Vaccination schedules on a stud farm

J. Richard Newton FRCVS
Epidemiology & Disease Surveillance
Animal Health Trust

Vaccinating on a stud farm

• What are we aiming to achieve from vaccinating on a stud farm?
• Three things:
  1. Stimulating **active immunity in mares & stallions/teasers** against diseases that threaten their health & reproductive efficiency
  2. Providing **passive immunity in foals** with maternal antibody in mares’ colostrum
  3. Stimulating **active immunity in foals** against diseases that threaten their health

Influenza
Tetanus
Lawsonia (EHV-1–4)

EVA in stallions/teasers

Influenza
Tetanus
Rotavirus (EHV-1–4)

Not considered here although vaccines are available:
Strangles (*S. equi*)
West Nile Virus (WNV)
Products (available in UK)

- **EHV-1/-4**: one licensed product
- **Equine Influenza**: three licensed products
- **Tetanus**: several licensed products & combined with equine influenza products
- **Equine Rotavirus**: one licensed product
- **Lawsonia intracellularis**: porcine product used ‘off-label’ in horses
- **EVA**: one licensed product (but currently not available since batch expired in Nov 2017)

Problems with vaccine supply

- **EHV-1/-4**: one licensed product *
- **Equine Influenza**: three licensed products
- **Tetanus**: several licensed products & combined with equine influenza products
- **Equine Rotavirus**: one licensed product *
- **Lawsonia intracellularis**: porcine product used ‘off-label’ in horses
- **EVA**: one licensed product (but currently not available since batch expired in Nov 2017)
  *VMD has licenced alternative products in event of supply issues

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**Equine Herpes Virus 1/-4**

<table>
<thead>
<tr>
<th>Vaccinate</th>
<th>To protect</th>
<th>Vaccination protocol</th>
<th>Disease syndrome*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Mare</td>
<td>Mare</td>
<td>@ 5th, 7th, 9th mth of pregnancy</td>
<td>Abortion &amp; foal death</td>
</tr>
<tr>
<td>2 Mare</td>
<td>Foal via MDA</td>
<td>@ 5th, 7th, 9th mth of pregnancy</td>
<td>Respiratory disease</td>
</tr>
<tr>
<td>3 Foal</td>
<td>Foal</td>
<td>2 doses 4-6 wks apart from 5 m.o. + 6 mth boosters</td>
<td>Respiratory disease</td>
</tr>
</tbody>
</table>

*No label claim for preventing EHV-1 neurological disease

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**Equine Influenza**

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</thead>
<tbody>
<tr>
<td>1 Mare</td>
<td>Mare</td>
<td>2 doses 4-6 wks apart from 4-6 m.o. + 5-6 mth booster + 12-15 mth boosters thereafter</td>
<td></td>
</tr>
<tr>
<td>2 Mare</td>
<td>Foal via MDA</td>
<td>Primary course or booster in final trimester of pregnancy</td>
<td></td>
</tr>
<tr>
<td>3 Foal</td>
<td>Foal</td>
<td>2 doses 4-6 wks apart from 4-6 m.o. + 5-6 mth booster + 12-15 mth boosters thereafter</td>
<td></td>
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**Tetanus**

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<tbody>
<tr>
<td>1 Mare</td>
<td>Mare</td>
<td>2 doses 4-6 wks apart from 3-6 m.o. + 24-36 mth boosters thereafter</td>
</tr>
<tr>
<td>2 Mare</td>
<td>Foal via MDA</td>
<td>Primary course or booster in final trimester of pregnancy</td>
</tr>
<tr>
<td>3 Foal</td>
<td>Foal</td>
<td>2 doses 4-6 wks apart from 3-6 m.o. + 24-36 mth boosters thereafter</td>
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**Equine Rotavirus**

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<th>Vaccination protocol</th>
<th>Disease syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Mare</td>
<td>Foal via MDA &amp; milk intake</td>
<td>@ 8th, 9th, 10th mth of pregnancy</td>
<td>Foal diarrhoea</td>
</tr>
</tbody>
</table>
### Lawsonia intracellularis

<table>
<thead>
<tr>
<th>Vaccinate</th>
<th>To protect</th>
<th>Vaccination protocol</th>
<th>Disease syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Foal</td>
<td>Foal</td>
<td>2 doses 30 days apart per-rectum a month before disease is anticipated (3-4 m.o.)</td>
<td>Equine Proliferative Enteropathy (EPE)</td>
</tr>
</tbody>
</table>

### Equine Viral Arteritis

<table>
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<tr>
<th>Vaccinate</th>
<th>To protect</th>
<th>Vaccination protocol</th>
<th>Disease syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Stallion/Teaser</td>
<td>Mares &amp; foals</td>
<td>2 doses 3-6 wks apart from 9 m.o. + 6 mth boosters (blood tested negative before 1st dose)</td>
<td>Viral arteritis after breeding Long-term shedding of EAV in semen</td>
</tr>
</tbody>
</table>

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**Vaccinating mares & foals**

The interface of **passive** and **active** immunity might be thought of as representing a hazardous ‘immunological junction’ in foals!

**A ‘hazardous junction’!**

- Difficult to stimulate active immunity in the face of maternally derived antibody
- So care is needed with the timing of initiating active immunisation in foals
- This inevitably creates a period of susceptibility to infection in foals
- Also longer-term effects on disease susceptibility have been demonstrated

**A ‘hazardous junction’!**

- This inevitably creates a period of susceptibility to infection in foals
- Also longer-term effects on disease susceptibility have been demonstrated

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A ‘hazardous junction’!

- Are these short and long term effects attributable entirely to interference by MDA?
- Is there any independent effect from post-natal maturation of the foal’s immune system?
- Consider some more recent evidence...
  - Fougerolle et al (2016) *Vaccine* 34, 3787-95

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Two French TB studs

- Two foal crops on two TB studs monitored serologically (SRH mm$^2$) during EI vaccination
  - Commercial canarypox vectored vaccine
  - Administered in accordance with datasheet
    - Primary course (V1+V2) 4-6 weeks apart
    - First booster (V3) 6 months after V2
  - **Main outcome** = SRH @ V3+3 months
  - **Risk factor 1** = SRH @ V1 measuring MDA
  - **Risk factor 2** = Age @ V1 in days

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Main outcome

- Significant difference (P=0.0002) in SRH @ **V3+3 mths** between the two studs in Year 1

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Risk factor 1

- Significant difference (P=0.007) in **MDA (SRH @ V1)** between the two studs in Year 1

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Risk factor 2

- Significant difference (P<0.0001) in **Age in days @ V1** between the two studs in Year 1
Null hypothesis: The Age at V1 effect is not real & is wholly explained by the presence of MDA at time of V1 in younger animals

Test the null hypothesis using multiple linear regression analysis (Stata12 software)

Evidence-based intervention

- Observations in Year 1 on Stud 1 were acted on by increasing Age @ V1 in Year 2 on Stud 1
- This significantly decreased the % of MDA positive animals in Year 2 on Stud 1
- These changes to both MDA and Age @ V1 on Stud 1 in Year 2 would be predicted by the Year 1 multiple linear regression model to correct the reduced SRH @ V3+3 months
- And they did:

Model predicts: SRH@V3+3m = -5.2 -0.46(MDA) + 0.59(Age@V1) (n = 60, R² = 0.31)
- SRH @ V3+3 months was independently statistically significantly associated:
  - negatively with increasing MDA @ V1 (P=0.009)
  - positively with increasing Age @ V1 (P=0.002)
- Allows rejection of the null hypothesis
Conclusions

• Avoiding the hazardous ‘immunological junction’ may be important for other diseases
  • EHV & tetanus as well as influenza
• Delaying V1 in foals may provide longer term benefits that outweigh shorter term risks
• Little evidence to justify giving V1 before 6 months of age in foals with adequate MDA undergoing active immunisation
  • Except for *Lawsonia intracellularis*

*Lawsonia intracellularis*

Equine Proliferative Enteropathy (EPE) in weanlings first described in 1996:

• Fever
• Colic
• Lethargy
• Diarrhoea
• Weight loss
• Dependent oedema

*Lawsonia* vaccine trial

• Intra-rectally administered avirulent live vaccine assessed in Kentucky in Sept. 2009

  – Randomised field trial in weanlings on 3 farms
  – 96 vaccinated + 106 non-vaccinated; co-housed
  – 2 x 30ml doses 30 days apart

*Lawsonia* vaccine trial

• 184 foals completed the study
• EPE prevalence was **1.9%** (vs 10% expected)
• EPE in 3/106 non-vaccinated vs 1/96 vaccinated (P=0.35)
• Subclinical EPE infection (serology) in 63/106 (59%) non-vaccinated weanlings
• EPE not noted to have decreased in prevalence elsewhere in central KY
• **Protection from cross-contamination??**
  • Vaccinates conveyed protection to non-vaccinates
  • Also seen with live polio vaccines in humans

*“Lawsonia means pigs right?”*

• Virulence varies in pigs and horses between pig & horse derived *L. intracellularis* isolates

Evidence of host adaptation in *Lawsonia intracellularis* infections

Fabbri A. *Veterinary Research* 2013, 54, 1003

Evidence of host adaptation in *Lawsonia intracellularis* infections

Fabbri A. *Veterinary Research* 2013, 54, 1003
Q’s remaining re. *Lawsonia*

- Are porcine *Lawsonia* isolates less significant than previously believed?
- If so are wildlife reservoirs the reason why (e.g. rabbits, deer, rodents, feral cats)?
- What are the roles of different wildlife reservoirs (farms-regions-countries)?
- Could there be host adaptation in reservoir species & what does this mean for foals?
- Field experience with foal vaccination?
- Need locally more targeted vaccines?

**Epidemiology of EVA**

- EVA vaccination targeted at stallions/teasers

**EVA vaccine issues**

- No DIVA vaccines
  - Need for pre-vaccination negative VN test
  - Limited data supporting field protection of stallions
- Multiple boosters required for adequate protection
  - First season sires poorly protected despite vaccine
  - Initiate EVA vaccination of stallion prospects whilst still competing?
- Occasional vaccine supply issues
  - 2003 Irish outbreak coincided w. vaccine supply issues, which left first season sires unprotected
  - Again in 2018 with batch expiry on 26th Nov 2017

**Antibody with Artervac**

- 0-30 days post-vaccine
- 31-100 days post-vaccine
- 320-400 days post-vaccine

**% horses protected (>1:100)**

- 0-30 days post-vaccine
- 31-100 days post-vaccine
- 320-400 days post-vaccine

**Artervac supply gap 2018**

*EQUIP ARTERVAC (Zoetis) POST-VACCINATION SEROLOGICAL MONITORING 2017-2018*