ANTHELMINTIC RESISTANCE: THE CLOCK IS TICKING!

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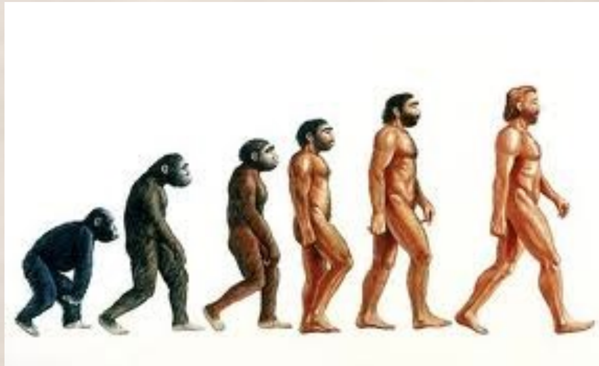
ANTHELMINTIC RESISTANCE

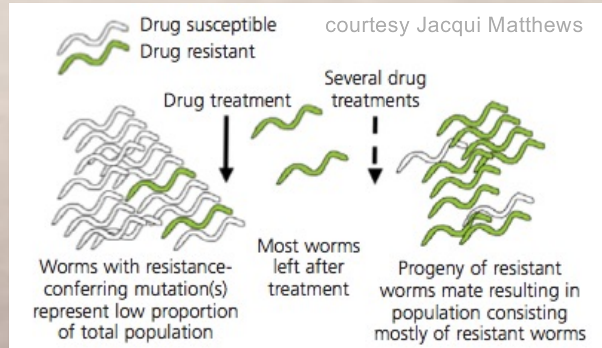
“Anthelmintic Resistance”

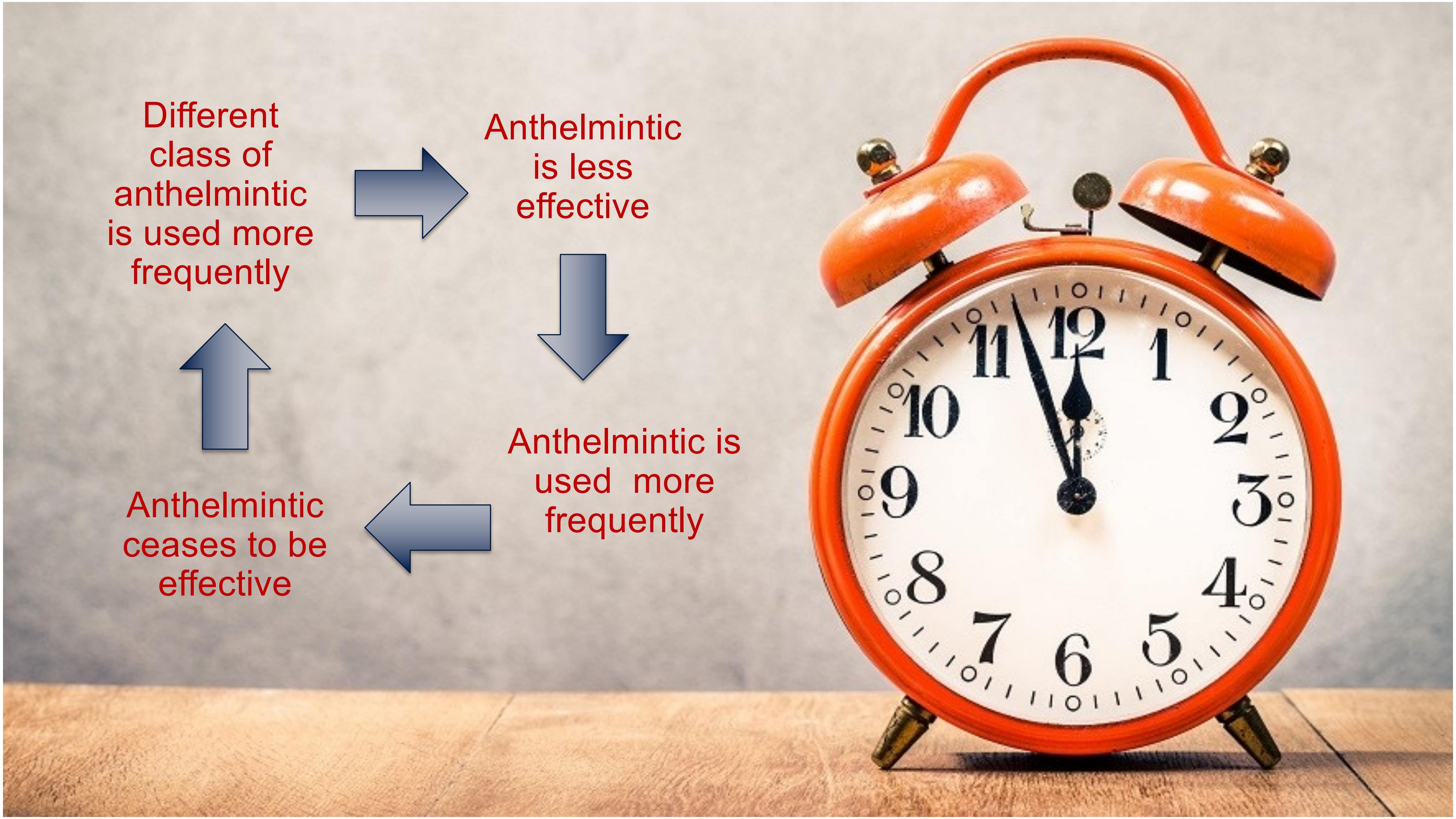
“a proportion of the worms picked up from a particular pasture are no longer killed by the de-wormer”



Why does resistance develop?

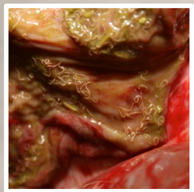
- Natural selection
- The more we de-worm, the faster resistance develops




Different class of anthelmintic is used more frequently
Anthelmintic is less effective
Anthelmintic is used more frequently
Anthelmintic ceases to be effective


1960s: Anthelmintics developed
1985: Need to discontinue routine de-worming highlighted
1990s: Consensus de-worming practices had to change
2000s: Most Vets and SQPs advise targeted de-worming protocols
2010s: Increasing reports of resistance to every available class of anthelmintic
2020's: No suggestion of any new class of anthelmintic being developed

WE ONLY HAVE 4 CLASSES OF ANTHELMINTIC!



Cyathostomins

- Benzimidazoles
  - ubiquitous
- Pyrantel
  - 16-70%
- Avermectins
  - <5%
  - 50% reduced ERP

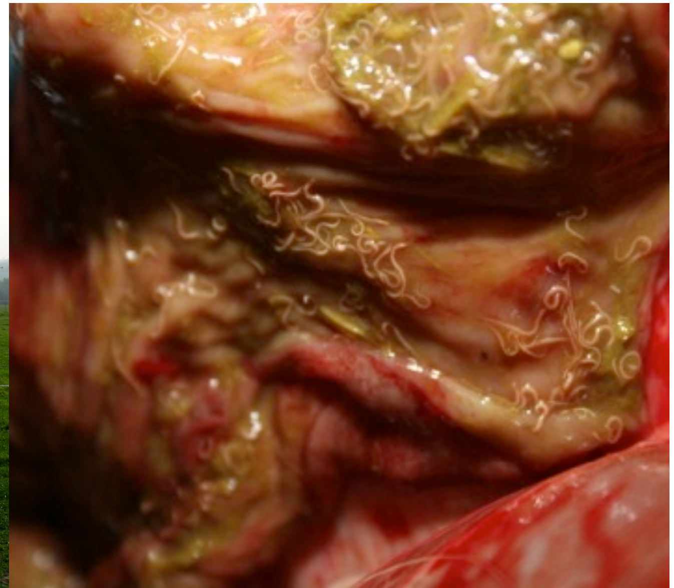
Ascarids

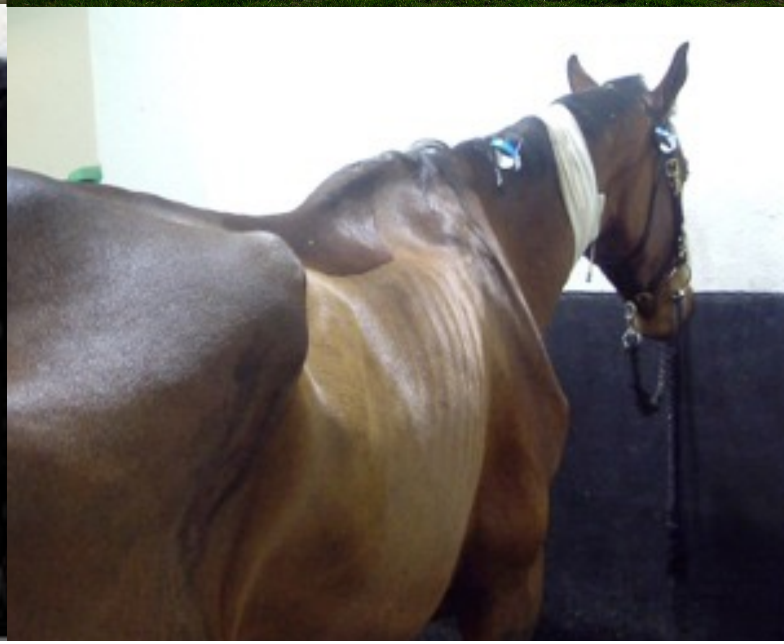
- Benzimidazoles
  - common
- Pyrantel
  - common
- Avermectins
  - ubiquitous

Tapeworms

- Pyrantel
  - early reports
- Praziquantel
  - early reports








ECOTOXICITY

STREAM 2 HALL 9
Tuesday 7th September

17.05–17.20

Environmental effects of anthelmintics

Bryony Sands, *PhD AFHEA*
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Background
Veterinary parasiticides have been identified as a source of environmental contamination. These compounds are insecticidal by nature and can be excreted unmetabolised in animal dung after treatment, where they have off-target effects on terrestrial and freshwater invertebrates.

Objectives
Landscape-scale impacts of veterinary parasiticides on dung beetle populations, and persistence of ivermectin residues in manure aged as a field heap, were examined.

Study design
Dung beetle biodiversity was measured on 24 farms across south-west England that either routinely treated with macrocyclic lactones (e.g. ivermectin), synthetic pyrethroids (e.g. deltamethrin) or no veterinary parasiticides. Manure contaminated with ivermectin was stored in a field heap for 4 months between February and March and used to examine invertebrate toxicity.

Methods
Dung baited pitfall traps were set up on farms and emptied after 24 hours. Dung beetles were identified to species level and biodiversity indices, community ordination and mixed-effects models were used to compare populations between farm treatment regimes. Rainwater run-off was collected monthly from a manure heap treated with ivermectin and an untreated control, and tested for toxicity to the freshwater crustacean *Daphnia magna*. Aged manure was spread on mesocosms containing topsoil, and impacts on terrestrial and soil invertebrates and pasture productivity were measured.

Results
Dung beetle species richness and diversity were significantly reduced on farms which regularly treated with veterinary parasiticides. Rainwater run-off from manure contaminated with ivermectin was highly toxic to *D. magna* for the entire 4 months of storage. Insect emergence and pasture productivity were significantly lower in mesocosms spread with ivermectin-contaminated manure.

Limitations
Actual concentrations of parasiticide residues in dung should be chemically quantified in further studies.

Conclusions
Parasiticide residues in manure may have pervasive off-target impacts on invertebrate biodiversity which persist for at least 4 months of storage.

NOTES

BVA British Veterinary Association | Policy statement — BSAVA British Small Animal Veterinary Association — BVZS

BVA, BSAVA and BVZS policy position on responsible use of parasiticides for cats and dogs

Introduction

Parasiticide products are commonly used in small animal medicine to prevent and treat for various parasites, including fleas, ticks and worms. As well as preventing animal health and welfare problems, human health risks from associated zoonotic threats have to be considered.

Recently, concerns have been raised that some of these medicines are contaminating the environment. Parasiticides could be reaching rivers through wastewater from homes or other premises where animals are kept, or from animals entering rivers. Parasiticides may also be excreted in urine and faeces, and therefore deposited in gardens and open spaces, and absorbed into soil. As parasiticides are harmful to a wide range of invertebrates, this could be highly detrimental to wildlife and ecosystems. This in turn could impact on public health.

Social obligation to minimise environmental damage

DIAGNOSTIC-LED DE-WORMING

Would reduce anthelmintic use by 80%

Advocated for 30 years

Low horse-owner uptake

0 – 60% *OF RESPONDENTS* to surveys

as little as 10% *OF RESPONDENTS* are then using FWEC to inform therapy

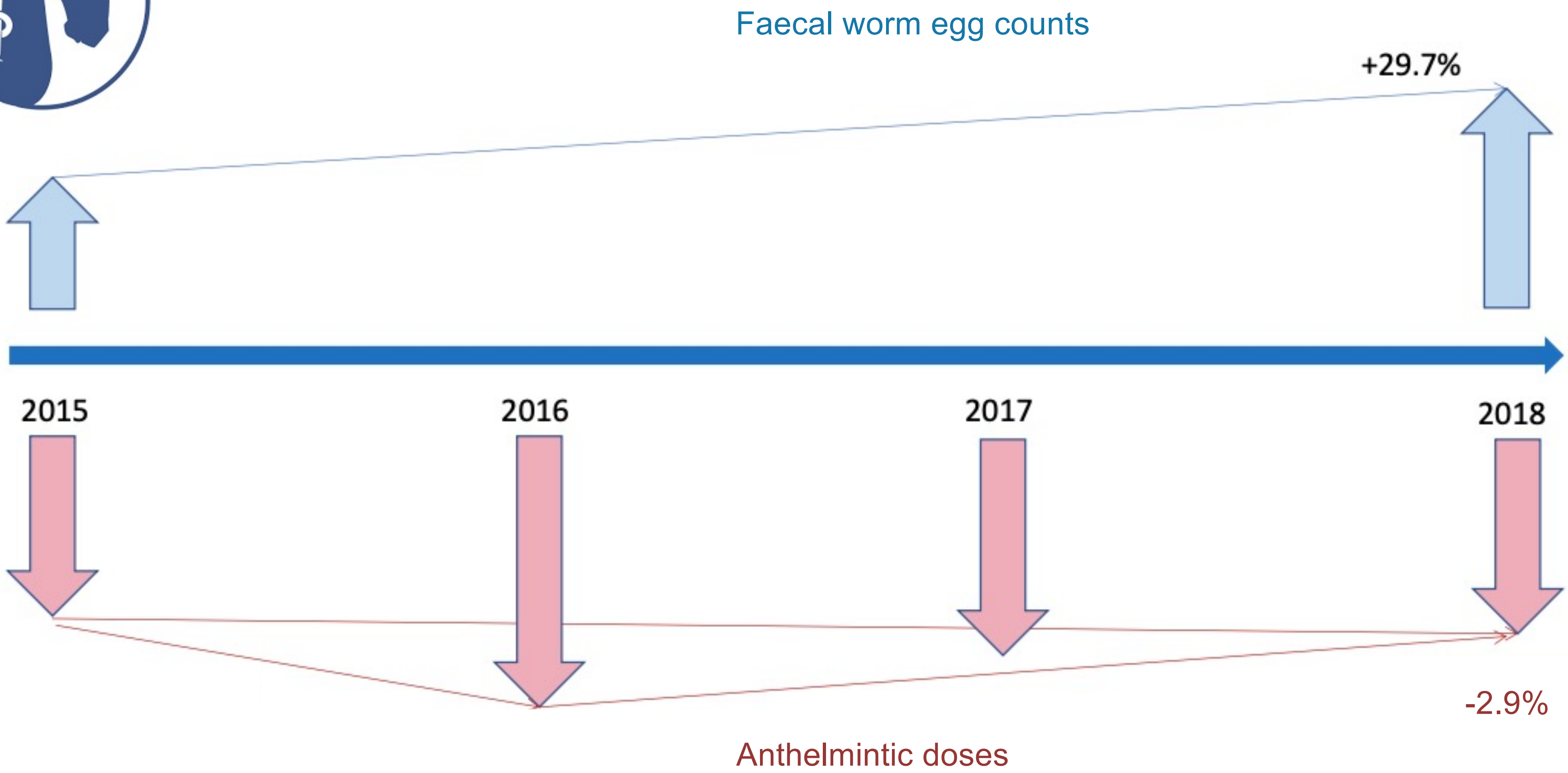
O'Meara & Mulcahy, 2002
Lind et al., 2007
Fritzen et al., 2010
Relf et al., 2012
Nielsen et al., 2014
Stratford et al., 2014
Bolwell et al., 2015
Robert et al., 2015
Salle and Cabaret, 2015
Rosanowski et al., 2016
Tzelos et al., 2019

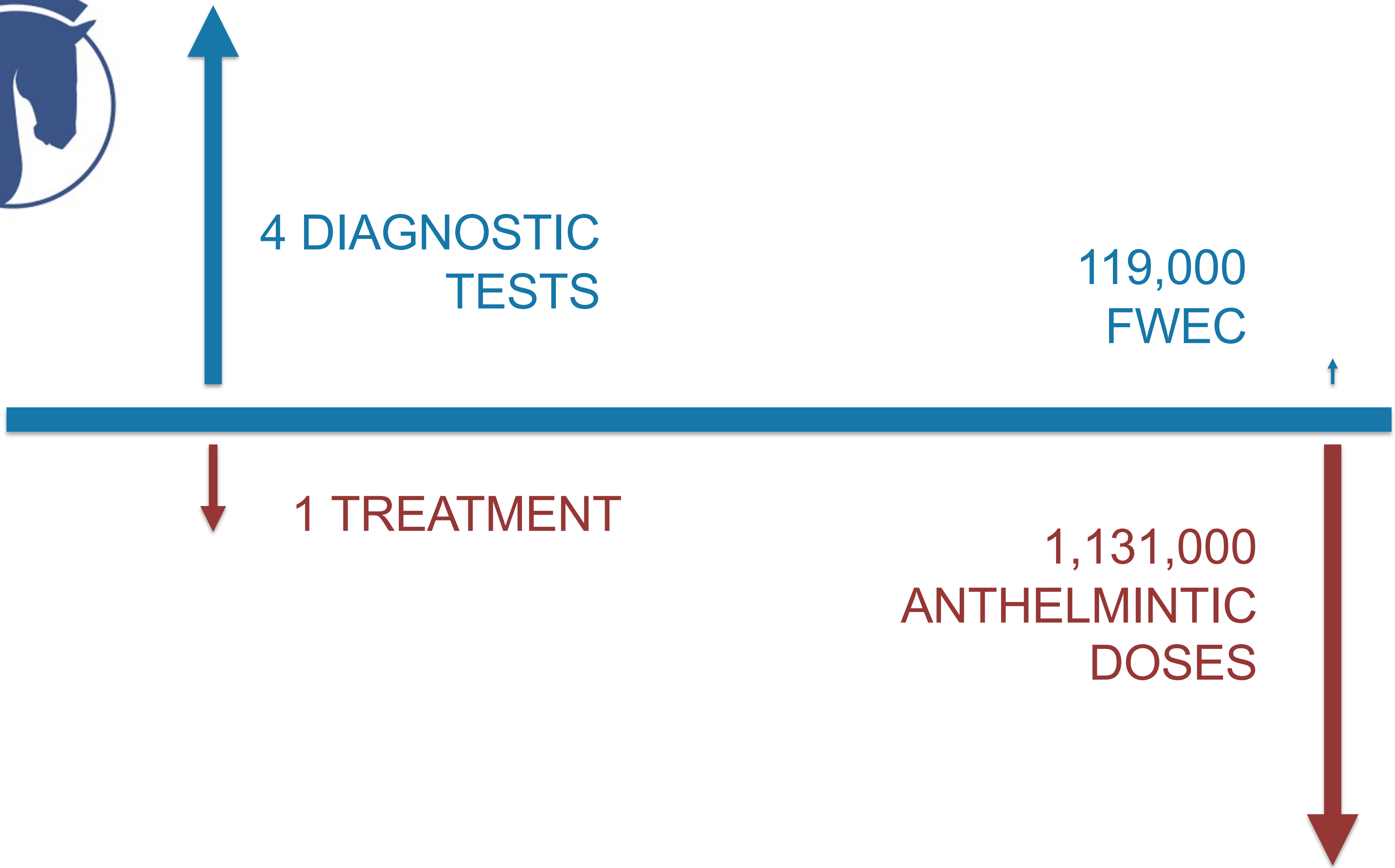
Respondents to questionnaire studies:

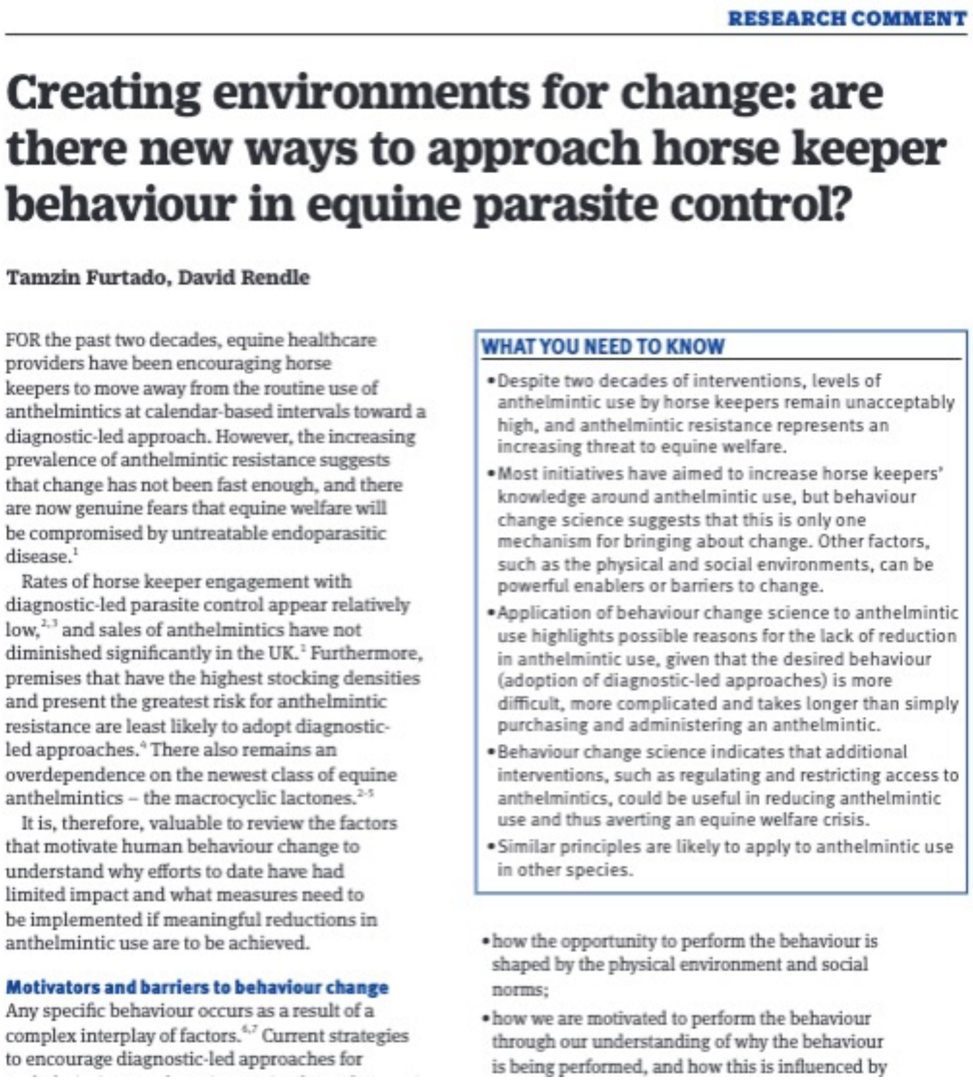
- Are engaged with the subject
- Are small private owners

We do not connect with the silent majority:

- larger owners/managers
- greater risk of anthelmintic resistance
- greater need for targeted use
- greatest consequences of resistance


Faecal worm egg counts
+29.7%
2015
2016
2017
2018
-2.9%
Anthelmintic doses


4 DIAGNOSTIC TESTS
1 TREATMENT
119,000 FWEC
1,131,000 ANTHELMINTIC DOSES


RESEARCH COMMENT

Creating environments for change: are there new ways to approach horse keeper behaviour in equine parasite control?

Tamzin Furtado, David Rendle

FOR the past two decades, equine healthcare providers have been encouraging horse keepers to move away from the routine use of anthelmintics at calendar-based intervals toward a diagnostic-led approach. However, the increasing prevalence of anthelmintic resistance suggests that change has not been fast enough, and there are now genuine fears that equine welfare will be compromised by untreatable endoparasitic disease.[1]

Rates of horse keeper engagement with diagnostic-led parasite control appear relatively low,[2,3] and sales of anthelmintics have not diminished significantly in the UK.[1] Furthermore, premises that have the highest stocking densities and present the greatest risk for anthelmintic resistance are least likely to adopt diagnostic-led approaches.[4] There also remains an overdependence on the newest class of equine anthelmintics – the macrocyclic lactones.[2-5]

It is, therefore, valuable to review the factors that motivate human behaviour change to understand why efforts to date have had limited impact and what measures need to be implemented if meaningful reductions in anthelmintic use are to be achieved.

WHAT YOU NEED TO KNOW

- Despite two decades of interventions, levels of anthelmintic use by horse keepers remain unacceptably high, and anthelmintic resistance represents an increasing threat to equine welfare.
- Most initiatives have aimed to increase horse keepers' knowledge around anthelmintic use, but behaviour change science suggests that this is only one mechanism for bringing about change. Other factors, such as the physical and social environments, can be powerful enablers or barriers to change.
- Application of behaviour change science to anthelmintic use highlights possible reasons for the lack of reduction in anthelmintic use, given that the desired behaviour (adoption of diagnostic-led approaches) is more difficult, more complicated and takes longer than simply purchasing and administering an anthelmintic.
- Behaviour change science indicates that additional interventions, such as regulating and restricting access to anthelmintics, could be useful in reducing anthelmintic use and thus averting an equine welfare crisis.
- Similar principles are likely to apply to anthelmintic use in other species.

Motivators and barriers to behaviour change

Any specific behaviour occurs as a result of a complex interplay of factors.[6,7] Current strategies to encourage diagnostic-led approaches for

- how the opportunity to perform the behaviour is shaped by the physical environment and social norms;
- how we are motivated to perform the behaviour through our understanding of why the behaviour is being performed, and how this is influenced by

- Education alone doesn't work
  - we preach to the converted
- The desired behaviour:
  - is more difficult
  - is more complicated
  - takes longer
  - is more expensive (initially)
- There have to be barriers to acquisition and use of anthelmintics

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- how the opportunity to perform the behaviour is shaped by the physical environment and social norms;
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- Healthcare providers?
- The desired behaviour:
  - is more difficult
  - is more complicated
  - takes longer
  - is less profitable
- Are we naïve to think everyone will work for the common good?

Nielsen et al. (2006, 2014)

“5 years after introduction of prescription only status, veterinary involvement in equine parasite control had increased tremendously, and routine FEC surveillance had become widely implemented”

Becher et al. (2018)

“45% treated their adult horses twice or less per year and the other half of the participants based their decisions on FECs”

2007

3645kg of macrocyclic lactones, benzimidazoles and pyrantel

2008

Introduction of prescription only status

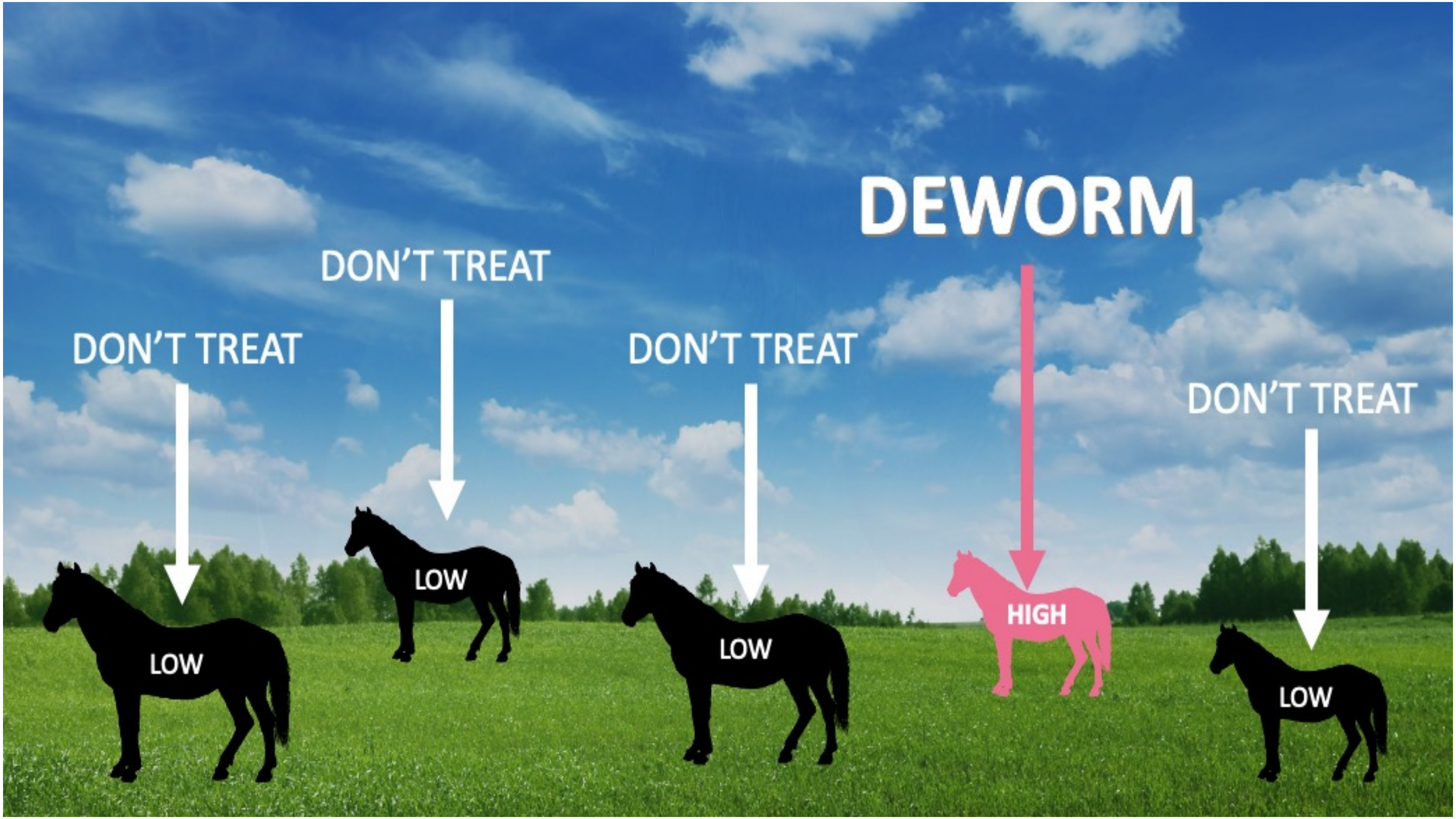
2016

1445kg of macrocyclic lactones, benzimidazoles and pyrantel

60% reduction in anthelmintic use

HOW DO WE IMPROVE THE SITUATION?

- The VMD have no appetite for legislative change
- Stakeholder initiatives replicating COWS, SCOPS
  - awareness and education of owners and professionals
  - is there sufficient incentive for owners and retailers to engage?
- Requirement for use in line with a risk-based annual health plan?
  - end individual transactions and adopt an holistic approach
  - mandate use of diagnostics
  - herd-based decisions
  - utilize medicines off-label (discordance between vets and SQPs)
  - utilize unregistered medicines
- Health and welfare pathway?


DEWORM
DON'T TREAT
DON'T TREAT
DON'T TREAT
DON'T TREAT
LOW
LOW
LOW
HIGH
LOW

The industry doesn’t appear to appreciate the threat level

Fundamental change is necessary to avert widespread morbidity and mortality in equines