Analysis of risk factors for horse falls in the cross-country test of FEI Eventing

This presentation will discuss

- Results of commissioned research to explore:
  - Risk factors for horse falls
  - Rotational vs non-rotational horse falls
  - Rider injury as a result of a horse fall

- Recommendations for future developments

Presented by Charles Barnett
Analysis of risk factors for horse falls in the cross-country test of FEI Eventing

The Research Team

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Background Information

- Data extracted from FEI database from July 2010 to December 2014
- ‘One fall and out’ rule introduced in July 2009

Study Sample

<table>
<thead>
<tr>
<th>Event Level</th>
<th>Number of horse falls</th>
<th>Total x-c starts</th>
<th>Total jumping efforts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1★</td>
<td>360</td>
<td>37,836</td>
<td>993,161</td>
</tr>
<tr>
<td>2★</td>
<td>394</td>
<td>24,781</td>
<td>726,813</td>
</tr>
<tr>
<td>3★</td>
<td>339</td>
<td>12,454</td>
<td>404,875</td>
</tr>
<tr>
<td>4★</td>
<td>87</td>
<td>1,567</td>
<td>59,640</td>
</tr>
<tr>
<td>Total</td>
<td>1,180</td>
<td>76,638</td>
<td>2,184,489</td>
</tr>
</tbody>
</table>
Horse Falls at each Event Level (2010 – 2014)

- Higher percentage of horse fall at 4* level, but
- Lower number of actual falls due to fewer competitors
Horse Falls at 3* / 4* Event Levels (2010 – 2014)

Total Number of Horse Falls

Percentage Horse Falls from X-C starts

- Higher percentage of horse fall for lower category riders (D and NC), but
- Higher number of actual falls in category C
Individual Factors (Univariables)

Factors that were individually found to affect the likelihood of a horse fall:

<table>
<thead>
<tr>
<th>Competition factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Event level (1* - 4*)</td>
</tr>
<tr>
<td>• Event type (CCI vs CIC)</td>
</tr>
<tr>
<td>• Championship?</td>
</tr>
<tr>
<td>• Venue</td>
</tr>
<tr>
<td>• Course Designer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fence Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Type</td>
</tr>
<tr>
<td>• Related to Water</td>
</tr>
<tr>
<td>• Combination</td>
</tr>
<tr>
<td>• Landing</td>
</tr>
<tr>
<td>• Frangible</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rider factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Rider category</td>
</tr>
<tr>
<td>• Gender</td>
</tr>
<tr>
<td>• National Federation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Horse factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Age</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Previous horse / rider performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Previous X-C performance – number of runs / starts</td>
</tr>
<tr>
<td>• Previous dressage performance</td>
</tr>
<tr>
<td>• Previous SJ performance</td>
</tr>
<tr>
<td>• Previous horse falls</td>
</tr>
</tbody>
</table>
Multivariabe Analysis

• Identifies the **independent** effects of the individual (univariable) factors
  – e.g. it was found that event type CCI / CIC was not influential – it was the level (1* - 4*) that affected the risk of a horse fall

• The following slides explore some of the more important independent risk factors
Risk of horse fall at different Event levels

- Risk of horse fall at 4* level is 3.5 x that at 1* level
- This was independent of all other factors e.g. number of fences, venue, whether it is a championship
Risk of horse fall at Championships

- Risk of horse fall at Championship is almost twice that at a standard competition.
- This was independent of all other factors e.g. event level, venue, rider category.
Risk of horse fall for different rider categories

- Decreased risk of horse fall for higher category riders
- This was independent of other factors e.g. event level, competition type
Risk of horse fall for different fence types

- Increased risk of horse fall at corner fences and square spreads
- Decreased risk of horse fall at brush fences and ascending spreads
Risk of horse falls at Frangible Fences

- Increased risk of horse fall at frangible fences
- This is independent of all other factors e.g. fence type, event level
- More control data required before firm conclusions can be drawn
• Increased risk of horse fall for fences related to water
• This is independent of other factors e.g. type of fence
Risk of horse falls at downhill fences

- Increased risk of horse fall at downhill fences
- This is independent of all other factors e.g. fence type, event level
Venue and Course Designer

• Some venues have higher risk of horse falls than other. This is independent of other factors e.g. event level.
• The same effect is evident for Course Designers
• Individual venues / CDs were not explored in detail in this study but this should be monitored
Rotational vs Non-rotational horse falls

<table>
<thead>
<tr>
<th>Horse falls</th>
<th>Non-rotational falls</th>
<th>Rotational falls</th>
</tr>
</thead>
<tbody>
<tr>
<td>1003</td>
<td></td>
<td>179</td>
</tr>
</tbody>
</table>

Graph showing the number of falls:
- Non-rotational falls: 1003
- Rotational falls: 179
Rotational vs Non-rotational horse falls

Factors that are linked with rotational (as opposed to non-rotational) horse falls:

<table>
<thead>
<tr>
<th>Factor</th>
<th>Risk ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horse hit fence hit hard</td>
<td>2.4</td>
</tr>
<tr>
<td>Horse hit fence on way up</td>
<td>2.7</td>
</tr>
<tr>
<td>Horse aged 7 years or younger</td>
<td>2.5</td>
</tr>
<tr>
<td>Horse approach too fast</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Assessment of speed and impact with fence via fence judge observation – some bias possible
Rider injury as a result of a horse fall

- Percentage seriously/fataly injured
- Rotational Fall: 16%
- Non-rotational Fall: 4%

Increased percentage of serious/fatal injuries following a rotational fall.
## Rider Injury Following a Horse Fall

### Other factors linked with rider injury

<table>
<thead>
<tr>
<th>Factor</th>
<th>Risk ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Championship Competition</td>
<td>1.8</td>
</tr>
<tr>
<td>Horse aged 7 years or younger</td>
<td>2.5</td>
</tr>
<tr>
<td>Horse approach too fast</td>
<td>1.5</td>
</tr>
<tr>
<td>Horse hit fence hard</td>
<td>2.4</td>
</tr>
<tr>
<td>Frangible fence</td>
<td>1.9</td>
</tr>
<tr>
<td>Fence jumped out of water</td>
<td>2.8</td>
</tr>
<tr>
<td>Fence jumped into water</td>
<td>0.2*</td>
</tr>
</tbody>
</table>

*Although there is a high risk of a horse fall for fences jumped into water, the risk of rider injury is lower.*
Key Recommendations

Competition Factors

• Event Level - review qualification system for all levels.
• Consider standardising competition entry requirements worldwide
• Venue and Course Design - continue to monitor

Horse / Rider Factors

• Rider Category - review qualifications for 3★ and 4★ events
  (rider licence?)
• Review MERs as more data become available
• Horse age - review the entry qualifications for younger horses.
• Monitor horse / rider faller partnerships
• Gather information about rider speed
• Rider education - disseminate report findings
Key Recommendations

Fence Factors

• Disseminate study findings to CDs and TDs
• Avoid combined use of high risk fences e.g.
  – Square parallels coming out of water
  – Corner fences with downhill landing
• Prioritise further analysis of frangible fences
  – Additional data collection including control data
  – Review information provided by TDs and fence judges
• Develop new fence descriptor form with more objective measurements
  – Height
  – Width at base and top
  – Ground line position
  – Terrain and location
  – Front face angle and contour
Key Recommendations

Data collection and input

• Explore methods of collecting objective data e.g. of rider speed
  – Use of head-cams (for fence judges)
  – Photographs of fences
  – Film record of all events

• Collect data from non-fallers
  – Random controls
  – All refusals
  – All activated frangible devices

• Modify and simplify forms and include standardised descriptions of:
  – Rotational fall
  – Horse injury
  – Rider injury

• Fence judge training – develop online guidelines / video examples
Other Recommendations

- Data
- Safety Equipment
- Medical Records
- Television Coverage
- Training
- Deformable Fences
- Penalty System
Any Questions ?