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AUTHORS: D. Pollard, C. E. Wylie, K. L. P. Verheyen, J. R. Newton

JOURNAL: Equine Veterinary Journal

PUBLISHER: Wiley

PUBLICATION DATE: November 2017

DOI: 10.1111/evj.12704

Assessment of horse owners' ability to recognise equine laminitis: a cross-sectional study of 93 veterinary diagnosed cases in Great Britain

Author names and affiliations: D. Pollard[1,3*], C. E. Wylie[2], K. L.P. Verheyen[3], J. R. Newton[1].

[1]Epidemiology Department, Centre for Preventive Medicine, Animal Health Trust, Newmarket, Suffolk, UK

[2]Rossdales Equine Hospital, Exning, Newmarket, UK

[3]Veterinary Epidemiology, Economics and Public Health Group, Production and Population Health, Royal Veterinary College, North Mymms, Hertfordshire, UK.

***Correspondence email**: danica.pollard@aht.org.uk

Key Words: horse, laminitis, epidemiology, clinical signs, cross-sectional; owner-reported

Word Count: 5423

Ethical Considerations

This study was granted institutional ethical approval from the Animal Health Trust (AHT01-2014) and the Royal Veterinary College (2014 0105H). Animal use not applicable. Return of a completed questionnaire was taken as informed owner consent.

Authorship

D.P., C.E.W., K.L.P.V. and J.R.N. designed the study. Data collection, analysis and interpretation was conducted by D.P., supervised by C.E.W., K.L.P.V. and J.R.N. All authors contributed to the preparation of the manuscript and approved the final version.

Competing Interests

The authors have declared no competing interests. None of the authors of this paper has a financial or personal relationship with other people or organisations that could inappropriately influence or bias the content of the paper.

Sources of Funding

The project was funded by World Horse Welfare, who support D.P.'s PhD. C.E.W. is funded by The Margaret Giffen Charitable Trust. J.R.N. is supported through a combined contribution to the Animal Health Trust's Equine Infectious Disease Service from the Horserace Betting Levy Board (HBLB), Racehorse Owners Association (ROA) and Thoroughbred Breeders' Association (TBA).

Acknowledgements

The authors would like to thank all the participating veterinary practitioners and horse owners for their assistance with this study.

Background: Use of owner-reported data could further epidemiological knowledge of equine laminitis. However, owner recognition of laminitis has not previously been assessed.

Objectives: The primary objective was to establish whether cases of owner-suspected laminitis would be confirmed as laminitis by the attending veterinary surgeon. Secondary objectives were to compare owner- and veterinary-reported information from veterinary-confirmed cases of equine laminitis.

Study Design: Cross-sectional study.

Methods: Twenty-five British veterinary practices were invited to submit laminitis reporting forms (LRFs) for active laminitis cases attended between January 2014 and October 2015; detailing 27 clinical signs, five underlying conditions and seven risk factors associated with laminitis. Owners were invited to independently complete a modified LRF if reason for the veterinary visit was suspicion of laminitis. Differences between paired veterinary and owner LRFs, and between cases where owners did and did not recognise laminitis, were assessed using McNemar's and Fisher's exact tests, respectively.

Results: Veterinary LRFs were received for 93 veterinary-diagnosed laminitis cases. All 51 owner-suspected cases were confirmed by veterinary diagnosis, with the remaining 42 (45.2%) not recognised as laminitis by owners. Undefined lameness, foot abscesses, colic and stiffness were common reasons for owner-requested- veterinary visits in owner-unrecognised cases. Divergent growth rings (prevalence difference: 27.3%, P=0.01) and 'breed type' (prevalence difference: 21.2%, P=0.04) were more commonly reported by veterinary surgeons in owner-recognised compared to owner-unrecognised cases. 'Difficulty turning', 'shifting weight' and 'body condition' were more frequently reported by veterinary surgeons whilst 'increased hoof temperature' was reported more frequently by owners.

Main limitations: The limited number of case data restricted statistical inferences regarding the secondary objectives.

Conclusions: All owner-suspected laminitis cases were confirmed upon veterinary examination, showing validity for the inclusion of owner-reported cases in future epidemiological studies. However, failure of laminitis recognition by owners highlights further need for evidence-based education to ensure early disease detection.

Introduction

Equine laminitis is a complex, multifactorial disease for which further epidemiological investigations have been identified as key to reducing its welfare impact [1; 2]. However, systematic reviews of studies addressing the frequency of, and risk factors for, equine laminitis identified a paucity of high-standard studies from which to extrapolate data to the general horse population [3; 4]. The most recent epidemiological investigation in Great Britain utilised a cohort with nested case-control study design, based within veterinary practices, such that cases were identified on the basis of a veterinary diagnosis of equine laminitis [5; 6]. Whilst data from first-opinion veterinary practices has also been used successfully to collect prospective data for other diseases [7-11], it is recognised that this may underestimate the true incidence of disease [12; 13]. This may be particularly true for equine laminitis due to the chronic and recurrent nature of the disease which potentially leads to owner recognition and treatment without veterinary intervention. As horse owners are likely to be the first to witness deviations from normality in their animal's health, disease estimates including data derived directly from owners, in conjunction with veterinary diagnoses, may prove to be more accurate and representative of the burden of laminitis to the horse-owning population. Before owner-reported information can be used to further epidemiological knowledge, it is important to confirm the validity of what horse owners report as laminitis in their animals is consistent with a veterinary diagnosis of the disease. Thus it is necessary to establish to what extent owners are able to recognise laminitis, and the basis on which they do so.

The aim of this study was to collect preliminary evidence on the potential usefulness and validity of including owner-reported laminitis data, alongside veterinary diagnoses, in future epidemiological studies. The primary objective was to establish whether what horse owners suspected to be laminitis in their animals was confirmed as laminitis by their veterinary surgeon. Such owner-suspected cases of laminitis would be most representative of cases which might contribute to further epidemiological studies as owner-reported, but not necessarily veterinary-diagnosed, cases of laminitis. It was therefore important to determine the confidence with which these cases could be considered to be 'true' cases of laminitis, based on comparison with concurrent veterinary assessment. It was anticipated that some laminitis cases would not be recognised as such by owners but would be diagnosed when attended by a

119 veterinary surgeon. As the collected data allowed the opportunity, the secondary objectives were to
120 compare: (i) veterinary-reported information between owner-recognised and owner-unrecognised
121 cases, giving insight into factors that made cases more or less likely to be recognised by owners, and
122 (ii) paired veterinary- and owner-reported information in owner-recognised cases only, exploring
123 veterinary and owner assessment of clinical signs and factors perceived to be important in assisting a
124 veterinary surgeon to diagnose active laminitis and an owner to recognise it.
125
126 **Material and methods**
127 *Study design and sample size*
128 A cross-sectional study was conducted using a convenience sample of veterinary practitioners in order
129 to assess the accuracy of owner-suspected laminitis against veterinary-diagnosis of the disease in horses
130 and ponies (hereafter referred to as 'horses'). Information was collected regarding the presence of pre-
131 defined clinical signs, underlying conditions and risk factors which may have contributed to laminitis
132 being suspected by the owner and/or diagnosed by the veterinary surgeon. Data were collected between
133 January 2014 and October 2015.
134
135 A sample size estimation (EpiTools[a]) was conducted to address the primary objective of establishing
136 whether owner-suspected active laminitis cases were subsequently confirmed as laminitis by the
137 attending veterinary surgeon. It was assumed that the majority of owner-suspected laminitis cases would
138 be veterinary-confirmed (98%). In order to detect this proportion with 4% precision and 95%
139 confidence, observations from 48 horses were required.
140
141 *Practice selection*
142 Twenty-eight veterinary practices that contributed to a previous laminitis study [5] were invited to
143 participate in the current study. Ten of these (35.7%) agreed to assist with the study, with a further 15
144 practices recruited following a public announcement.
145
146 *Data collection tools*

147 A ‘laminitis reporting form’ (LRF) previously used to collect data on clinically apparent veterinary-
148 diagnosed active cases of laminitis in British horses [5] was modified for use in this study, resulting in
149 a veterinary LRF (Supplementary Information Item 1). The veterinary LRF was further modified for
150 owner use by using lay person terminology and the addition of explanatory images, resulting in a
151 corresponding owner LRF (Supplementary Information Item 2). The veterinary and owner LRFs
152 specifically collated information regarding:
153
154 1. Identifying information
155 The forms were distributed with pre-set practice ID numbers, allowing identification upon return.
156 Respondents were further asked to record the name of the horse, owner, consulting veterinary surgeon
157 and date of veterinary consultation.
158
159 2. Clinical signs
160 Tick-box responses were collected for 27 common clinical signs associated with both acute- and
161 chronic-phase laminitis. Clinical signs were based on lameness, stance, feet affected and characteristics
162 of the most severely affected foot/feet [5]. Responses were recorded as present, absent or not assessed.
163
164 3. Underlying conditions
165 Tick-box responses were collected regarding evaluations (yes, no or don’t know) of five clinical features
166 indicative of an underlying condition, which may assist in differentiating between endocrinopathic,
167 systemic inflammatory response syndrome and contralateral limb-related laminitis cases. Respondents
168 were asked to state whether the horse currently, or in the past week, had any of the following:
169 suspected/confirmed pituitary *pars intermedia* dysfunction (PPID)/ Cushing’s Disease or equine
170 metabolic syndrome (EMS), gastrointestinal disease (e.g. colic/diarrhoea), retained placenta/metritis
171 and severe unilateral weight bearing/contralateral limb overloading.
172
173 4. Risk factors

Tick-box responses were collected regarding the evaluations (yes, no or don't know) of seven horse- and management-level risk factors perceived to be associated with laminitis. Respondents were asked if these factors helped with suspicion/enhanced confidence in diagnosis of laminitis: horse breed type, age, body condition score (BCS) (overweight/underweight), a previous history of laminitis, quality of available grazing/pasture, accidental carbohydrate/concentrate overload and season/weather conditions.

5. Additional information

Veterinary LRF: The veterinary surgeon was asked to provide additional information including the horse's age and breed, their opinion as to whether the horse was underweight, neither overweight nor underweight (adequate) or overweight/obese, whether the owner suspected their horse had laminitis and whether this agreed with the final diagnosis. Free text was used to record the owner's reason for seeking veterinary attention if laminitis was not suspected or to record a different diagnosis if the owner suspected laminitis but the veterinary surgeon diagnosed another condition.

Owner LRF: Owners were asked to indicate if they had prior direct experience with laminitis, in order to indirectly gauge their likely knowledge of the disease. They had a choice of four pre-specified tick box responses relating to experience with the same horse having laminitis, with another horse they owned, another circumstance, or no prior experience with laminitis. Any additional information of relevance was invited as free-text.

Owners and veterinary surgeons were asked to report information independently from each other, based on the owner's reason for requesting the veterinary visit (whether laminitis was suspected or not):

1) If the owner suspected laminitis, they were asked to complete an owner LRF prior to and independent of the veterinary surgeon examining the horse. Post-examination and diagnosis, the veterinary surgeon completed the veterinary LRF, indicating the final diagnosis, even if this was not laminitis.

2) If the owner identified a clinical problem necessitating veterinary intervention but did not suspect laminitis, yet a laminitis diagnosis was made by the veterinary surgeon, only a veterinary LRF was submitted.

Case definition

Cases were defined as veterinary-diagnosed, clinically apparent active laminitis in horses and ponies attended by the participating veterinary practices [5; 6]. Active cases of laminitis, both acute and chronic, and of any suspected origin were included in the study. Multiple episodes of laminitis in a single individual were not included although information as to whether the animal had previously had laminitis was collected. Recruited practices were asked to complete and submit LRFs for 10 to 15 prospective cases of owner-suspected and/or veterinary-confirmed laminitis cases attended.

Data analysis

Initial data processing and descriptive statistics were conducted using Microsoft Excel[b] (v.2010). Subsequent statistical analyses were performed in STATA[c] (IC v.13.1). Statistical significance was set at a P-value of <0.05; however, marginally significant results of potential clinical relevance were also presented. P-values were not adjusted for multiple comparisons [14] to decrease the likelihood of type II errors (not detecting a difference that does exist) in particular, in light of the relatively small sample sizes to achieve the (opportunistic) secondary objectives. Proportions are presented with corresponding 95% confidence intervals (CI).

i) Equine demographics: Descriptive statistics were used to describe the distribution of horse breeds, age and veterinary opinion as to whether the horse was underweight, in adequate body condition or overweight/obese.

ii) Owner recognition of laminitis: The proportion of owner-suspected cases of laminitis that were also veterinary-diagnosed and the proportion of these owners that had direct prior experience of laminitis were determined. Additionally, the proportion of veterinary-diagnosed

cases of laminitis that were not initially recognised as such by owners was determined, along with the reasons that veterinary attention was sought.

iii) Comparison of veterinary-reported data between owner-recognised and owner-unrecognised cases: Differences in prevalence of clinical signs, underlying conditions and risk factors between veterinary LRFs where the owners did and did not recognise laminitis were compared using Fisher's exact test.

iv) Comparison between veterinary- and owner-reported data in owner-recognised cases: Differences in the prevalence of clinical signs, underlying conditions and risk factors recorded by pairs of veterinary surgeons and owners evaluating the same owner-recognised laminitis cases were compared using the McNemar's exact conditional test without continuity correction.

Results

Twenty-five veterinary practices were recruited (22 located in England and 3 in Scotland). The range of LRFs returned was 0-26 per practice (median 4), with at least one submitted from 15 of the practices (60.0%). A total of 137 LRFs were returned, reflecting 93 cases of veterinary-diagnosed laminitis.

i) Equine demographics

The study population represented a range of breeds and their crosses (Figure 1), with Welsh breeds and crosses most frequently reported in this sample (32.2%; CI 22.8-41.8%). Age and body condition assessments by veterinary surgeons were available for 92 animals. The horses had a median age of 15 years (range 3-26 years) and 62.0% (n=57, CI 52.0-71.9%) were considered to be overweight/obese by the veterinary surgeons, 35.9% (n=33, CI 26.1-45.7%) were considered to be of adequate weight and 2.2% (n=2, CI 0.0-5.2%) underweight.

ii) Owner recognition of laminitis

Of the 93 cases of veterinary-diagnosed active laminitis, 54.8% (n=51, CI 44.7-65.0%) had been suspected as having laminitis by their owners (Figure 2). All 51 of these owner-suspected cases of laminitis were confirmed by a veterinary surgeon, i.e. no 'false positive' cases of owner-suspected laminitis were reported and all owner-suspected cases were therefore classed as 'owner-recognised'. Seven owner LRFs were not returned, resulting in 44 completed owner LRFs with corresponding paired veterinary LRFs. The majority of owners who completed a LRF (n=34; 77.3%, CI 64.9-89.7%) reported having direct experience with laminitis prior to this active episode; more than half with the same animal (n=19; 55.9%, CI 39.2-72.6%). The 45.2% (n=42, CI 35.0-55.3%) of owners who did not suspect laminitis, in horses with a subsequent veterinary diagnosis of laminitis, either did not know what the problem was or suspected another condition. Owner-suspected conditions reported in these cases were lameness in one or more feet (either undefined [n=14], thought to be foot abscesses [n=5], bruised sole [n=1] or navicular disease [n=1]) (n=21; 50.0%, CI 34.9-65.1%), colic (n=6; 14.3%, CI 3.7-24.9%) and musculoskeletal stiffness (n=4, 9.5%, CI 0.6-18.4%). Three owners (7.1%, CI 0.0-14.9%) reported three other conditions (retained placenta, sunburned heels and swollen sheath) and eight (19.1%, CI 7.2-30.9%) either did not know or did not report what the problem was.

iii) Comparison of veterinary-reported data between owner-recognised and owner-unrecognised cases

Two incomplete veterinary LRFs were excluded along with their paired owner LRFs, resulting in 133 useable forms available for analysis (Figure 2). These comprised 42 owner LRFs and 91 veterinary LRFs, of which 49 were from cases recognised by owners and 42 were from laminitis cases that were not recognised by owners.

The only significant difference in prevalence of veterinary-reported clinical signs (n=27) between cases where owners recognised laminitis and those where owners did not recognise laminitis was the presence of divergent growth rings (prevalence difference: +27.3%, P=0.01) (Table 1). Divergent growth rings

were more commonly reported by veterinary surgeons in cases where owners recognised laminitis (54.2%, CI 40.1-68.2%) compared to cases where owners did not recognise laminitis (26.8%, CI 13.3-40.4%). There were no significant differences in veterinary-reported prevalence of the five underlying conditions between owner-recognised and owner-unrecognised cases.

From the seven listed risk factors for laminitis, only the veterinary-reported breed type of the animal was significantly different between owner-recognised and owner-unrecognised cases (prevalence difference: +21.2%; P=0.04). The animal's breed type was more commonly reported as a risk factor that assisted with final laminitis diagnosis by veterinary surgeons attending owner-recognised laminitis cases (n=38; 77.6%, CI 65.9-89.2%) compared to veterinary surgeons attending laminitis cases not recognised by owners (n=22; 56.4%, CI 40.8-72.0%) (Table 1). There was a significant difference in breed distribution between owner-recognised and owner-unrecognised cases (P=0.001) with pony breeds generally being more prevalent than horse breeds in owner-recognised cases of laminitis. A table of breed distributions is provided in Supplementary Information Item 3.

iv) Comparison between veterinary- and owner-reported data in owner-recognised cases

Paired veterinary and owner LRFs were available for 42 out of 51 cases of owner-recognised laminitis (Figure 2).

Four of the 27 clinical signs evaluated were reported differentially by veterinary surgeons and owners. 'Difficulty turning' (P=0.02) and 'shifting of weight from leg to leg' (P=0.04) were more frequently reported by veterinary surgeons while 'increased hoof temperature' (P=0.04) and 'recumbency' (P=0.06) were reported more frequently by owners (Table 2).

Suspected or confirmed EMS was more frequently reported by veterinary surgeons compared to owners (P=0.06) and veterinary surgeons more frequently considered BCS useful for laminitis diagnosis than owners (P=0.04) (Table 2).

Discussion

This is the first study to provide epidemiological data regarding owner-recognition of active laminitis in Great Britain, to evaluate differences between veterinary data from owner-recognised and unrecognised cases and to consider differences in data reported by veterinary surgeons and owners in owner-recognised cases.

The data presented provides evidence to confirm that what horse owners suspected as laminitis in their horses, in a very high proportion of cases (>98% *a priori*) was confirmed as laminitis by their veterinary surgeons. This suggests that owner-reported laminitis cases could reliably contribute to epidemiological studies of this disease. The inclusion of these cases would be of particular value in instances where owners recognise laminitis but may not necessarily seek veterinary intervention. In this study, nearly 80% of owners that suspected laminitis, which was also subsequently diagnosed by a veterinary surgeon, had previous direct experience with the disease; over half of them with the same animal. A previous study found that the decision for horse owners to consult a veterinary surgeon regarding occurrence of colic relied mainly on the owner's knowledge and previous experience with the disease, as well as their interpretation of the severity of associated clinical signs [15]. Theoretically, an owner that has had previous experience with a disease would be more aware of the clinical signs but may also be less likely to consult a veterinary surgeon, especially if clinical signs are not perceived to be severe or the horse recovers due to management interventions based on either the owner's previous experience or following telephone advice from their veterinary surgeon. The owner's previous direct experience with the disease could also be used as a secondary validity indicator when collecting owner-reported data, in the absence of veterinary diagnosis. Inclusion of non-veterinary attended owner-reported laminitis cases would therefore be a useful addition to data on veterinary-diagnosed cases when gathering epidemiological information about the disease, creating a better-informed picture of the true disease burden and welfare implications of horses which undergo multiple recurrent episodes during their lifetime and whilst with the same owner. Additionally, by using a combination of both veterinary- and owner-reported data, the potential over-representation of recurrent laminitis cases recognised and reported by owners may be balanced by the veterinary-reporting of incident cases.

342

343 Owners were unable to recognise laminitis in approximately half of the veterinary-diagnosed cases;
344 indicating that further targeted owner education is required to raise awareness of common clinical signs
345 associated with laminitis, and to encourage rapid and evidence-based decision-making to seek
346 veterinary advice. This is especially important if owners have not had previous direct experience with
347 the disease or their horse's prior clinical history is unknown. While less knowledgeable owners may be
348 more likely to seek veterinary advice if a change in their animal's well-being is observed, and would
349 ultimately contribute to veterinary-reported cases, earlier and more accurate recognition of the disease
350 will lead to better outcomes for the horse. Laminitis diagnosis is complicated by the absence of
351 recognised clinical signs pathognomonic of the disease [5]. Appearance of (initial) acute unilateral limb
352 lameness, along with heat, an increased digital pulse and sensitivity to hoof-testers are clinical signs
353 typical of a foot abscess that are also common to many laminitis cases and as such laminitis should
354 always be ruled out in these instances [16]. Encouraging owners to monitor all four feet continuously
355 in such cases could improve earlier laminitis recognition. Similarly, failure to recognise laminitis can
356 lead to actions which could unintentionally place the horse in danger of further damage. In a case in
357 this study where the horse was thought to have colic, the owner had been walking the horse in-hand
358 throughout the night prior to veterinary diagnosis. Recent decision tree-analysis of clinical data
359 comparing clinical signs of veterinary-diagnosed laminitic cases with non-laminitic but lame controls
360 has shown promise as a tool for evaluating clinical signs to differentially diagnose laminitis [17].
361 Providing owners with a list of potential clinical signs to be aware of, including questions relating to
362 management and clinical history of their animals, could encourage more rapid and pro-active decision-
363 making.

364

365 The presence of divergent growth rings on the hoof capsule as reported by veterinary surgeons was
366 almost 30% more prevalent in owner-recognised compared to owner-unrecognised cases. Thus either
367 owners recognised laminitis because the horse had had it previously while under their care (observed
368 in approximately 56% of owner-recognised cases), or the presence of divergent growth rings was being
369 used as a distinct indicator of laminitis pathology. Divergent growth rings are a visual consequence of

internal insult to the lamellar layer and signify that the foot had in the past undergone chronic-phase changes in the suspensory apparatus of the distal phalanx; however, their presence alone does not necessarily mean that the horse is undergoing an active, acute phase of the disease [18]. There is continual regeneration and growth of the tubular hoof wall at the coronary band, where insult to the lamellae, and the appearance of the divergent growth rings, would originate. The downward migration of the keratinocytes from the coronary band to the ground surface can take up to eight months, replacing hoof wall lost due to motion or regular foot trimming [19]. Thus the location of the divergent growth rings on the hoof wall in relation to the coronary band, while indicating historic insult, would likely not be a direct result of the present active acute-phase episode. The presence of divergent growth rings is much less prevalent than clinical signs that are perhaps less publicised; being reported by veterinary surgeons in 41.6% of laminitis cases in the present study and 23.7% of cases in a prior study [5] compared with 'difficulty turning' which was reported in more than 75% of laminitis cases in both studies. Recent research suggests that commonly cited clinical signs such as the classic 'laminitis stance' and divergent growth rings, which were found in less than half of the active laminitis cases diagnosed, are not useful laminitis discriminators [17]. Ensuring this is clarified in educational material and communications with owners, as well as raising the profile of other more subtle clinical signs should help reduce the proportion of cases not recognised by owners.

Veterinary surgeons attending owner-recognised cases reported breed type as a risk factor that assisted in their final diagnosis more frequently than veterinary surgeons that attended owner-unrecognised cases. This was reflected in a difference in breed distribution between owner-recognised and unrecognised cases (Supplementary Information Item 3). Horse breeds and their crosses, with the exception of Irish draught horses, were more prevalent in the owner-unrecognised laminitis cases compared to pony breeds and their crosses. This suggests that while both veterinary surgeons and owners may rely on breed type to assist in laminitis diagnosis or recognition, perception of laminitis risk based on breed may be resulting in owners not considering laminitis as a possibility in horse breeds, contributing to misrecognition of the disease. Although certain breeds are perceived to be at an increased risk of laminitis, there is currently little evidence to support a true breed-linked association

398 with laminitis [4]. In fact, Wylie et al. [6] found that a horse's height, rather than breed, was a more
399 discriminating risk factor for laminitis with smaller animals being at a greater risk of having laminitis
400 than taller animals, and that this was along a significant biological gradient. This indicates that breed
401 alone may not be the most valid laminitis discriminator. In the present study breed type may be a proxy
402 for size, however, height data were not collected.
403
404 Overall, veterinary surgeon and owner paired laminitis data showed broad consistency when reporting
405 the presence or absence of clinical signs, underlying conditions and risk factors associated with
406 laminitis. Statistically significant and marginally significant difference between discordant pair
407 proportions was found for only four clinical signs, one underlying condition and one risk factor;
408 signifying a difference between veterinary- and owner-reporting. Veterinary surgeons reported a higher
409 proportion of animals as having 'difficulty turning' and 'shifting weight from leg to leg' compared with
410 owners, who more frequently reported the horse having 'increased hoof temperature' and being
411 'recumbent'. Difficulty turning was previously reported in over 90% of veterinary-diagnosed cases and
412 while shifting weight was reported less frequently (55.2%), both clinical signs were among five
413 lameness investigation and stance features considered most useful in laminitis diagnosis [17]. The
414 difference in reporting between veterinary surgeons and owners could be influenced by disease
415 progression in the time interval between an owner noticing the clinical signs and the veterinary surgeon
416 examining the horse. Additionally, a clinical lameness investigation by a veterinary surgeon is more
417 systematic and thorough than an owner assessment of lameness. Shifting weight and difficulty turning
418 may be lesser-known clinical signs amongst owners or could signal the progression of the disease
419 between owner assessment and veterinary clinical examination. The larger proportion of time owners
420 spend with the animal compared with veterinary surgeons may also play a role; recumbency may be
421 reported more by owners as they are able to observe their animals for a longer period of time.
422
423 Fewer owners reported that their horse had suspected or confirmed EMS compared with veterinary
424 surgeons, although a similar trend was not observed for suspected or confirmed PPID. Owners may be
425 more aware of PPID and its association with laminitis due to a combination of visually-apparent clinical

signs that mark progression of the disease in older animals and the annual PPID-testing campaign run in Britain over the last few years. The clinical consensus statement for EMS is the presence of three characteristics: obesity (whether general or regional), insulin resistance (IR) and history of laminitis [20]. However, the existing difficulty in defining clinical cases (for example, IR and laminitis in the absence of obesity) and the varying terminology used (IR, hyperinsulinaemia, insulin dysregulation), may contribute to potential confusion amongst owners. Since hyperinsulinaemia/IR is considered instrumental in the development of endocrinopathic laminitis [21; 22] perhaps it is this feature of EMS that should be more clearly translated to owners alongside encouragement of insulin testing.

While not all obese animals will be insulin resistant, obesity is considered a risk factor for EMS and thus laminitis [23]. It was therefore surprising to note that fewer owners in this study population, which included a high proportion of owners with prior laminitis experience, reported using BCS as a risk factor to help with laminitis recognition compared to veterinary surgeons. While owners may be aware that obesity and a high BCS are associated with an increased laminitis risk, their perception of obesity may be skewed. A previous study has shown that 50% of owners underestimated their horse's BCS compared with an experienced researcher [24]. This indicates that when collecting owner-reported condition and weight estimates, apart from providing owners with clear instructions on how to conduct hands-on condition scoring, a more objective method of weight estimation should be used concurrently.

Sample size requirements were satisfied to achieve the primary objective of demonstrating a very high proportion of owner-suspected laminitis cases being confirmed upon veterinary examination, and thereby supports use of owner-reported data in research studies. However, we caution that the limited extent of data does restrict statistical inferences regarding the secondary objectives. The data from the secondary objectives are therefore presented in their raw format, including proportions and corresponding CIs, allowing readers to evaluate the potential effect of small numbers on the presented significance levels.

Conclusion

Although derived from a relatively small convenience sample, due to the very high proportion of owner-suspected cases of laminitis which were subsequently also veterinary-confirmed, the findings from this study indicate that cases based on owner-recognition of laminitis would be a valid and useful metric alongside veterinary-reported data. These owner-reported laminitis cases would be of particular benefit to future epidemiological studies that seek to identify laminitis risk factors or where laminitis diagnosis is considered an inclusion criterion. Using a combination of veterinary- and owner-reported data would also increase accuracy of current veterinary-reported disease estimates. However, owner-reporting alone, in the absence of veterinary diagnosis, would underestimate actual disease frequency and does raise concerns about the number of cases that are neither owner-recognised nor veterinary-attended. These findings also emphasise that owner education about laminitis and its associated risk factors, which should have a strong evidence base, is vital to encourage earlier and more accurate detection of the disease. Additionally, raising awareness of clinical signs that have been shown to be the best discriminators for laminitis, rather than those commonly perceived to be present in affected animals, will promote swift treatment and provide animals with the best chance of recovery. Owner education could further be targeted to owners lacking previous direct experience of the disease and those owning breeds not perceived to be at risk.

Manufacturer's addresses

[a]Sergeant, ESG, 2016. Epitools epidemiological calculators. AusVet Animal Health Services and Australian Biosecurity Cooperative Research Centre for Emerging Infectious Disease. http://epitools.ausvet.com.au.

[b]Microsoft Corporation, Redmond, Washington, USA.

[c]StataCorp LP, Texas, USA.

480 **Tables**

481 Table 1

482 The prevalence, difference in prevalence and Fisher's exact P-value for the presence of
483 veterinary-reported clinical signs, underlying conditions and risk factors in cases of
484 veterinary-diagnosed laminitis in a cross-sectional study in Great Britain, ordered by
485 difference in prevalence.

Clinical sign	Prevalence among owner-recognised cases	95% CI (%)	Owner-unrecognised cases	95% CI (%)	Difference in prevalence (%)	P-value
Lame at trot	19/20 (95.0%)	85.4-100.0	6/9 (66.7%)	35.9-97.5	+28.3	0.08
Divergent growth rings	26/48 (54.2%)	40.1-68.3	11/41 (26.8%)	13.3-40.4	+27.3	**0.01**
Front feet placed in front of body	27/49 (55.1%)	41.2-69.0	16/42 (38.1%)	23.4-52.8	+17.0	0.14
Short, stiff gait at trot	18/19 (94.7%)	84.7-100.0	9/11 (81.8%)	59.0-100.0	+12.9	0.54
Hind feet placed underneath body	15/49 (30.6%)	17.7-43.5	8/41 (19.5%)	7.4-31.6	+11.1	0.33
Stretched white line	11/43 (25.6%)	12.5-38.6	6/38 (15.8%)	4.2-27.4	+9.8	0.41
Shifting weight from leg to leg	30/49 (61.2%)	47.6-74.9	22/42 (52.4%)	37.3-67.5	+8.8	0.41
Short, stiff gait at walk	45/47 (95.7%)	90.0-100.0	34/39 (87.2%)	76.7-97.7	+8.6	0.24
Increased hoof temperature	17/47 (36.2%)	22.4-49.9	12/41 (29.3%)	15.3-43.2	+6.9	0.51
Change in dorsal hoof wall angle	14/48 (29.2%)	16.3-42.0	9/40 (22.5%)	9.6-35.4	+6.7	0.63
Difficulty turning	44/47 (93.6%)	86.6-100.0	35/39 (89.7%)	80.2-99.3	+3.9	0.70
Recumbent	5/47 (10.6%)	1.8-19.5	3/39 (7.7%)	0.0-16.1	+2.9	0.72
Coronary band swelling	0/47 (0.0%)	0.0	0/39 (0.0%)	0.0	0.0	*
Prolapsed sole	0/49 (0.0%)	0.0	0/42 (0.0%)	0.0	0.0	*
Coronary band depression	2/47 (4.3%)	0.0-10.0	2/41 (4.9%)	0.0-11.5	-0.6	1.00
Increased digital pulse	42/49 (85.7%)	75.9-95.5	37/42 (88.1%)	78.3-97.9	-2.4	0.77
Hoof wall separation	0/48 (0.0%)	0.0	1/42 (2.4%)	0.0-7.0	-2.4	0.47
Lame at walk	40/47 (85.1%)	74.9-95.3	37/41 (90.2%)	81.2-99.3	-5.1	0.53
Reluctance to walk	36/49 (73.5%)	61.1-85.8	33/41 (80.5%)	68.4-92.6	-7	0.47
Flattened sole	16/47 (34.0%)	20.5-47.6	16/39 (41.0%)	25.6-56.5	-7	0.65
Crescent shaped bruising dorsal to frog	0/48 (0.0%)	0.0	3/40 (7.5%)	0.0-15.7	-7.5	0.09
Convex sole	2/47 (4.3%)	0.0-10.0	5/39 (12.8%)	2.3-23.3	-8.6	0.24
Leg trembling	5/48 (10.4%)	1.8-19.1	8/41 (19.5%)	7.4-31.6	-9.1	0.25
Hoof wall pain	3/46 (6.5%)	0.0-13.7	6/37 (16.2%)	4.3-28.1	-9.7	0.18
Reluctance for foot to be lifted	23/49 (46.9%)	33.0-60.9	24/42 (57.1%)	42.2-72.1	-10.2	0.40
Refusal to move unless forced	13/48 (27.1%)	14.5-39.7	19/41 (46.3%)	31.1-61.6	-19.3	0.08
Hoof sole pain	17/46 (37.0%)	23.0-50.9	22/39 (56.4%)	40.8-72.0	-19.5	0.08
Underlying condition						
Unilateral weight-bearing	0/45 (0.0%)	0.0	0/41 (0.0%)	0.0	0.0	*
Suspected/confirmed EMS	27/44 (61.4%)	47.0-75.8	23/37 (62.2%)	46.5-77.8	-0.8	1.00
Gastrointestinal disease	0/45 (0.0%)	0.0	1/41 (2.4%)	0.0-7.2	-2.4	0.48

Retained placenta/metritis	0/45 (0.0%)	0.0	1/41 (2.4%)	0.0-7.2	-2.4	0.48
Suspected/confirmed PPID	23/44 (52.3%)	37.5-67.0	20/36 (55.6%)	39.3-71.8	-3.3	0.82
Risk factor						
Breed type	38/49 (77.6%)	65.9-89.2	22/39 (56.4%)	40.8-72.0	+21.2	**0.04**
Previous laminitis history	25/48 (52.1%)	38.0-66.2	11/35 (31.4%)	16.0-46.8	+20.7	0.08
Grazing quality	29/45 (64.4%)	50.5-78.4	24/41 (58.5%)	43.5-73.6	+5.9	0.66
Body condition score	34/48 (70.8%)	58.0-83.7	27/41 (65.9%)	51.3-80.4	+4.9	0.65
Season/weather conditions	32/48 (66.7%)	53.3-80.0	25/40 (62.5%)	47.5-77.5	+4.2	0.82
Accidental carbohydrate overload	2/48 (4.2%)	0.0-9.8	2/39 (5.1%)	0.0-12.1	-0.9	1.00
Age	21/45 (46.7%)	32.1-61.2	19/39 (48.7%)	33.0-64.4	-2.0	1.00

* not calculable as zero in multiple cells

Table 2

The number of paired veterinary and owner laminitis reporting forms detailing veterinary- and owner-reported presence of clinical signs, underlying conditions and risk factors of laminitis and the McNemar's exact conditional P-value for the difference in the proportion of discordant pairs in a cross-sectional study in Great Britain, ordered by ascending P-value.

Clinical sign	LRF pairs (n)	+/+	-/+	+/-	-/-	P-value
Difficulty turning	38	29	0	7	2	**0.02**
Increased hoof temperature	39	11	12	3	13	**0.04**
Shifting weight from leg to leg	39	16	1	8	14	**0.04**
Recumbent	35	4	5	0	26	**0.06**
Flattened sole	34	3	2	8	21	0.11
Reluctance for foot to be lifted	37	16	8	2	11	0.11
Stretched white line	29	3	0	4	22	0.13
Lame at walk	37	25	1	6	5	0.13
Short, stiff gait at trot	12	9	0	3	0	0.25
Hoof sole pain	27	4	0	3	20	0.25
Short, stiff gait at walk	38	32	1	4	1	0.38
Change in dorsal hoof wall angle	38	6	2	5	25	0.45
Front feet placed in front of body	38	9	6	10	13	0.45
Reluctance to walk	41	20	6	10	5	0.46
Refusal to move unless forced	37	7	6	3	21	0.51
Divergent growth rings	40	13	3	6	18	0.51
Coronary band depression	36	0	1	1	34	1.00
Coronary band swelling	36	0	1	0	35	1.00
Convex sole	34	1	0	1	32	1.00
Crescent shaped bruising dorsal to frog	34	0	1	0	33	1.00
Hoof wall pain	32	1	3	3	25	1.00
Hind feet placed underneath body	37	6	4	4	23	1.00
Increased digital pulse	34	26	3	4	1	1.00
Leg trembling	36	2	1	1	32	1.00
Lame at trot	14	13	0	1	0	1.00
Hoof wall separation	37	0	0	0	37	*
Prolapsed sole	40	0	0	0	40	*
Underlying condition						
Suspected/confirmed EMS	29	6	3	11	9	**0.06**
Unilateral weight-bearing	38	0	4	0	34	0.13
Suspected/confirmed PPID	30	10	2	6	12	0.29
Gastrointestinal disease	38	0	1	0	37	1.00
Retained placenta/metritis	38	0	0	0	38	*
Risk factor						
Body condition score	39	21	2	10	6	**0.04**
Age	33	8	4	9	12	0.27
Breed type	40	22	4	9	5	0.27
Grazing quality	35	17	2	6	10	0.29
Season/weather conditions	40	23	6	3	8	0.51
Previous laminitis history	41	19	1	1	20	1.00
Accidental carbohydrate overload	39	0	3	2	34	1.00

504 * not calculable as zero in multiple cells, +/+ reported present by both veterinary surgeon and owner, -/+
505 veterinary surgeon reported absent while owner reported present, +/- veterinary surgeon reported present while
506 owner reported absent, -/- reported as absent by both veterinary surgeon and owner.

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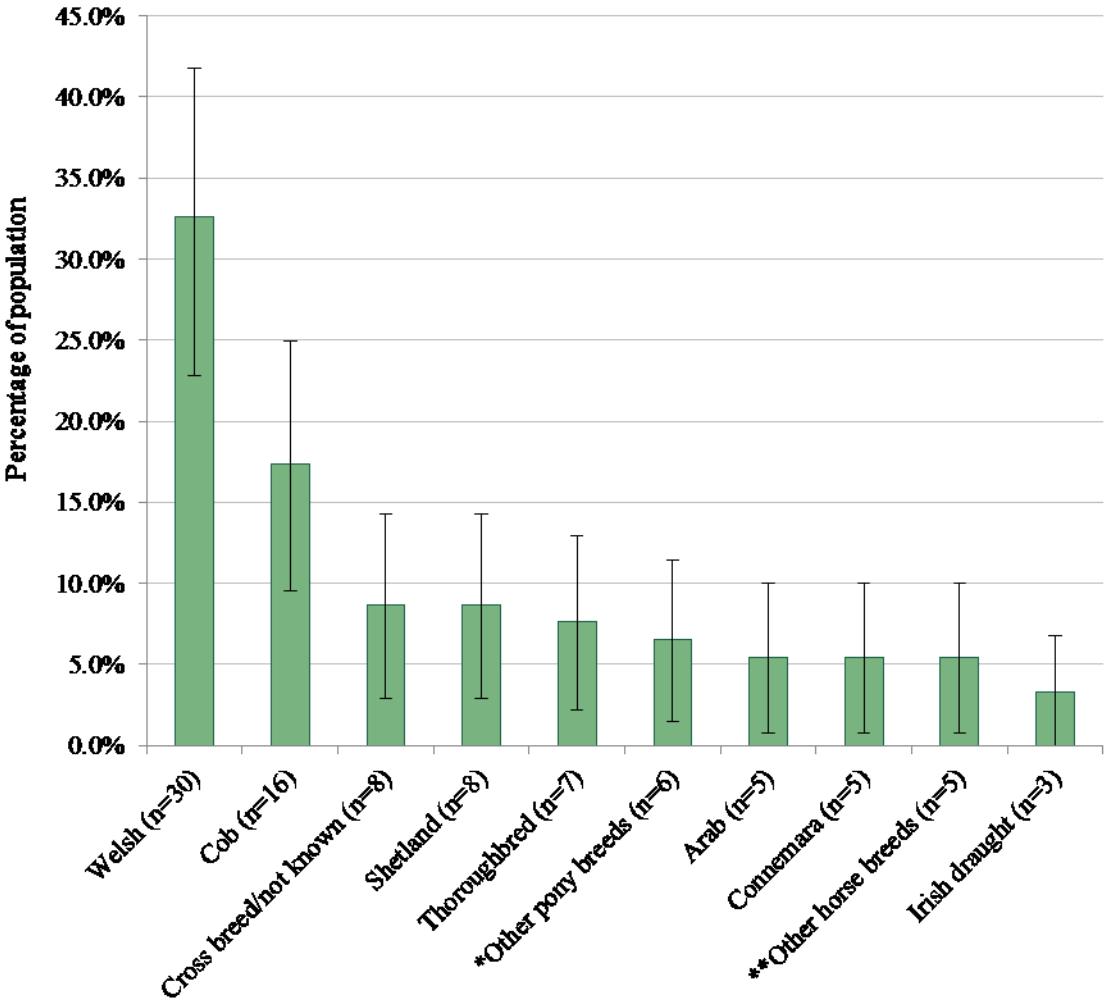
511 **Figures**



512

513 Figure 1: Breed distribution (including breed crosses) of horses and ponies with veterinary-
514 diagnosed active laminitis (n=93) reported by attending veterinary surgeons from a
515 convenience sample of veterinary practices in Great Britain between January 2014 and October
516 2015, presented in descending order of frequency. Error bars represent 95% confidence
517 intervals. *Includes Dales, Dartmoor, Highland and New Forest ponies, **Includes Hanoverian,
518 Quarter horses and heavy breeds.

519

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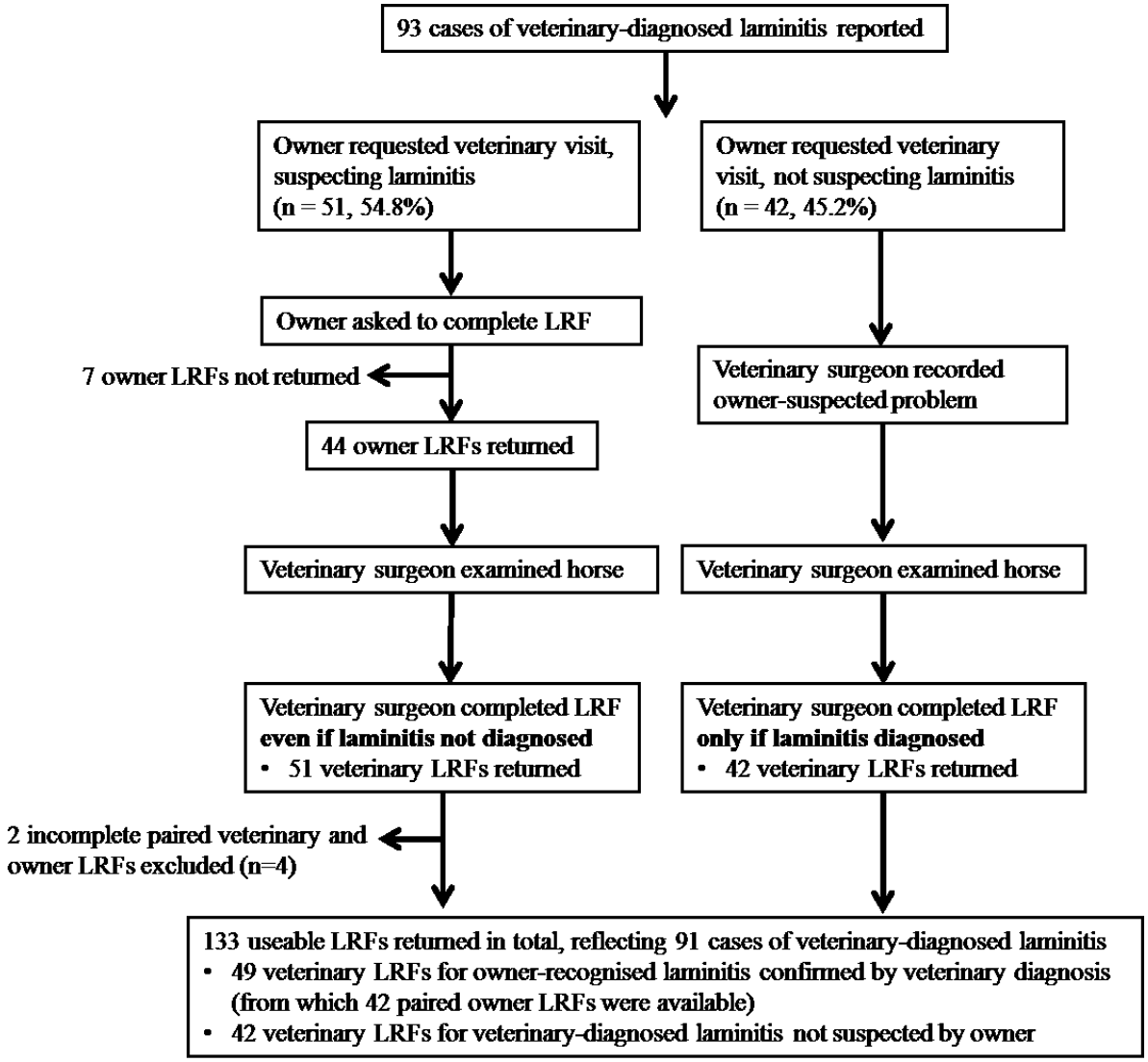

Figure 2: Flow diagram to illustrate the grouping of data received from both veterinary surgeons and owners in a cross-sectional study of laminitis in Great Britain between January 2014 and October 2015.

Supplementary information

Item 1: Veterinary laminitis reporting form used to collect data on active laminitis episodes in a cross-sectional study of laminitis in Great Britain between January 2014 and October 2015.

CARE about Laminitis *Pilot Study*

Practice ID ☐☐☐

Vet Laminitis Reporting Form

Thank you very much for contacting me and expressing your interest in helping with the pilot study. I greatly appreciate your contributions and your time.

I require your help in testing the Laminitis Reporting Forms (LRFs) and for validating owner-reported information regarding clinical signs and diagnosis of laminitis. The LRF is a short 4 page checklist of common clinical signs and features of laminitis which comes in two versions – one for the vet (blue) and one for the owner (yellow).

Please have the LRFs readily available when you attend initial consultations and return the completed forms via the reply paid envelopes provided.

❖ Scenario 1 – "Owner suspects laminitis"
If the owner suspects laminitis, ask if they are willing to complete the owner LRF regarding the clinical signs that led them to suspect laminitis. **It is important that the owner completes the LRF without your input.** Post-diagnosis, you would complete the vet LRF and post both forms back to me. **Please complete the LRF even if laminitis is not the diagnosis.**

❖ Scenario 2 – "Owner unaware but laminitis diagnosed"
If the owner does not suspect laminitis, but you confirm a diagnosis of laminitis, then only you would complete the vet LRF (no need for owner LRF) and post this back to me.

We would ask that you submit between 10-15 cases of suspected/confirmed laminitis per practice, starting from the date that you receive the information, although more than 15 cases would of course be welcome.

If you have any questions, please don't hesitate to contact me on
01638 751000 (Ext 1506) or danica.pollard@aht.org.uk

Many thanks and kind regards,
Dee Pollard

*Please complete the form if your client has consented to participate in the pilot study and in **case of suspected/confirmed laminitis – even if laminitis is not your final diagnosis**. Please complete all **FOUR pages** of this form*

1. Did the owner initially suspect laminitis to be the cause of the reported illness/lameness?

☐ Yes
If yes, please make sure the owner completes the owner LRF indicating clinical signs which led them to suspect laminitis, without your input.

☐ No
If no, what did the owner suspect the problem may have been? Please indicate below. The owner would not have to complete the owner LRF.

.....

2. Owner surname: .....

3. Name of horse/pony: .....

Page **1** of **4**

CARE about Laminitis *Pilot Study*

Practice ID ☐☐☐

4. Age of horse/pony: ☐☐ years

5. Breed of horse/pony: .....

6. In your opinion, is the horse/pony:

☐ Underweight ☐ Neither overweight nor underweight (adequate) ☐ Overweight/obese

7. Consulting vet initials: .....

8. Date of veterinary consultation: ☐☐/☐☐/☐☐☐☐

Below is a list of common clinical signs associated with laminitis. Please provide details of the ***clinical signs observed in this instance, even if laminitis was not the diagnosis.***

9.

Lameness *(please tick one option per line)*	YES	NO	NOT ASSESSED
Recumbent (lying down)	☐	☐	☐
Refusal to move unless forced	☐	☐	☐
Reluctance to walk	☐	☐	☐
Lame at walk	☐	☐	☐
Lame at trot	☐	☐	☐
Short, stiff gait at walk	☐	☐	☐
Short, stiff gait at trot	☐	☐	☐
Difficulty turning	☐	☐	☐

10.

Stance *(please tick one option per line)*	YES	NO	NOT ASSESSED
Shifting weight from leg to leg	☐	☐	☐
Leg trembling	☐	☐	☐
Front feet placed in front of body	☐	☐	☐
Hind feet placed underneath body	☐	☐	☐
Reluctance for foot to be lifted	☐	☐	☐

11.

Feet affected *(please tick all feet that apply)*	YES	NO	Please indicate which of these were most severely affected
Right foreleg	☐	☐	☐
Left foreleg	☐	☐	☐
Right hindleg	☐	☐	☐
Left hindleg	☐	☐	☐

CARE about Laminitis *Pilot Study*

Practice ID ☐☐☐

12.	**Clinical signs of the <u>most severely affected foot/feet</u>** *(please tick one option per line)*	YES	NO	NOT ASSESSED
	Strong/bounding pulse at the back of fetlock	☐	☐	☐
	Hoof or coronet band unusually warm to the touch	☐	☐	☐
	Painful sole, especially in front of frog	☐	☐	☐
	General pain at the front of the hoof wall	☐	☐	☐
	Painful swelling at the coronary band	☐	☐	☐
	Painful depression at the coronary band	☐	☐	☐
	Visible growth rings on the hoof wall (narrow at the toe and wider at the heel)	☐	☐	☐
	Change in the angle of the hoof wall	☐	☐	☐
	Visible separation of the hoof wall at the coronary band	☐	☐	☐
	Change in sole shape - becoming flat as opposed to concave (dished)	☐	☐	☐
	Change in sole shape - becoming convex (bulging outwards) as opposed to concave (dished)	☐	☐	☐
	White line abnormally stretched and wide	☐	☐	☐
	Visible bruising in front of frog e.g. half-moon/crescent bruise	☐	☐	☐
	Protrusion of the pedal bone through the bottom of the hoof (prolapsed sole)	☐	☐	☐

13. Please indicate if the horse/pony <u>has, or in the past 7 days had</u>, each of these clinical features and, <u>irrespective of their presence/absence</u>, rate their importance in formulating your final diagnosis. *(please tick a choice/(s) for each line)*

Horse/pony has, or <u>in the past 7 days</u> had:	YES	NO	DON'T KNOW	How **IMPORTANT** was the applicable feature to your clinical diagnosis?
Pituitary *Pars Intermedia* Dysfunction (PPID)/Cushing's	☐confirmed ☐suspected	☐	☐	☐ Very ☐ Moderately ☐ Not
Equine Metabolic Syndrome (EMS)	☐confirmed ☐suspected	☐	☐	☐ Very ☐ Moderately ☐ Not
Gastrointestinal disease (e.g. colic/diarrhoea)	☐	☐	☐	☐ Very ☐ Moderately ☐ Not
Retained placenta or metritis	☐	☐	☐	☐ Very ☐ Moderately ☐ Not
Severe unilateral lameness of contralateral limb	☐	☐	☐	☐ Very ☐ Moderately ☐ Not

Please don't forget to turn over and complete the last page.

CARE about Laminitis Pilot Study

Practice ID ☐☐☐

Horse/pony has, or in the past 7 days had:	YES	NO	DON'T KNOW	How **IMPORTANT** was the applicable feature to your clinical diagnosis?
Radiographic changes in the hoof	☐	☐	☐	☐ Very ☐ Moderately ☐ Not
Were there any other clinical features that helped form your final diagnosis? *(please specify)*				☐ Very ☐ Moderately ☐ Not

14. Did you diagnose laminitis in this animal?

☐ Yes ☐ No, the diagnosis was .....

14.1. If yes, did any of these additional factors enhance the confidence of your laminitis diagnosis? *(please tick one option per line)*

	YES	NO	DON'T KNOW
Breed type	☐	☐	☐
Age	☐	☐	☐
Body condition score (overweight/underweight)	☐	☐	☐
Previous history of laminitis	☐	☐	☐
Quality of grazing or pasture available	☐	☐	☐
Accidental carbohydrate/concentrates overload	☐	☐	☐
Season/Weather conditions	☐	☐	☐
Did any other additional factors enhance your laminitis diagnosis? (*please specify*)			

15. Any other comments relevant to this consultation?

.....

.....

Once complete please return form to:

Danica Pollard, Animal Health Trust, CPM, Lanwades Park, Kentford, Newmarket, CB8 7UU.
Phone: 01638 751000 Ext 1506 Email: danica.pollard@aht.org.uk

RVC Royal Veterinary College University of London

WorldHorseWelfare

AHT Animal Health Trust

548 Item 2: Owner laminitis reporting form used to collect data on active laminitis episodes in a

549 cross-sectional study of laminitis in Great Britain between January 2014 and October 2015.

CARE about Laminitis *Pilot Study*

Practice ID ☐☐☐

Owner Laminitis Reporting Form

Thank you for volunteering your information for this study. Please complete the form in the event that you suspect your horse/pony has laminitis, **before the vet examines them.** It may feel unusual to complete this form without your vet's assistance – we are interested in the reason you called the vet out, not in what the veterinary diagnosis is! You are welcome to keep the CARE about laminitis information flyer. Please complete all **FOUR pages** of this form.

By completing this form I agree to the use of the collected data for research purposes. I understand that my details will remain confidential and will not be shared with third parties. I also give consent for my veterinary practice to be contacted directly with regards to my animal's health records.

1. Owner name: .....

2. Owner surname: .....

3. Name of horse/pony: .....

4. Name of consulting veterinarian: .....

5. Date of veterinary consultation: DD / MM / YYYY

*Please think about the reasons you called your vet for a visit today and indicate the **presence or absence** of these **clinical signs/characteristics**.*

6.

Lameness *(please tick one option per line)*	YES	NO	NOT ASSESSED
Recumbent (lying down)	☐	☐	☐
Refusal to move unless forced	☐	☐	☐
Reluctance to walk	☐	☐	☐
Lame at walk	☐	☐	☐
Lame at trot	☐	☐	☐
Short, stiff gait at walk	☐	☐	☐
Short, stiff gait at trot	☐	☐	☐
Difficulty turning	☐	☐	☐

7.

Stance *(please tick one option per line)*	YES	NO	NOT ASSESSED
Shifting weight from leg to leg	☐	☐	☐
Leg trembling	☐	☐	☐
Front feet placed in front of body	☐	☐	☐
Hind feet placed underneath body	☐	☐	☐
Reluctance for foot to be lifted	☐	☐	☐

8.

Feet affected *(please tick all feet that apply)*	YES	NO	Please indicate which of these were most severely affected
Right foreleg	☐	☐	☐
Left foreleg	☐	☐	☐
Right hindleg	☐	☐	☐
Left hindleg	☐	☐	☐

Page **1** of **4**

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CARE about Laminitis *Pilot Study*

Practice ID ☐☐☐

9.	**Characteristics (clinical signs) of the <u>most severely affected foot/feet</u>** *(please tick one option per line)*		YES	NO	NOT ASSESSED
	Strong/bounding pulse at the back of fetlock		☐	☐	☐
	Hoof or coronet band unusually warm to the touch		☐	☐	☐
	Painful sole, especially in front of frog		☐	☐	☐
	General pain at the front of the hoof wall		☐	☐	☐
	Painful swelling at the coronary band		☐	☐	☐
	Painful depression at the coronary band		☐	☐	☐
	Visible growth rings on the hoof wall (narrow at the toe and wider at the heel)		☐	☐	☐
	Change in the angle of the hoof wall		☐	☐	☐
	Visible separation of the hoof wall at the coronary band *Image courtesy of Dr L. Wells-Smith		☐	☐	☐
	Change in sole shape - becoming flat (red line) as opposed to concave/dished (blue line)		☐	☐	☐
	Change in sole shape - becoming convex/bulging outwards (red line) as opposed to concave/dished (blue line)		☐	☐	☐

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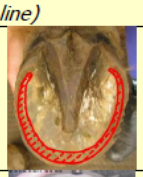
CARE about Laminitis *Pilot Study*

Practice ID ☐☐☐

Characteristics (clinical signs) of the <u>most severely affected foot/feet</u> *(please tick one option per line)*		YES	NO	NOT ASSESSED
White line abnormally stretched and wide		☐	☐	☐
Visible bruising in front of frog e.g. half-moon/crescent bruise		☐	☐	☐
Protrusion of the pedal bone through the bottom of the hoof (prolapsed sole) *Image courtesy of Dr S. N. Collins		☐	☐	☐

10. Have you had direct experience with laminitis before? *(please tick all that apply)*

- ☐ Yes, this horse/pony has had laminitis before
- ☐ Yes, with another horse/pony I currently own or owned
- ☐ Yes, other *(please specify)* .....
- ☐ No

11. Please indicate if your horse/pony <u>has, or in the past 7 days had</u>, each of these conditions and, <u>irrespective of their presence/absence</u>, rate their importance in making you suspect your horse/pony had laminitis. *(please tick a choice/(s) for each line)*

Horse/pony has, or <u>in the past 7 days</u> had:	YES	NO	DON'T KNOW	How **IMPORTANT** was the applicable condition to your laminitis suspicion?
Pituitary *Pars Intermedia* Dysfunction (PPID)/Cushing's	☐confirmed ☐suspected	☐	☐	☐ Very ☐ Moderately ☐ Not
Equine Metabolic Syndrome (EMS)	☐confirmed ☐suspected	☐	☐	☐ Very ☐ Moderately ☐ Not
Gastrointestinal disease (e.g. colic/diarrhoea)	☐	☐	☐	☐ Very ☐ Moderately ☐ Not
Retained placenta or metritis	☐	☐	☐	☐ Very ☐ Moderately ☐ Not
Severe lameness/injury in leg opposite to the one with suspected laminitis	☐	☐	☐	☐ Very ☐ Moderately ☐ Not

Please don't forget to turn over and complete the last page.

CARE about Laminitis *Pilot Study*

Practice ID ☐☐☐

12. Have any of these additional factors helped you suspect your horse/pony has laminitis?
(please tick one option per line)

	YES	NO	DON'T KNOW
Breed type	☐	☐	☐
Age	☐	☐	☐
Body condition score (overweight/underweight)	☐	☐	☐
Previous history of laminitis	☐	☐	☐
Quality of grazing or pasture available	☐	☐	☐
Accidental carbohydrate/concentrates overload	☐	☐	☐
Season/Weather conditions	☐	☐	☐
Did any other additional factors help you suspect laminitis? (*please specify*)			

13. Any other comments relevant to this suspected laminitic episode?

.....

.....

Once complete please return form to:

Danica Pollard, Animal Health Trust, CPM, Lanwades Park, Kentford, Newmarket, CB8 7UU.
Phone: 01638 751000 (Ext: 1506) Email: danica.pollard@aht.org.uk

RVC Royal Veterinary College University of London

WorldHorseWelfare

AHT Animal Health Trust

565 Item 3: Frequency and difference in breed distribution of veterinary-diagnosed active laminitis
566 cases between owner-recognised and owner-unrecognised cases in a cross-sectional study of
567 laminitis in Great Britain between January 2014 and October 2015 ($\chi^2(9)=28.32$, P=0.001).

	Frequency of laminitis cases recognised by owner		**Difference in breed distribution**
Breed (including breed crosses)	Yes (%)	No (%)	(%)
Welsh	19 (38.8%)	11 (26.2%)	+12.6%
Cob	7 (14.3%)	9 (21.4%)	-7.1%
Cross breed/not known	3 (6.1%)	4 (9.5%)	-3.4%
Shetland	7 (14.3%)	1 (2.4%)	+11.9%
Thoroughbred	0 (0.0%)	7 (16.7%)	-16.7%
Connemara	5 (10.2%)	0 (0.0%)	+10.2%
Arab	1 (2.0%)	3 (7.1%)	-5.1%
Irish draught	3 (6.1%)	0 (0.0%)	+6.1%
Other pony breeds*	4 (8.2%)	2 (4.8%)	+3.4%
Other horse breeds**	0 (0.0%)	5 (11.9%)	-11.9%

568 *Including Dales, Dartmoor, Highland and New Forest ponies and their crosses, **Including Hanoverian, Quarter
569 horses, heavy breeds and their crosses
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578 **References**

[1] Moore, R.M. (2009) ‘‘Vision 20/20 – Conquer Laminitis by 2020’’. In: *2nd AAEP Foundation Equine Laminitis Research Workshop*, Journal of Equine Veterinary Science, Florida, USA. pp 74-76.

[2] Cohen, N.D. and Coleman, M.C. (2013) Strengths and limitations of the epidemiological approach for studying laminitis. In: *International Equine Conference on Laminitis and Diseases of the Foot*, Journal of Equine Veterinary Science, Florida, USA. pp 838-859.

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