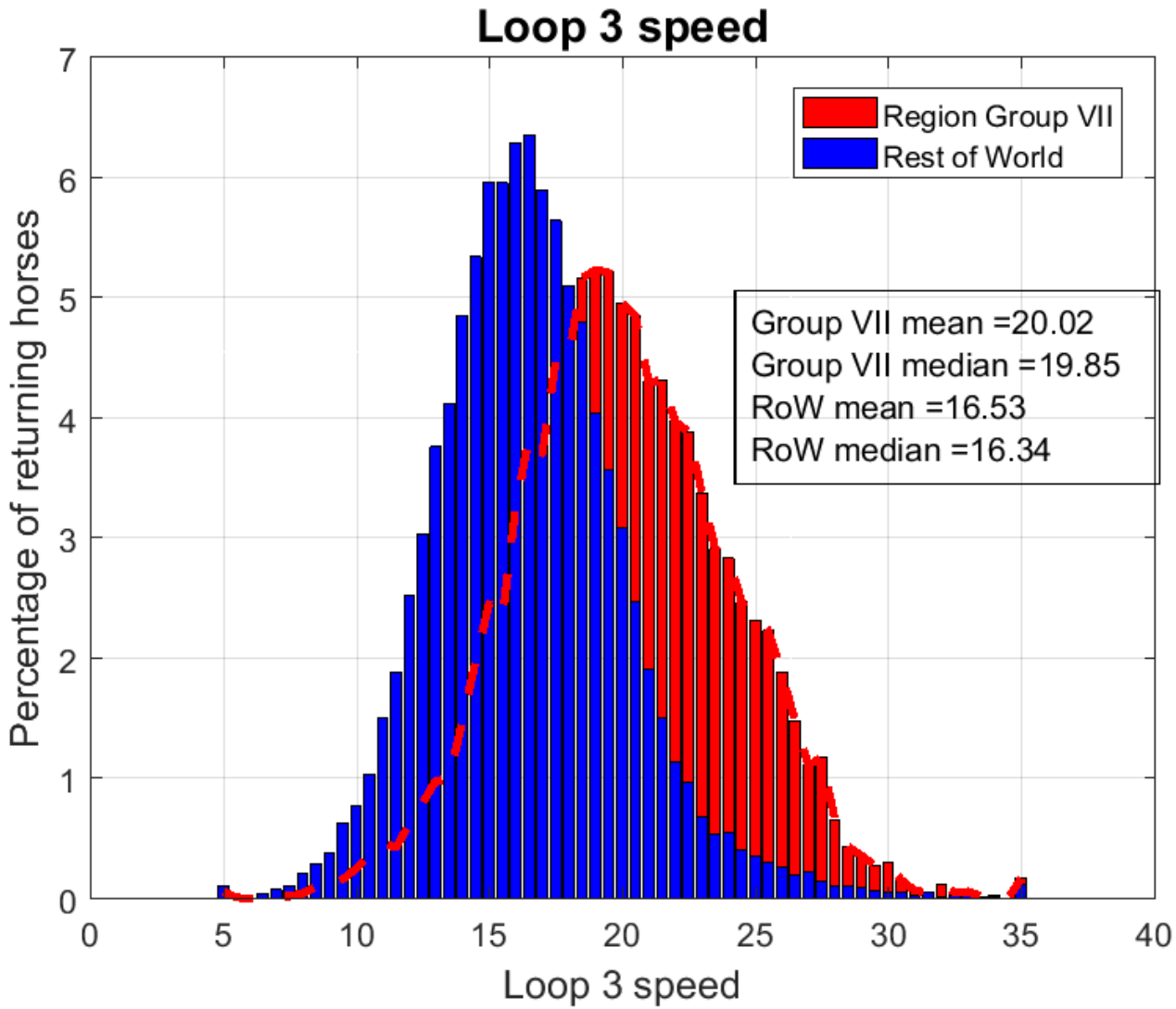
Loop 1 speed


Loop 1 speed
Region Group VII
Rest of World
Group VII mean =20.96
Group VII median =20.79
RoW mean =16.85
RoW median =16.67
Percentage of returning horses
Loop 1 speed
0
1
2
3
4
5
6
7
8
9
0
5
10
15
20
25
30
35
40

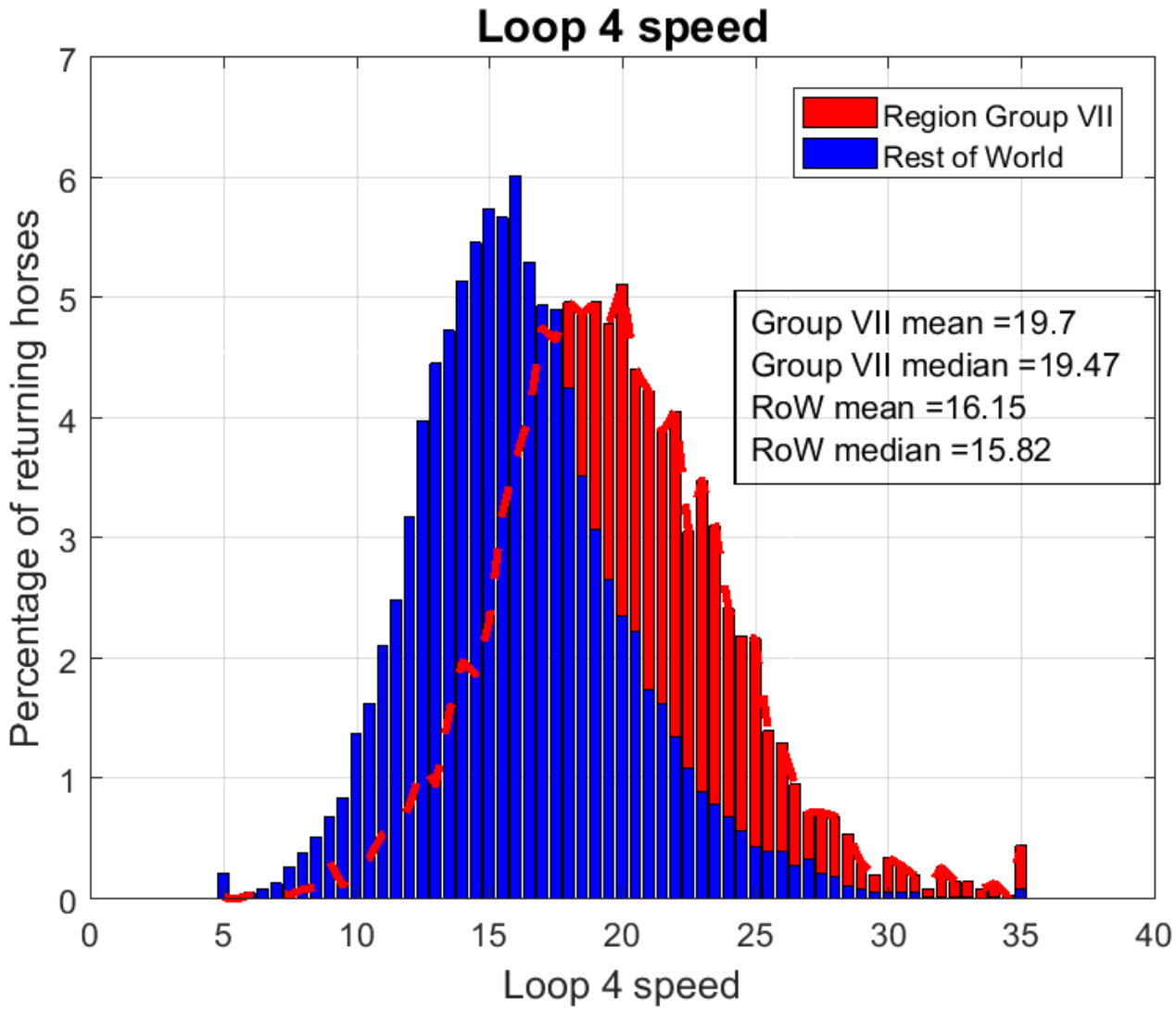
Loop 2 speed


Loop 2 speed
Region Group VII
Rest of World
Group VII mean =20.38
Group VII median =20.21
RoW mean =16.72
RoW median =16.71
Percentage of returning horses
Loop 2 speed
0
1
2
3
4
5
6
7
8
0
5
10
15
20
25
30
35
40

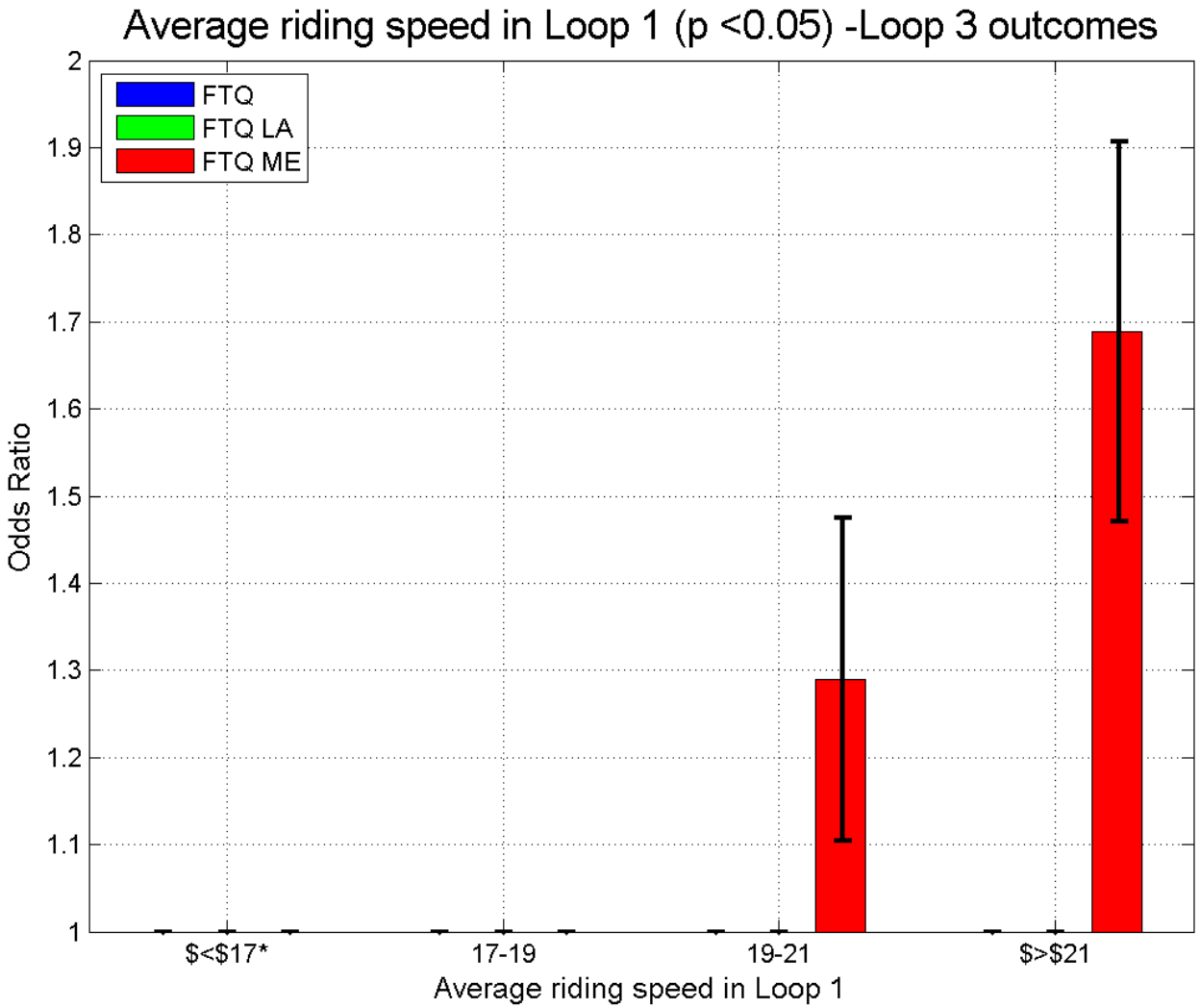
Loop 3 speed


Loop 3 speed
Region Group VII
Rest of World
Group VII mean =20.02
Group VII median =19.85
RoW mean =16.53
RoW median =16.34
Percentage of returning horses
Loop 3 speed
0
1
2
3
4
5
6
7
0
5
10
15
20
25
30
35
40

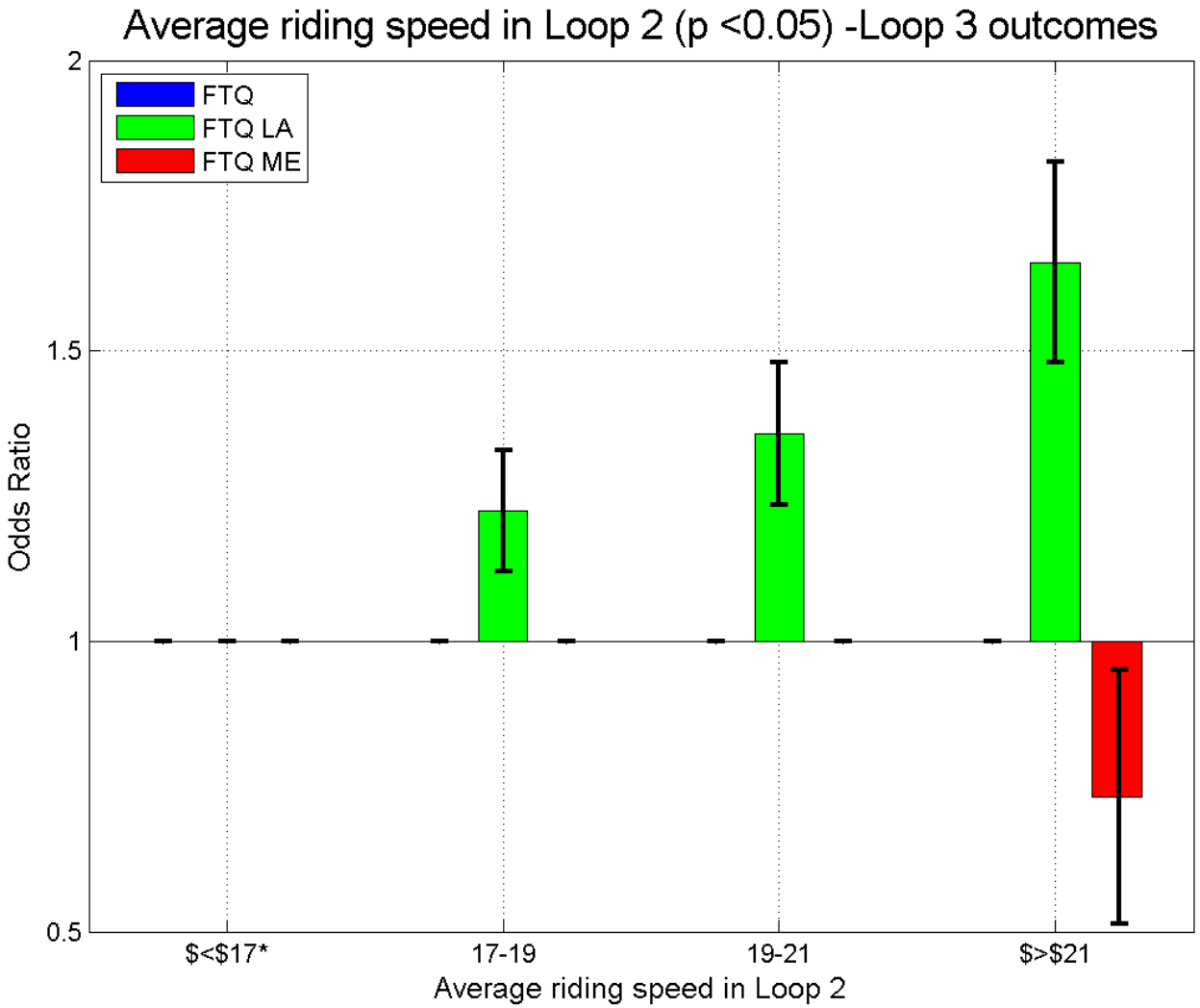
Loop 4 speed


Loop 4 speed
Region Group VII
Rest of World
Group VII mean =19.7
Group VII median =19.47
RoW mean =16.15
RoW median =15.82
Percentage of returning horses
Loop 4 speed
0
1
2
3
4
5
6
7
0
5
10
15
20
25
30
35
40

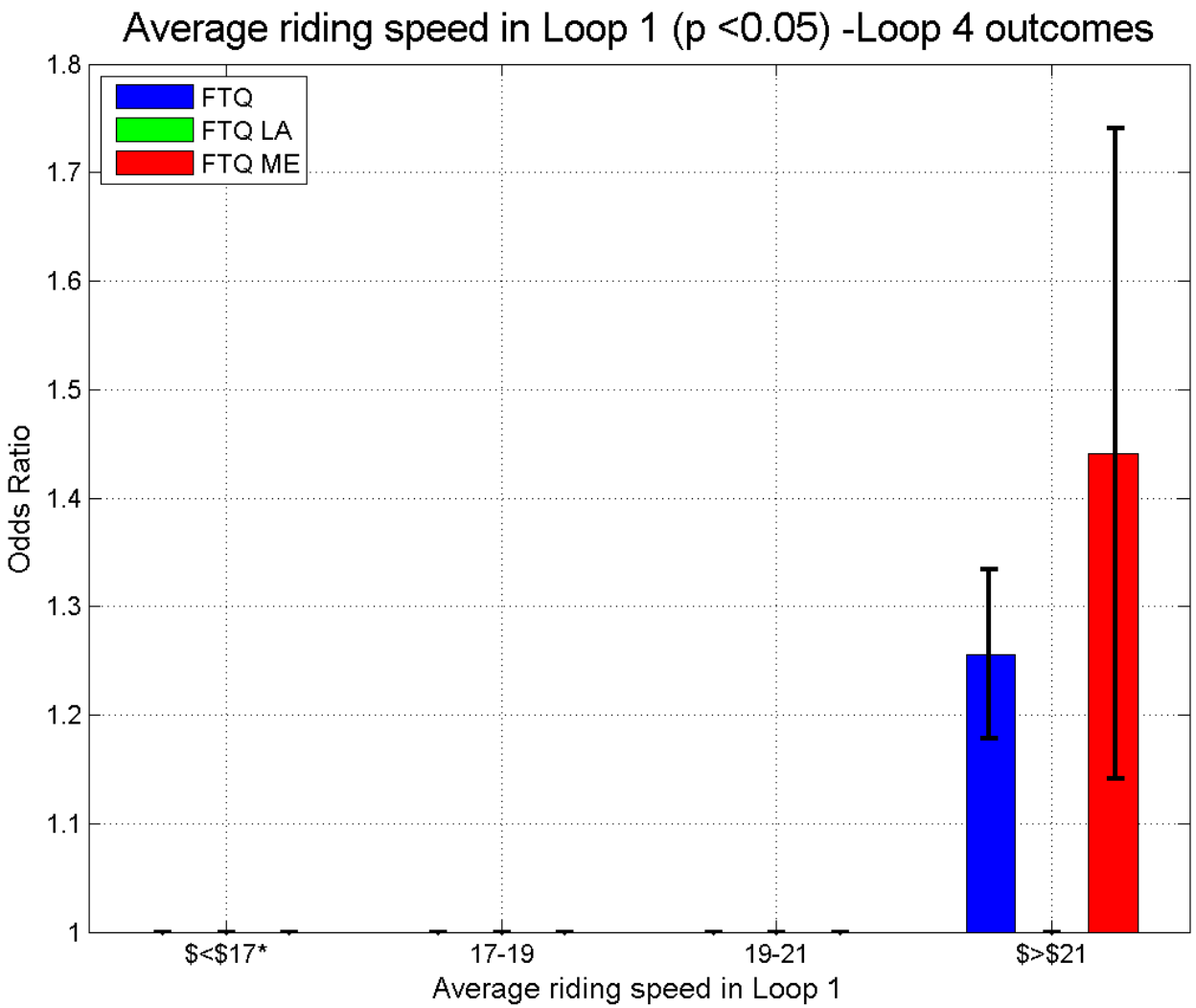
Elimination in Loop 3



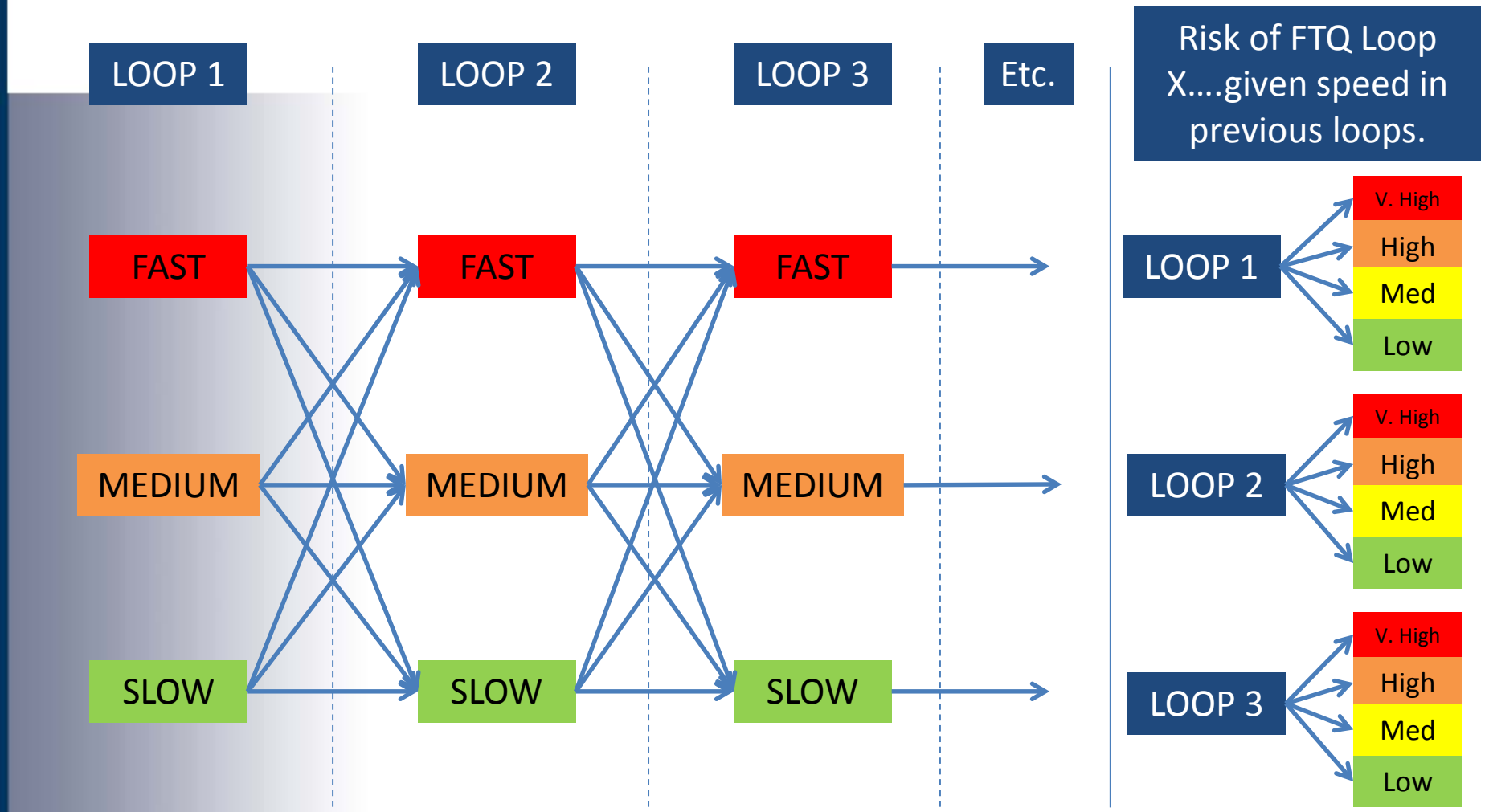
Elimination in Loop 3



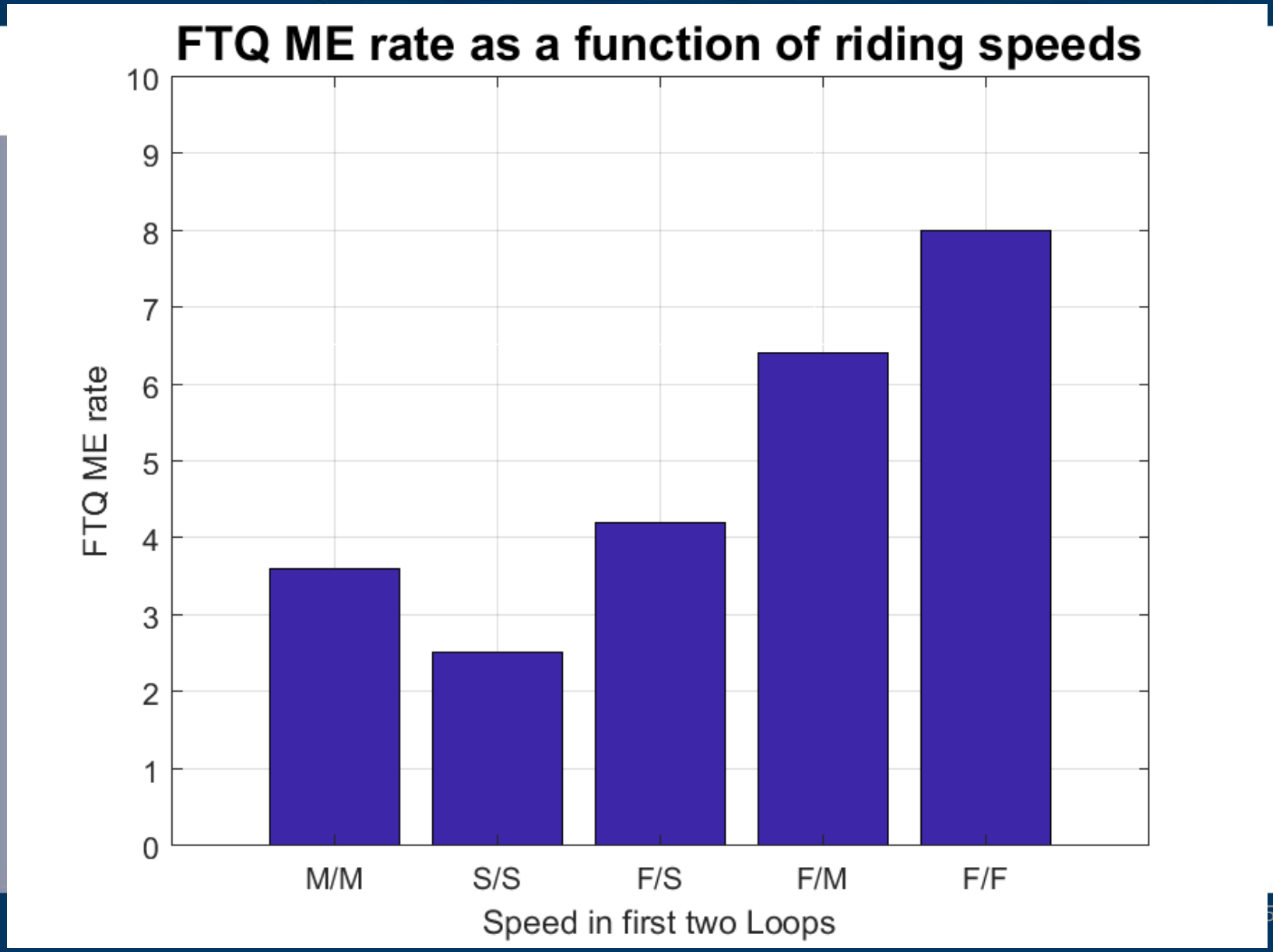
Elimination in Loop 4



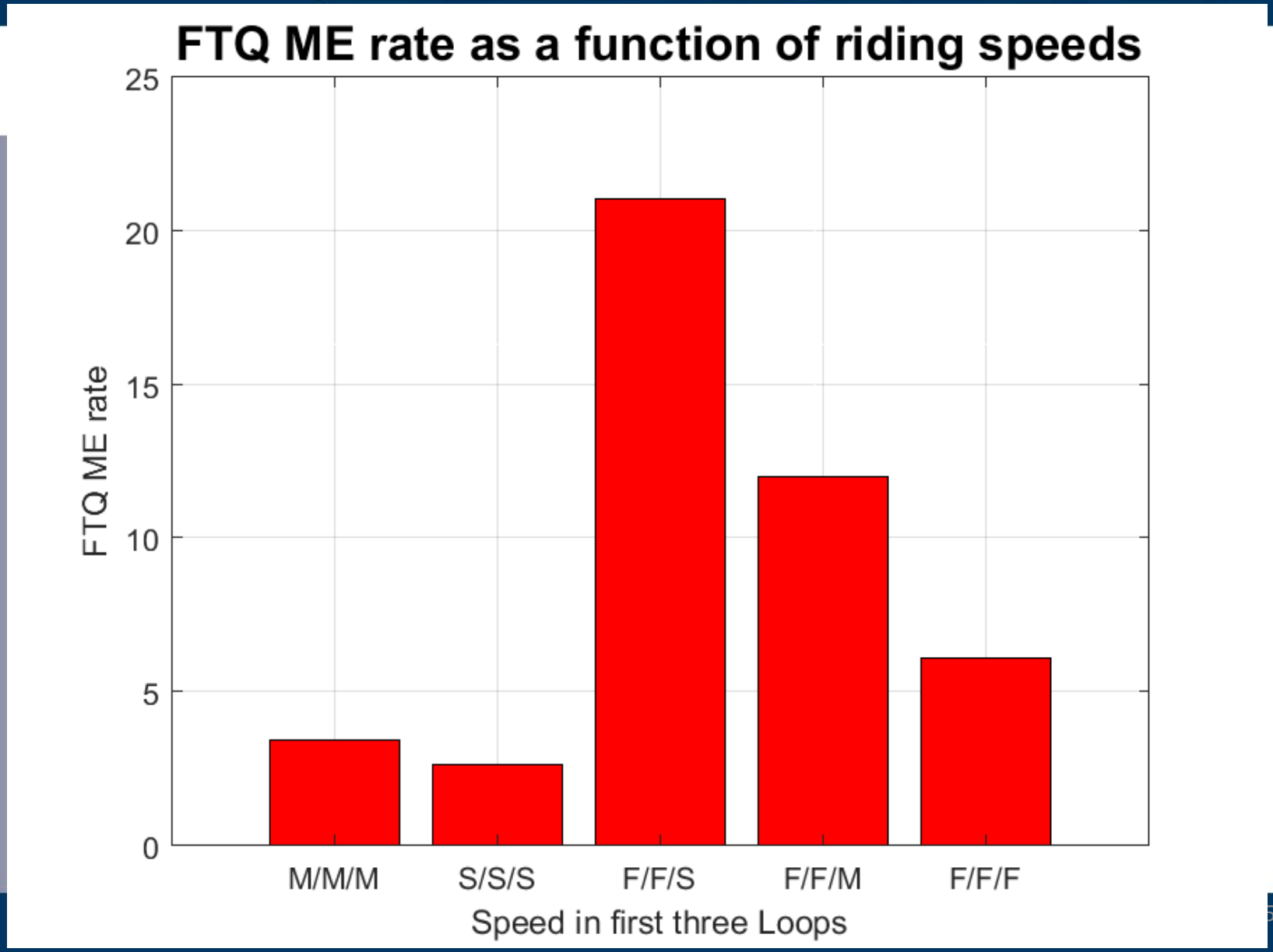
Loop speed combinations



Speed in Loops 1 and 2



Speed in Loops 1, 2, and 3



Conclusions – riding speed

- Association between high average riding speeds (particularly during Loops 1 and 2) FTQ outcomes.
- Furthermore, associations between high average riding speeds in Loop 1 and 2, and FTQ during Loops 2, 3, and 4 specifically.
- Certain combinations of riding speeds in Loops 1-3 are predictive of FTQ outcomes during Loops 3 and 4.
- High riding speeds in Loops 1-2 are particularly associated with FTQ ME outcomes.

Mandatory Rest Periods

Mandatory rest periods

- Current mandatory rest periods (MRP)
  - Additional rest times if previous ride ended in FTQ.

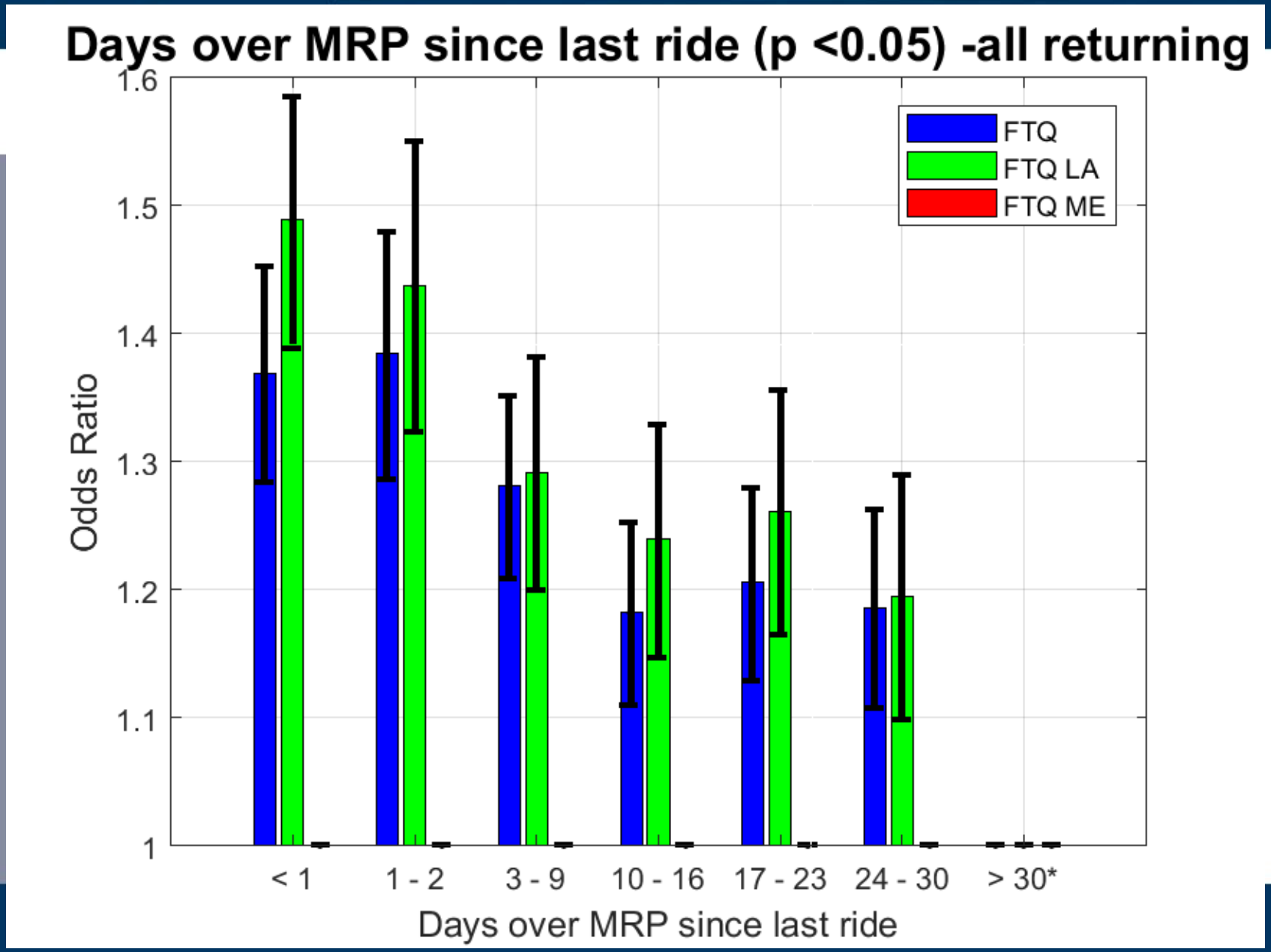
Distance Completed in last ride	MRP (days)	MRP if "irregular gait"	MRP if "invasive treatment"
Start – 40km	5	19	65
40 – 80km	12	26	72
80 – 120km	19	33	79
120 – 140km	26	40	86
> 140km	33	47	93

- New risk factor: days over MRP since last ride.

MRP as a risk factor

- Each returning horse has a “rest time over MRP” based on the applicable mandatory rest period.
- Compared to “greater than 30 days over MRP since previous ride”
- Category “less than 1 day over MRP since previous ride” covers pre-2014 when current MRPs enforced.

Horse-level: Rest time



FTQs prevented by MRPs

- Current mandatory rest periods have been in place since 2014 – covering 3 out of 7 years studied.
- Possible to estimate how many horses “saved” from FTQ.
- Can also estimate the potential impact of extending MRPs.

Extending MRPs

- The mandatory rest period a horse must observe after a ride depends on the distance it covered during that ride.

- Given the risks associated with high riding speed (See also Prof Whitton's presentation), MRPs could also take into account the recorded speed of the horse during the ride.
  - In this example we consider speed in Loops 1 and 2

Extending MRPs

- **Model 1:** extend MRPs **only** for horses recorded as riding “fast” (in top 25% of all horses, >20 km/h) during Loop 1 or Loop 2 of their previous ride.
- **Model 2:** extend MRPs for everyone i.e. a flat increase to each existing MRP.
- **Model 3:** extend MRPs for everyone by 7 days, with an additional MRP for those riding “fast” in Loop 1 or Loop 2.
- **Model 4:** extend MRPs for everyone by 14 days, with an additional MRP for those riding “fast” in Loop 1 or Loop 2.

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Potential impact – LA outcomes

NUMBER OF LA OUTCOMES PREVENTED	No penalty for speed	+7 days for speeding	+14 days for speeding
Current MRPs	76	107	54
+ 7 days for all	222	247	240
+ 14 days for all	299	341	299

Potential impact – LA outcomes

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Clear benefit of a one-week speeding fine…

… is not improved by a two-week fine

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Least impact

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Highest impact but high cost

Potential impact – LA outcomes

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Best-value impact?

ME OUTCOMES

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Potential impact – ME outcomes

NUMBER OF ME OUTCOMES PREVENTED	No penalty for speed	+7 days for speeding	+14 days for speeding
Current MRPs	0	51	61
+ 7 days for all	34	105	105
+ 14 days for all	208	254	256

Potential impact – ME outcomes

NUMBER OF ME OUTCOMES PREVENTED	No penalty for speed	+7 days for speeding	+14 days for speeding
Current MRPs	0	51	61
+ 7 days for all	34	105	105
+ 14 days for all	208	254	256

Clear benefit of a one-week speeding fine…

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Potential impact – ME outcomes

NUMBER OF ME OUTCOMES PREVENTED	No penalty for speed	+7 days for speeding	+14 days for speeding
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Least impact

Potential impact – ME outcomes

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Current MRPs	0	51	61
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+ 14 days for all	208	254	256

Best-value impact

But significant extra benefits for additional cost

Cost-benefit analysis

- "Best value" MRP extension for LA outcomes is +7 days for all, with additional +7 days for horses riding >20 km/h in Loops 1 or 2.
- This would extend MRPs by 7 days for all horses, and an additional 7 days for 32% of horses (until rider behaviour changes).
- However, +14 days for all +7 days for speeding could prevent significantly higher numbers of LA ***and*** ME outcomes – worth considering.

Conclusions – rest periods

- Horses with longer rest periods between rides are less likely to become injured.
- Horses returning after FTQ outcomes are more likely to experience the same outcome again.
- Mandatory rest periods could be further increased as an effective preventative measure, benefitting ***all*** horses.
- Introducing a link between riding speed and MRP could provide the additional benefit of modifying rider behaviour, reducing horses' risk of FTQ in both current and future rides.

Take-home message

- Recommend extending the present mandatory rest periods as follows:
  - +7 days for all horses (benefits all horses, 9% of horses would have had a longer mandatory wait before returning)
  - +7 days for horses recorded as riding at >20 km/h during Loops 1 or 2 (affects 32% of horses).

- If acceptable to the community, further benefit could be gained by extending the present mandatory rest periods even further:
  - +14 days for all horses (benefits all horses, 15% would have had a longer mandatory rest period)
  - +7 days for horses recorded as riding at >20 km/h during Loops 1 or 2 (affects 32% of horses).

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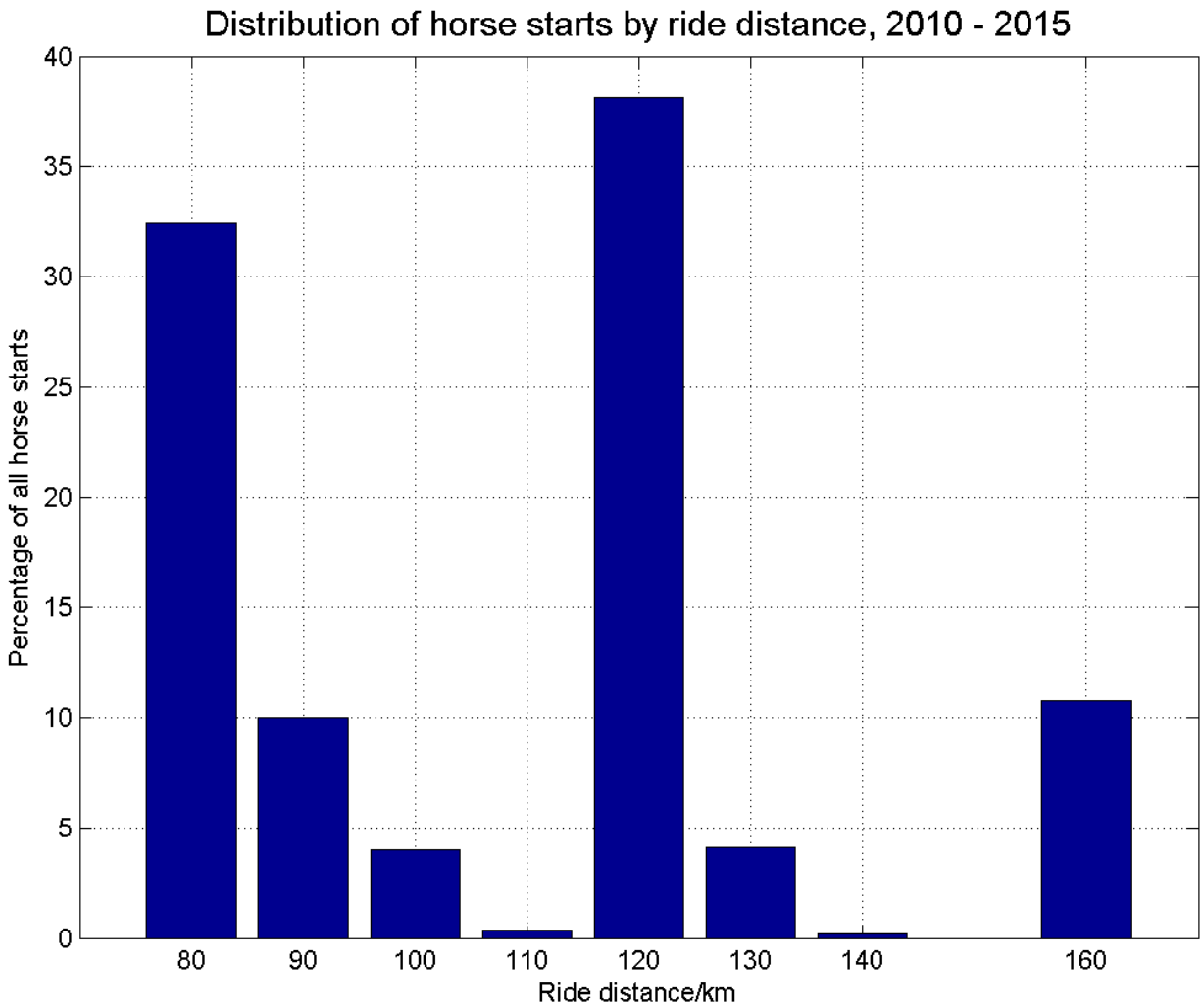
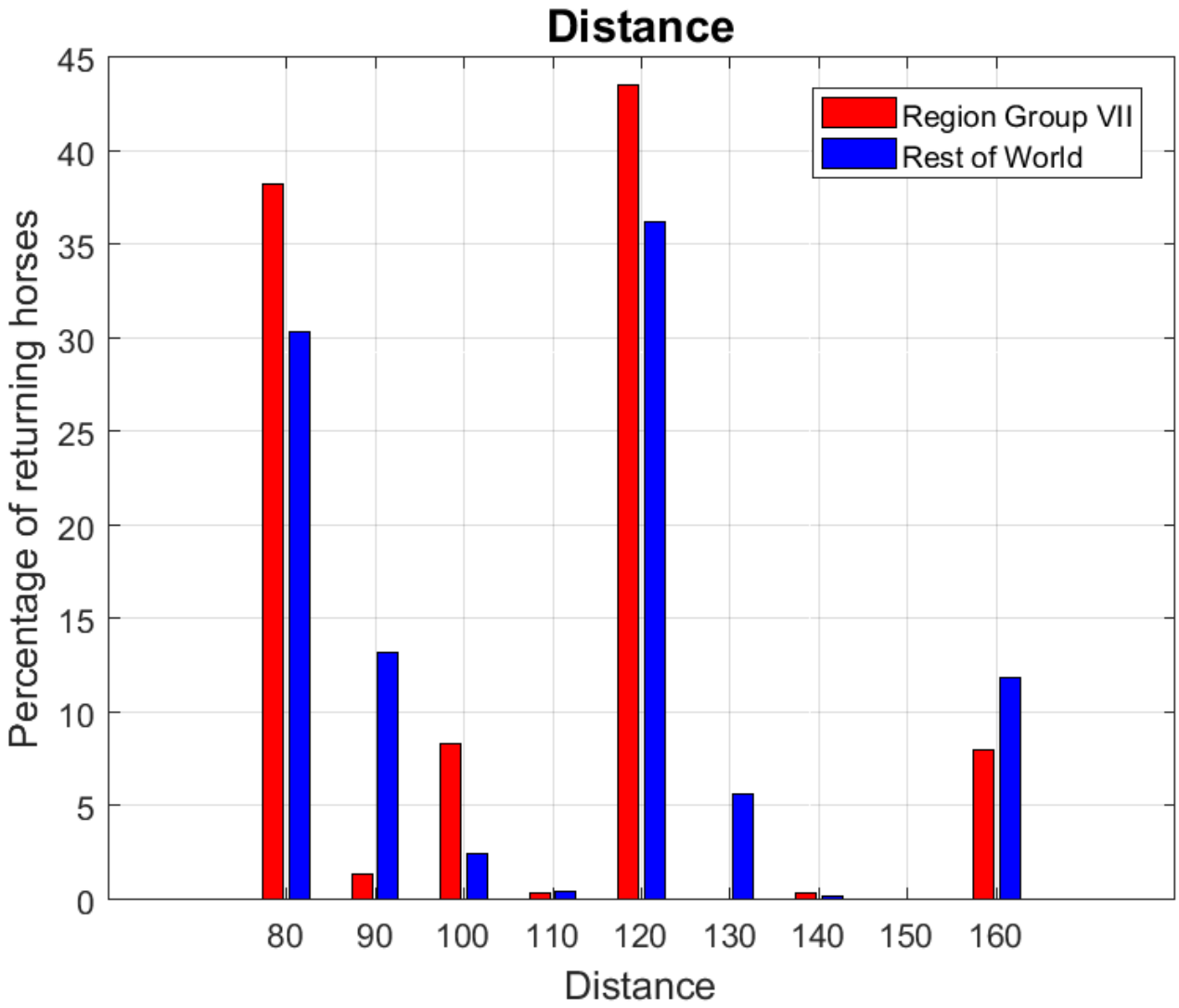
Thanks for your attention!

Extra slides

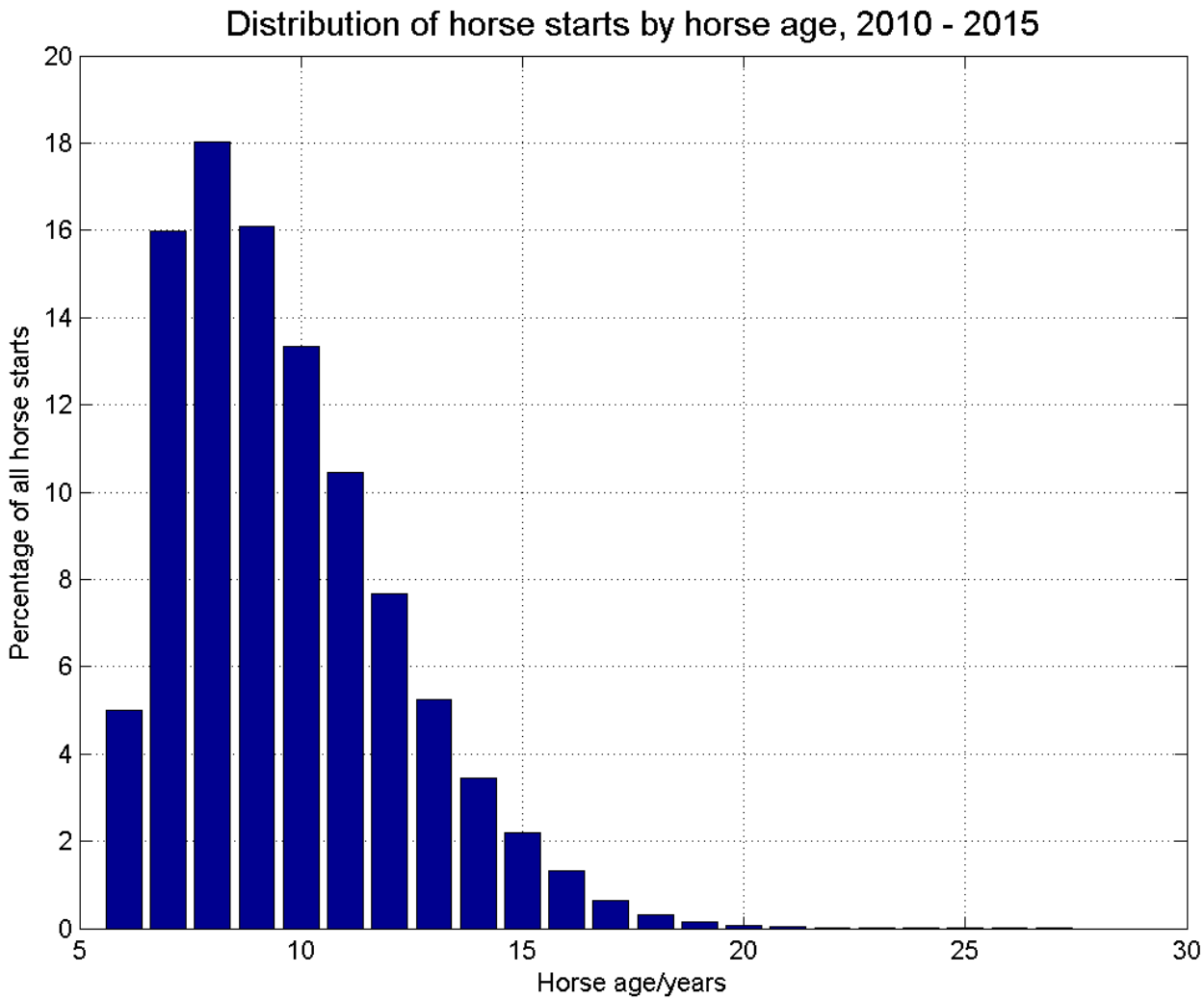
Ride distance



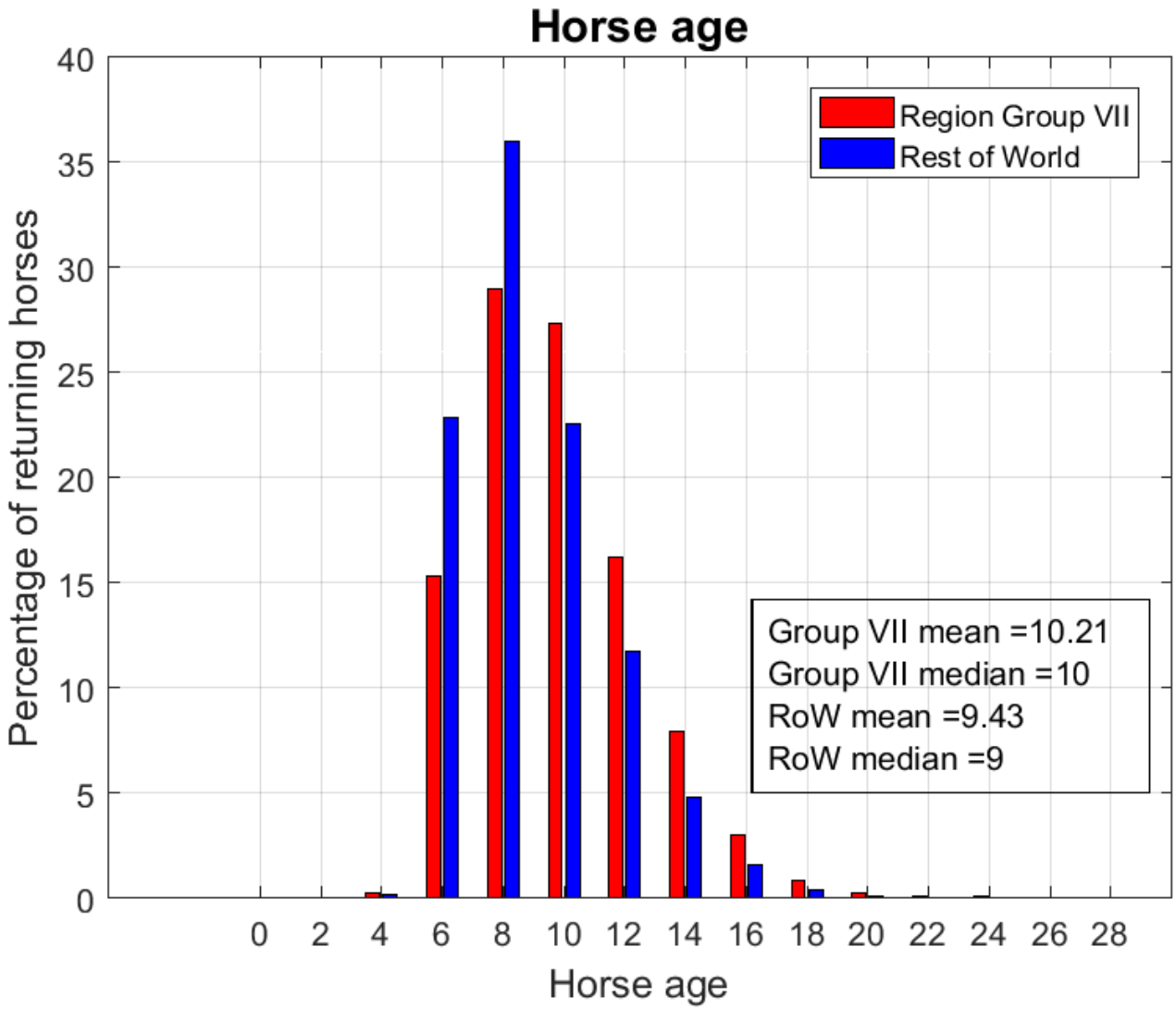
Ride distance



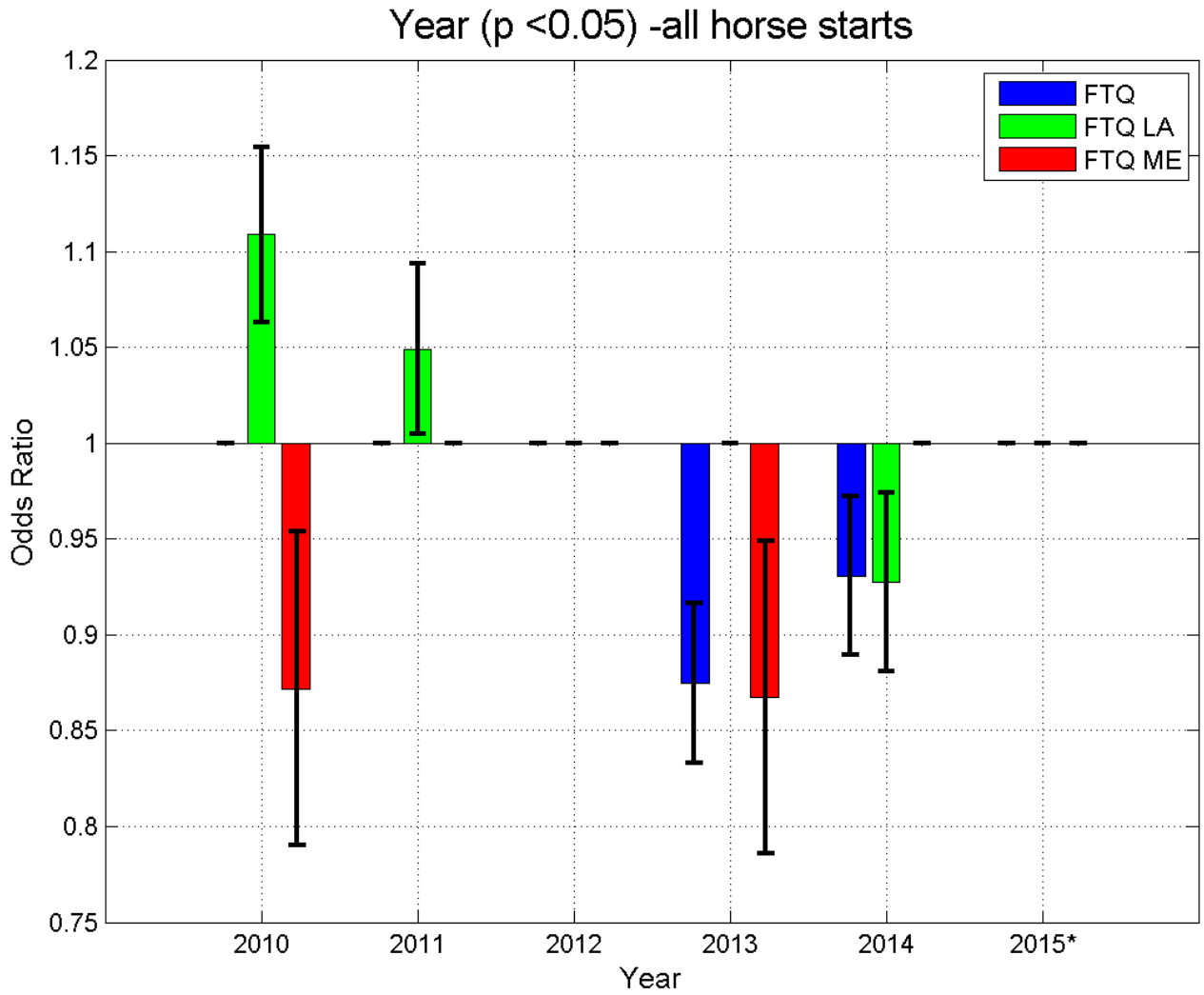
Horse age


Distribution of horse starts by horse age, 2010 - 2015
Percentage of all horse starts
Horse age/years
0
2
4
6
8
10
12
14
16
18
20
5
10
15
20
25
30

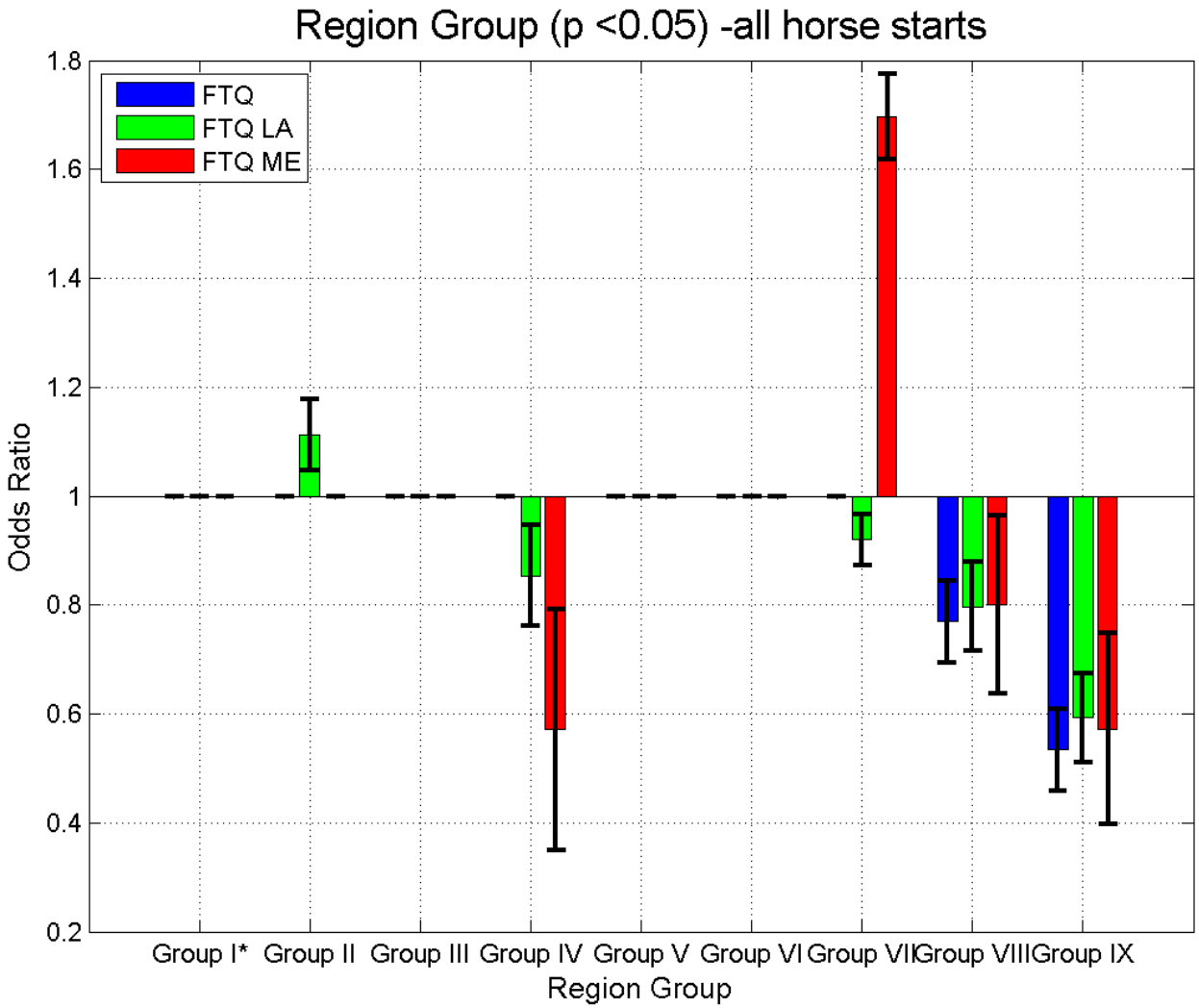
Horse age


Horse age
Region Group VII
Rest of World
Group VII mean =10.21
Group VII median =10
RoW mean =9.43
RoW median =9
Percentage of returning horses
Horse age
0
5
10
15
20
25
30
35
40
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28

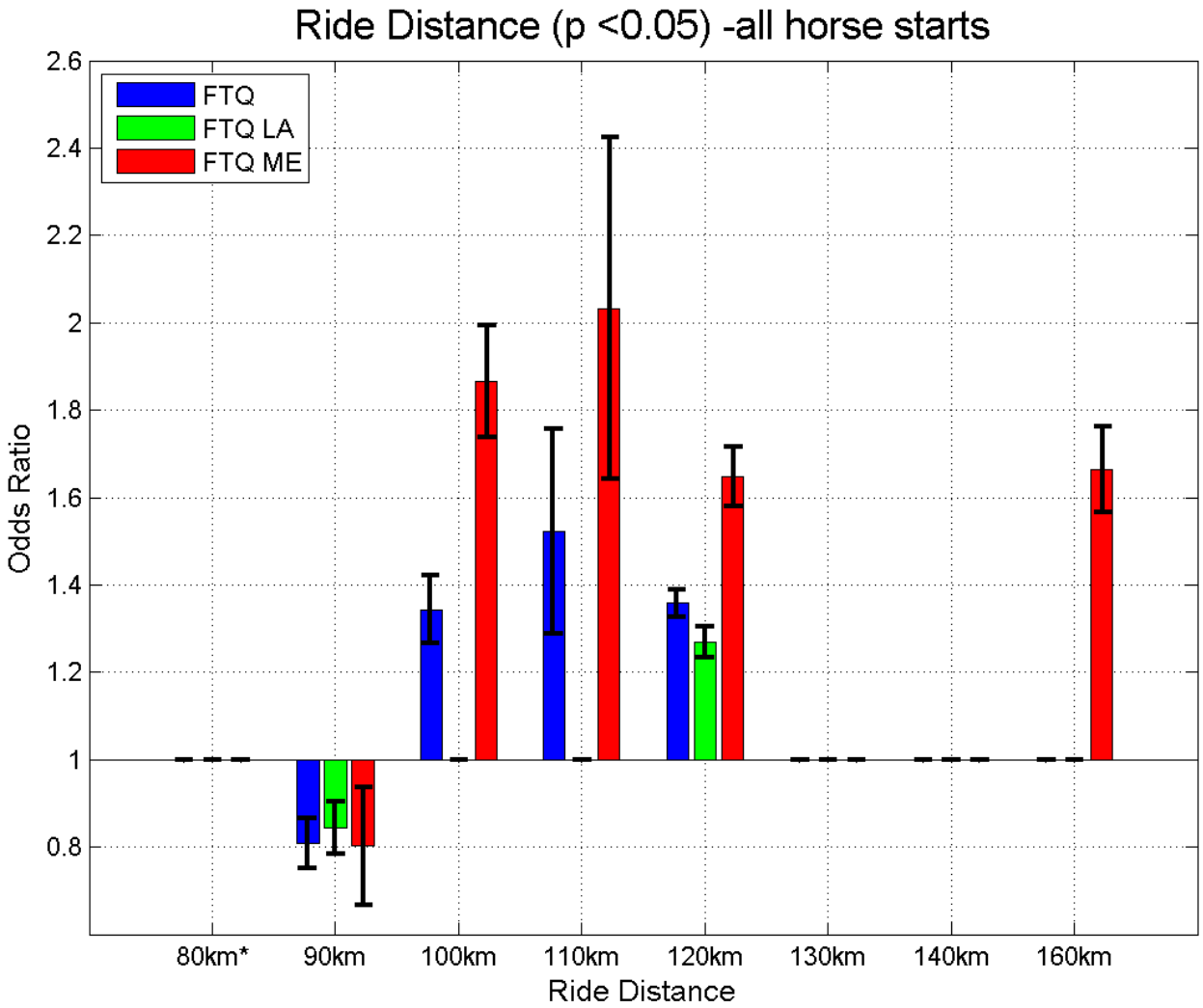
Ride-level: Year



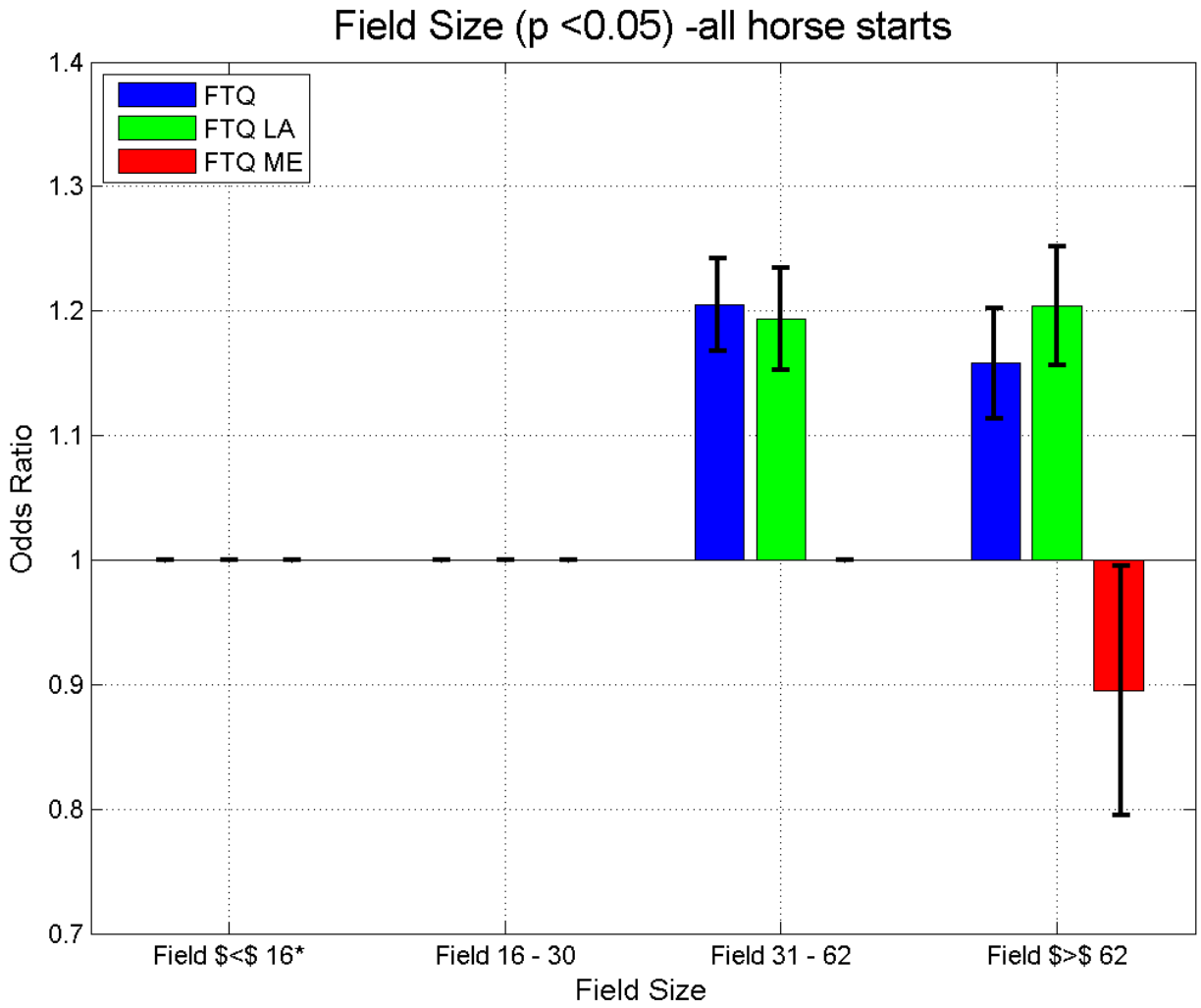
Ride-level: Region Group



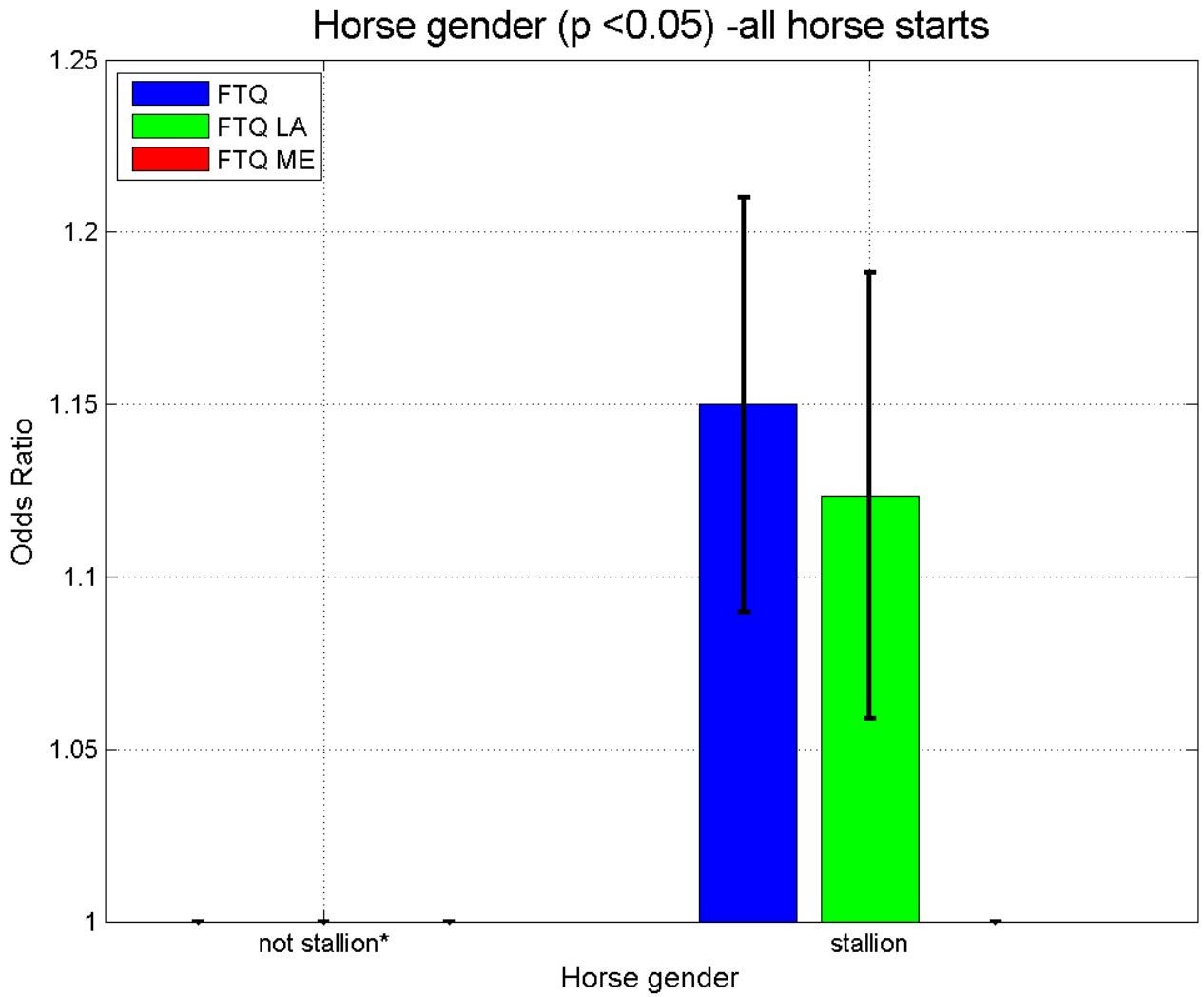
Ride-level: Distance



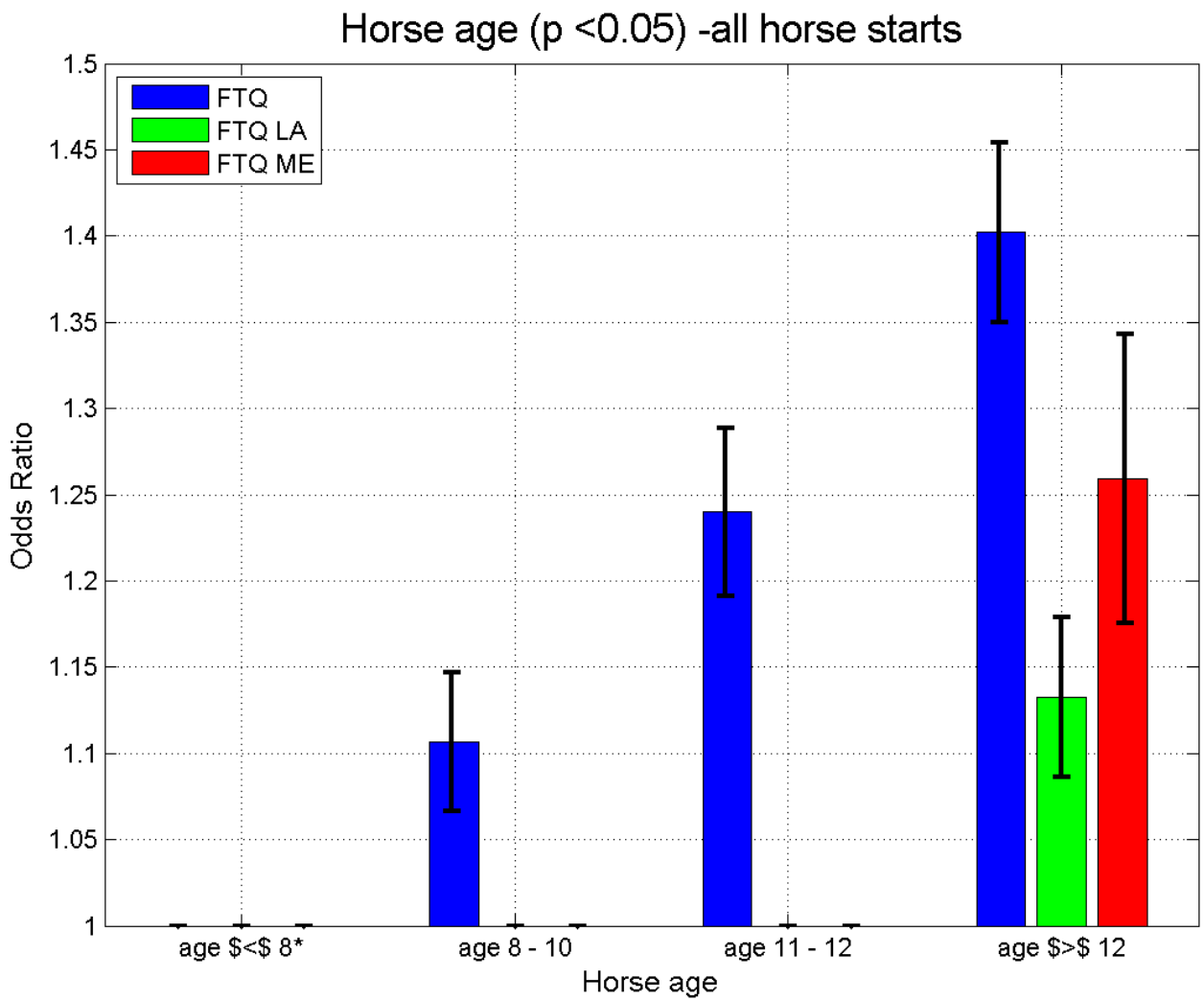
Ride-level: Field size



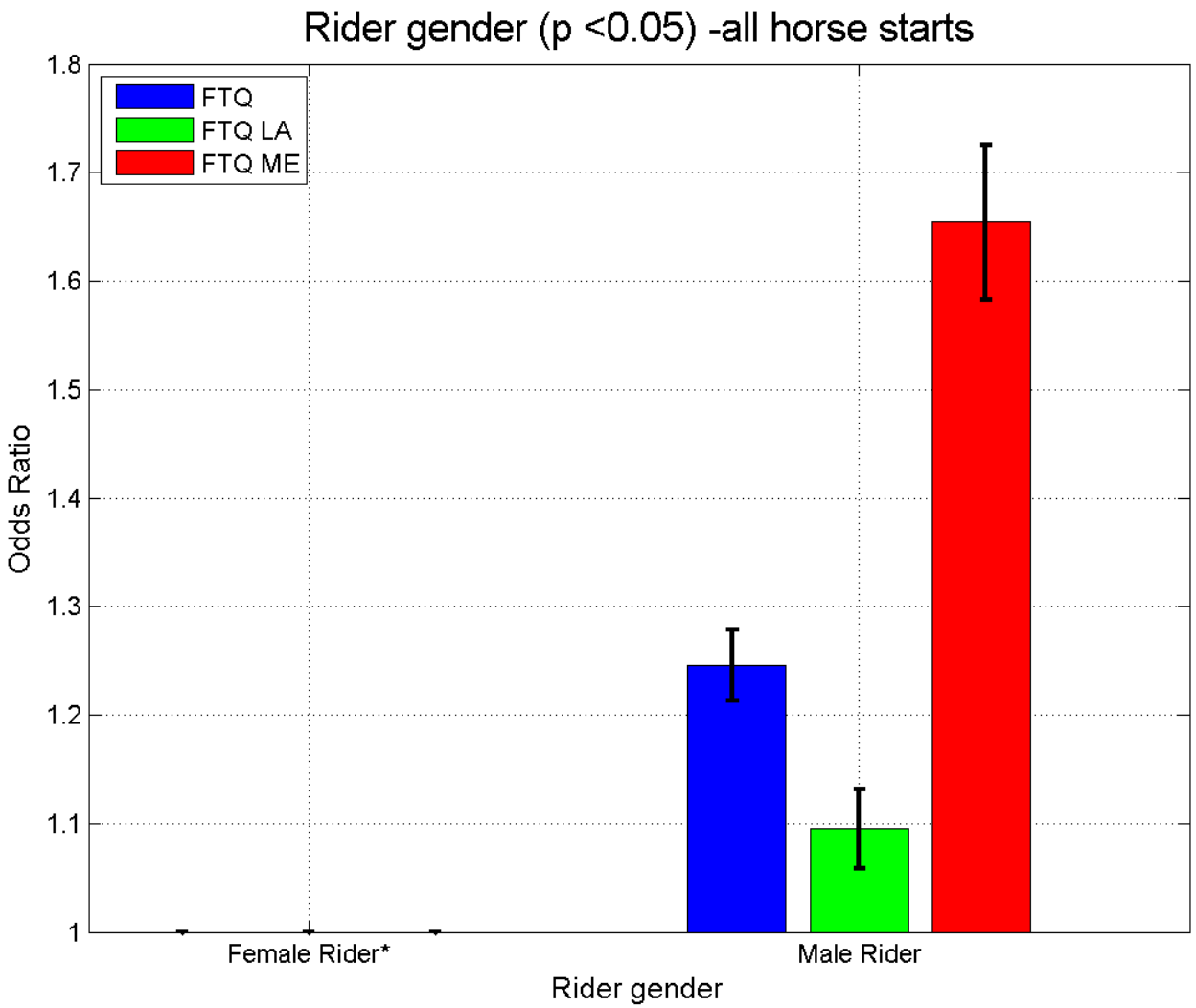
Horse-level: Gender



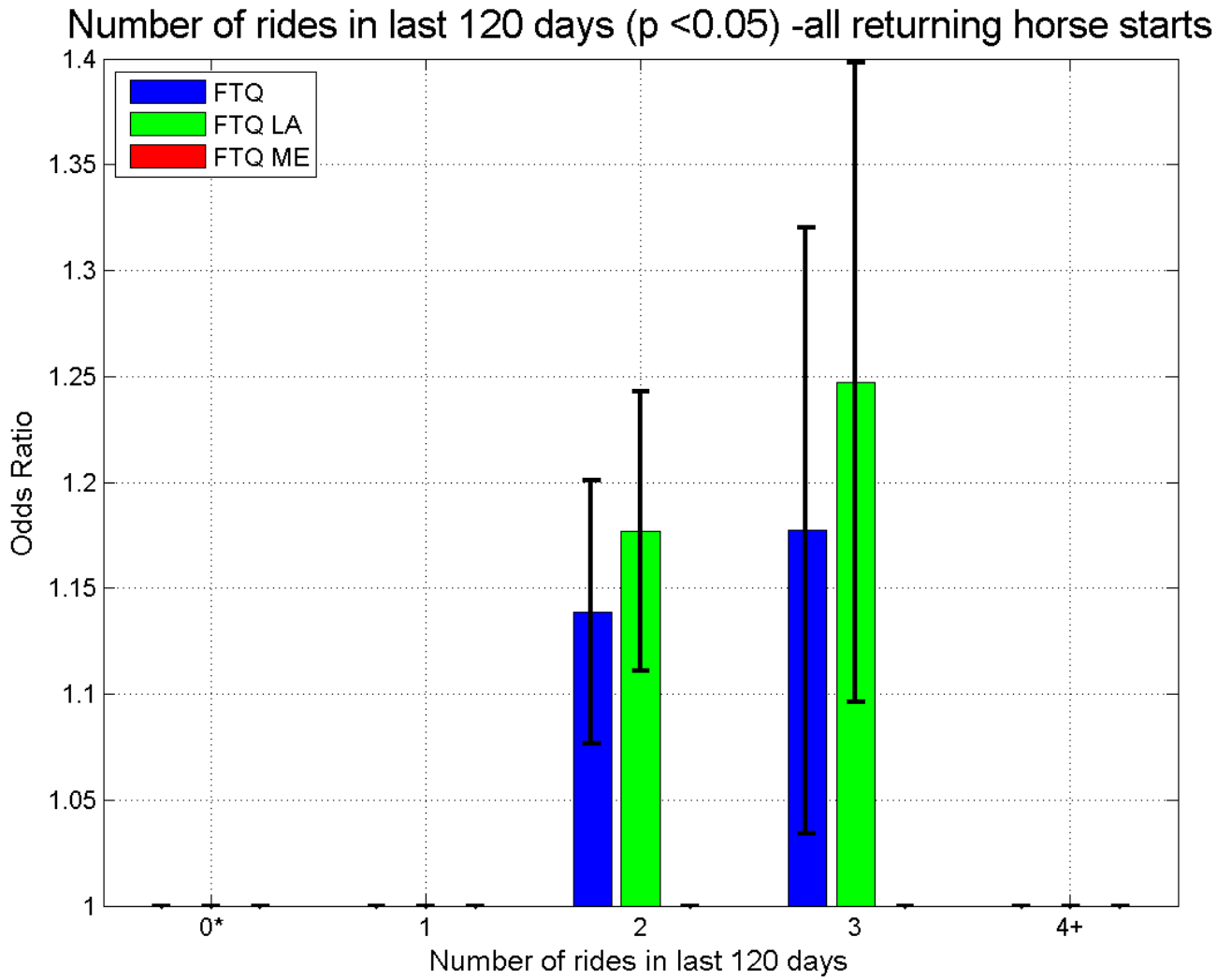
Horse-level: Age



Rider-level: Gender



Horse-level:
Recent intensity of ride schedule



Rider-level: number of previous FTQ ME outcomes