Assessing quality of life in older horses

The equine population is ageing and equine geriatric medicine is a growing field. With increasing horse age, both the frequency of veterinary attention and the provision of several preventive health care measures are reduced. Moreover, owners appear to under-recognise several prevalent age-associated diseases, often considering clinical signs as normal signs of ageing. There is a high burden of chronic disease within the geriatric equine population, which may have a detrimental effect on quality of life. In the absence of a validated equine quality of life measurement scale, this review highlights factors and domains that should be evaluated in a comprehensive assessment of the quality of life in older horses. The potential benefits of assessing quality of life as a routine component of veterinary care for older horses are also summarised.

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As is the case in the human population (Office for National Statistics, 2019), through increasing life expectancy, the equine population is ageing (Welsh et al, 2016), comprising a considerable proportion (28–34%) of geriatric animals (McGowan et al, 2010; Ireland et al, 2011a; Bushell and Murray, 2016). Similar to the situation described for humans (Haywood et al, 2005), older horses represent a very diverse sector of the equine population and this diversity is reflected across age, health status and healthcare requirements. As horses get older, owners frequently make considerable changes to their management practices, including diet and exercise (Ireland et al, 2011a). However, there is limited available information regarding the reasons for, and impact of, horse owners making these changes. Weight management and use of supplements were reported to be the most common aspects of daily management that owners changed as their horse aged (Bushell and Murray, 2016). Dietary alterations such as the increased use of hay replacers and complete chopped fibre or mash feeds are likely to be beneficial in older horses with advanced dental disease (Ireland et al, 2011a), whereas the widespread use of in-feed supplements, despite a paucity of evidence regarding their oral bioavailability and efficacy, may represent an area for improved owner education (Bushell and Murray, 2016). Furthermore, with increasing horse age, the frequency of routine veterinary attention and several preventive healthcare measures, including farrier care and vaccination, are reduced (Mellor et al, 2001; McGowan et al, 2010; Ireland et al, 2011b).

The term 'quality of life' (QoL) is used extensively in human and veterinary healthcare. Despite this, there is a lack of consistency regarding its definition in the literature, and in veterinary medicine QoL is often considered synonymously with welfare (Broom, 2007; Taylor and Mills, 2007). However, QoL is a broader concept with a slightly different emphasis to welfare, encompassing physical health, psychological state (including negative and positive affective states) (Taylor and Mills, 2007) and 'general enjoyment of life' (Broom, 2007). Although the vast majority of owners consider their older horses to have good or excellent QoL, increasing horse age is associated with reduced owner QoL rating (Ireland et al, 2011c).

Assessing quality of life

Quality of life assessment is well established in human medicine, with a large number of published generic and disease-specific measurement scales (Bowling, 2001). For example, different QoL assessments have been validated for monitoring the effect of pain management (Skevington et al, 2001) and chronic disease in humans (Sprangers et al, 2000; Osborne et al, 2003; Öztürk et al, 2011) and used to evaluate age-related changes in QoL (Blane et al, 2004; Wiggins et al, 2004). There are numerous applications beyond evaluating the status of an individual patient. In a practice setting, QoL instruments are used as an adjunct to more objective clinical indicators for evaluating the effectiveness of medical treatments (Higginson and Carr, 2001). For example, a simple QoL assessment using linear visual analogue scales to measure eight variables including appetite, dyspnoea, feelings of wellbeing, and social activity, was evaluated in geriatric patients with chronic obstructive pulmonary disease (Katsura et al, 2003). When used in an outpatient clinic, the QoL scale was reported to correlate well with more complex health-related and respiratory-specific QoL instruments and to improve alongside improvement in several clinical parameters following a pulmonary rehabilitation programme (Katsura et al, 2003). In pharmaceutical development, QoL assessment is increasingly used as an outcome measure in clinical trials and drug licenc-

Table 1. Quality of life (QoL) domains used in human health care with suggested adaptions for use in equine QoL assessment

WHO quality of life domain*	Examples of facets incorporated within domain	Possible adaptation for assessment in the equine veterinary setting
Physical health	Pain and discomfort	Pain scores (van Loon and Van Dierendonck, 2018)
	Energy and fatigue	Lethargy Exercise intolerance
	Sleep and rest	Owner-observed changes in sleep patterns
Psychological	Negative feelings	Indicators of stress or fear Aggressiveness
	Positive feelings	Interest in surroundings Responsiveness to attention from owner/carer
Level of independence	Mobility	Able to ambulate Able to stand after rolling/lying down
	Activities of daily living	Able to ambulate Appetite and ability to masticate Grooming Thermoregulation
	Dependence on medicinal substances and medical aids	Evaluation of prescribed and alternative therapies
	Work capacity	Current discipline and level of exercise Exercise intolerance
Social relations	Personal relationships	Interaction with other horses Interaction with handlers
Environment	Freedom, physical safety and security	Suitable field and/or stable environment Appropriate herd mates
	Health and social care: accessibility and quality	Provision of preventive health care

*World Health Organization (2020) (WHO) QoL domains included in the WHOQOL-100

ing applications (Chassany et al, 2002). QoL measures are also used in veterinary pharmaceutical development, as well as randomised controlled clinical trials in small animal medicine, such as owner completion of a cardiac-specific questionnaire to measure QoL in a trial comparing two diuretics in dogs with congestive heart failure (Peddle et al, 2012).

In human medicine, the gold standard QoL assessment instrument is a validated questionnaire with well-established reliability (Chassany et al, 2002; Varricchio and Ferrans, 2010). Ideally information about an individual's perspective or subjective feelings would be gathered directly from that individual, for example using patient self-assessment questionnaires. However, in veterinary medicine, this information must necessarily be obtained from human observers, interpreting an animal's behaviour or physiological characteristics in order to assess QoL indirectly. Generic QoL instruments using owner questionnaires have been developed in small animal medicine (Wojciechowska et al, 2005; Mullan and Main, 2007; Bijsmans et al, 2016). *Table 1* shows some of the World Health Organization (2020) QoL domains and facets, together with examples of how these could be adapted for use in an equine veterinary setting.

Health-related quality of life

Ageing is characterised by an increasing susceptibility to the development of multiple chronic diseases (Fabbri et al, 2015). Geriatric cats and dogs rarely have a single disease, but instead have a unique combination of diseases together with varying degrees of organ dysfunction (Fortney, 2004). In human medicine, more than 55% of elderly people have multimorbidity (defined as the coexistence of two or more chronic diseases), which is associated with poor QoL (Marengoni et al, 2011).

Multimorbidity is also highly prevalent in older horses and there is a high burden of chronic disease within the geriatric equine population (Ireland et al, 2012a; Welsh et al, 2016). For example, pituitary pars intermedia dysfunction (*Figure 1*) was a comorbidity in nearly half of horses with more than one chronic disease (Welsh et al, 2016). Although the study population included animals of all ages, cases of multimorbidity frequently involved conditions that are prevalent in older horses: 26% of horses diagnosed with osteoarthritis also had a history of laminitis, and 8% of laminitis cases had severe equine asthma as a comorbidity (previously recurrent airway obstruction) (Welsh et al, 2016). Where therapeutic and management recommendations for concurrent conditions are potentially contradictory, the treatment of multimorbidities in older horses may be particularly challenging.

Owners frequently consider many clinical signs of disease as benign changes associated with normal ageing (Ireland et al, 2012b), meaning that some chronic diseases may be unrecognised by owners. While owners report a high degree of confidence in their ability to recognise obesity and weight loss (Bushell and

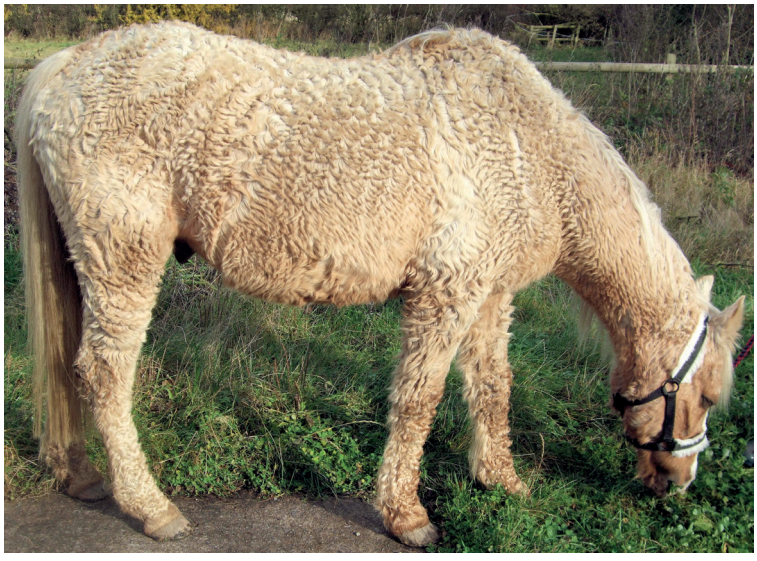

Figure 1. Aged pony with marked hypertrichosis, consistent with advanced pituitary pars intermedia dysfunction, which is a common comorbidity in older animals affected by other chronic conditions.

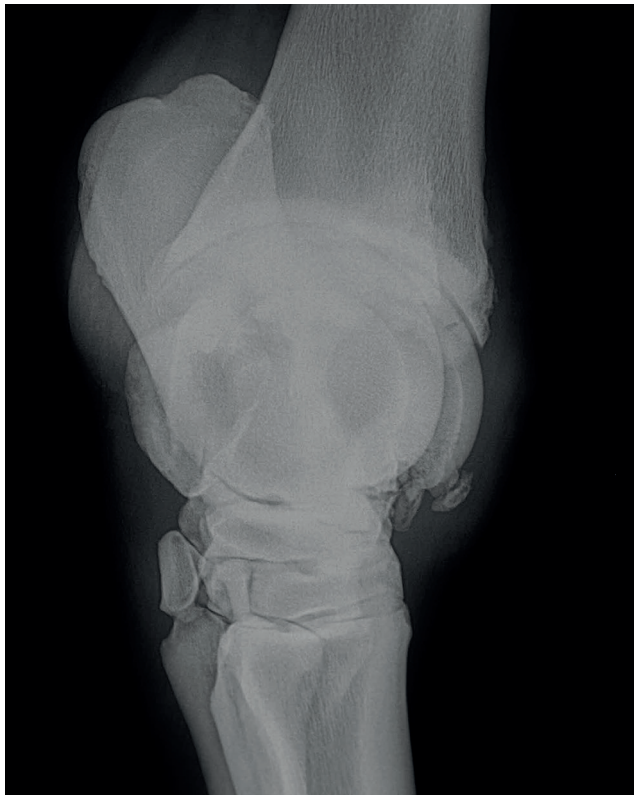

Figure 2. Severe tarsal pathology in an elderly mare, which the owner reported to have had bilateral hind limb stiffness for a prolonged period before an increase in the frequency and duration with which she was observed to lie down in the field.

Murray, 2016), owner underestimation of body condition in older horses is common (Ireland et al, 2012b). Additionally, clinical signs associated with some highly prevalent conditions in geriatric horses, including dental disease, ocular pathology and cardiac abnormalities, may not be apparent to owners based on external observations of their horse (Ireland et al, 2012a). Therefore the health status of an older horse will be an important determinant of its QoL, and inevitably, health is likely to be the primary focus of veterinary assessments.

While veterinary surgeons are well placed to assess the health-related QoL (HRQoL) of their patients, it is important to recognise that this includes more than a thorough clinical examination. Assessment of a person's health status will primarily encompass evaluation of the impact of specific clinical signs or physical limitations resulting from disease, such as pain or fatigue, whereas measures of HRQoL are broader, including mental and social wellbeing (Haywood et al, 2005).

Questionnaires for assessment of HRQoL have been developed for use in dogs (Reid et al, 2013) and cats (Freeman et al, 2016; Noble et al, 2019). In addition to physical domains, these instruments include domains that assess mental wellbeing such as distress, anxiety (Reid et al, 2013) and emotions (Freeman et al, 2016; Noble et al, 2019), and also social functioning, as determined based on the animal's engagement with the owner or carer and their environment (Freeman et al, 2016). Several specific instruments have been described in small animal medicine for assessment of HRQoL in a range of conditions including canine chronic pain (Wiseman-Orr et al, 2004), idiopathic epilepsy (Wessmann et al, 2014), atopic dermatitis (Favrot et al, 2010), feline diabetes mellitus (Niessen et al, 2010) and cardiac disease (Freeman et al, 2012). Since welfare requirements of horses differ from those of small animals, direct extrapolation of these published tools is not possible. However, collectively they provide a valuable resource from which to derive some domains that should be included in equine HRQoL assessment.

Activities of daily living and social interaction

While poor health has been used as a proxy measure of QoL in human geriatric medicine, it is increasingly recognised that health represents only one component. Patients with significant medical problems do not necessarily have QoL ratings proportionate with their health (Carr and Higginson, 2001). This is important since simply equating poor health with poor QoL neglects people's ability to adapt and overcome or cope with illness, and suffering from chronic disease may not necessarily lead to poor QoL. Therefore many of the health and utility tools widely used to measure QoL in geriatric patients include a large component devoted to activities of daily living, mental health and social interactions (Haywood et al, 2005), which are considered more frequently by older people as determinants of their QoL.

Similarly, activities of daily living are important for older horses. Activities of daily living such as level of activity when turned out at pasture or lying down when stabled or resting (*Figure 2*) were significantly associated with increased risk of mortality in older horses where owners reported some degree of compromise or impairment (Ireland et al, 2011d). Importantly, owners are readily able to assess activities of daily living, and consider these to be major determinants of QoL. Several management factors related to activities of daily living and social interactions (such as nutrition, comfort, company of other horses, regular field turnout and human contact) were more frequently considered by owners to influence QoL of older horses than health-related factors such as preventive

Table 2. Possible components of veterinary assessment of health-related quality of life (HRQoL), in animals diagnosed with conditions prevalent in aged horses, using pituitary pars intermedia dysfunction and osteoarthritis as examples

Disease/disorder	Pituitary pars intermedia dysfunction	Osteoarthritis
Clinical assessment	Veterinary examination • Blood sample for basal adrenocorticotropic hormone assay and investigation of insulin dysregulation • Hoof examination for signs of lamellar pathology (such as divergent hoof growth rings, widened white lines) • Evaluation of body condition and muscle atrophy Owner-reported factors relevant to HRQoL • History of delayed hair coat shedding and/or regional or generalised hypertrichosis • Regional or generalised hyperhidrosis	Veterinary examination • Palpation of limbs • Assessment of joint range of motion: subjective and/or objective (e.g. use of goniometry; Ireland et al, 2012a) • Lameness evaluation: subjective, using a lameness scale +/- objective (e.g. use of a motion analysis system) Owner-reported factors relevant to HRQoL • Joint stiffness • Lameness, abnormal gait or short strides • Difficulty lifting limb(s) or maintaining limb position when picking out feet

Examples of QoL domains and activities of daily living that could be assessed	• General health
	  ◦ owner perception of, or satisfaction with, horse's overall health
	  ◦ regular veterinary examination to identify concurrent disease(s)
	• Energy/fatigue
	  ◦ exercise intolerance
	  ◦ lethargy
	• Mental health
	  ◦ depression or behaviour changes
	• Emotional behaviour
	  ◦ owner perception of general 'happiness'
	• Eating
	  ◦ appetite
	  ◦ quidding or other signs of dysmastication or dental disease
	• Dependence on medicinal substances
	  ◦ monitoring response to treatment
	  ◦ use of any complementary or alternative therapies and supplements
	• Home environment
	  ◦ appropriate pasture turnout, particularly for cases with a history of laminitis or concurrent insulin dysregulation
		• General health
		  ◦ owner perception of, or satisfaction with, horse's overall health
		  ◦ regular veterinary examination to identify concurrent disease(s)
		• Pain/discomfort
		  ◦ lameness and pain scores
		• Mobility
		  ◦ ambulation
		  ◦ difficulty getting up after lying down or rolling
		• Sleep and rest
		  ◦ increased or decreased frequency of lying down
		• Dependence on medicinal substances
		  ◦ monitoring response to treatment
		  ◦ use of any complementary or alternative therapies and supplements
		  ◦ usual activity
		• Capable of maintaining normal exercise regimen for usual discipline
		• Social functioning and quality of social interaction
		  ◦ maintaining place in herd hierarchy

Key areas for ongoing owner monitoring	• Progression of existing clinical signs
	• Development of new clinical signs
	• Body condition scoring and weight management
	• Change in ability to perform any activities of daily living
	• Adequate provision of preventive health care
		• Degree of lameness
		• Change in ability to perform any activities of daily living
		• Changes during farriery
		  ◦ difficulty flexing, extending or maintaining elevated limb during trimming/shoeing
		  ◦ uneven shoe/hoof wear
		• Weight management

healthcare and effective analgesia (Ireland et al, 2011c). Using pituitary pars intermedia dysfunction and osteoarthritis as examples, *Table 2* summarises some potential components of HRQoL assessment in animals diagnosed with a chronic disease or disorder. In addition to taking a thorough history and performing a comprehensive clinical examination, HRQoL assessment should include disease-specific clinical assessments as well as evaluation of general health (both physical and mental), the horse's environment and its ability to perform key activities of daily living (*Table 2*).

Individualised quality of life assessment

The major challenge in measuring QoL lies in its uniqueness to individuals. In human medicine, there is concern that many of the existing assessment tools fail to take account of this by im-

Ask owner to nominate factors they consider important to their horse's quality of life

- Owner-reported factors important to horse:
  - companionship of other horses in same herd when turned out at pasture
  - able to do a variety of easy exercises regularly
  - ability to move freely without pain

Devise scale or other scoring method for each factor

- Equine companionship:
  - How much does [horse name] interact with other horses?
    ☐ Not at all ☐ A little ☐ Quite often ☐ Very often ☐ Always
- Exercise:
  - How would you rate [horse name]'s capacity for light ridden exercise?
    ☐ Very poor ☐ Poor ☐ Neither poor nor good ☐ Good ☐ Very good
- Pain-free mobility:
  - To what extent do you feel that pain limits [horse name]'s ability to move around during his/her normal daily activities?
    ☐ Not at all ☐ A little ☐ Moderately ☐ Very much
    ☐ An extreme amount
- Scores can be weighted dependent on the degree of importance that the owner assigns to each factor being evaluated
- Discuss with the owner an appropriate frequency with which they should rate their nominated factors for their horse
- Ask owners to record their ratings to facilitate monitoring
- Incorporate owner scores within future health-related quality of life assessments

Figure 3. Example of a possible approach to individualised quality of life assessment for an older horse. Likert-style question responses are shown here, which tend to be more sensitive to change than binary response options. However, depending on the specific factors to be assessed, other options such as visual analogue scales may be useful.

posing standardised models of QoL, with preselected domains. Therefore, there is growing awareness of the importance of individualised assessments, where patients identify key life activities relating to their own QoL. Early examples of this are the Subjective Domains of Quality of Life Measure (SDQLM) (Bar-On and Amir, 1993) and the Schedule for the Evaluation of Individual Quality of Life – Direct Weighting (SEIQoL-DW) (O'Boyle et al, 1993), where respondents identify areas of importance in their life, rate these areas on an individually generated scale and rank their importance. The SEIQoL-DW has been reported to be a feasible and valid QoL instrument (Wettergren et al, 2009), which is of particular use for exploring determinants that contribute to individuals' QoL (Moons et al, 2004). This method has been successfully adapted for owner-perceived QoL assessment in dogs, where owners of both healthy dogs and those with spinal cord injuries volunteered the same broad domains of mobility, play or mental stimulation, health and companionship (Budke et al, 2008), which could be readily be adapted to apply to older horses (*Figure 3*).

Equine quality of life assessment

While it is an area of ongoing research, no validated QoL instrument is currently available in equine medicine. However, various equine welfare assessment tools are available, focussing primarily on environmental assessment or health indicators, including body condition score, hydration status, cardiorespiratory parameters, and lameness (reviewed by Hockenhull and Whay, 2014) or pain scales (reviewed by van Loon and Van Dierendonck, 2018). Additionally, there is growing interest in behavioural ethograms and evaluation of horses' emotions (Henry et al, 2017). Independently these tools cannot provide a comprehensive QoL assessment, but they provide a useful framework for selecting domains to include when assessing QoL in older horses.

QoL assessment undertaken by a veterinary surgeon is likely to be the most practical option, typically requiring less time and effort to complete than owner questionnaires. However, a veterinary examination is unlikely to result in a comprehensive, reliable assessment of the horse's QoL in its normal environment, performing a full range of activities. Owners have a long-term perspective and considerably greater knowledge of their horse's history and normal daily activities, and more awareness of how these matter from the horse's perspective (Yeates and Main, 2009). Therefore, owners are potentially better placed to assess the horse's mental wellbeing, making them useful proxies for QoL assessment.

Together with a thorough veterinary examination, asking owners to identify QoL domains that they consider to be important for their older horse could be a useful and practical way to inform a tailored assessment for rating and monitoring QoL in that individual. Using these owner-reported factors to design a small series of single-item questions could provide a valid, rapid assessment of QoL, which is feasible to use in a clinical setting (McGowan and Ireland, 2016; *Figure 3*).

Value of assessing quality of life

Formal QoL assessment in older horses has an array of benefits. Including owners in assessment of their horse's QoL can increase their level of reflection, encouraging them to consider the impact of management, healthcare and health problems. It can facilitate communication around geriatric health concerns, such as weight management or provision of analgesia, and allow owners to identify problems or possible improvements (Yeates and Main, 2009).

QoL evaluations can help inform management and treatment options, and can help to prioritise therapeutic interventions where animals have multiple concurrent conditions. It plays a major role in owner decision making, with owners of geriatric horses ranking QoL following treatment as the most important factor when considering potential treatment options for a severe illness or injury (Ireland et al, 2011c). QoL assessment can also be used in evaluating response to treatment, where it may be a more important measure of success than prolongation of life. Decreased scores for QoL measures may also help to identify detrimental side effects of treatment.

QoL ratings can be useful prognostic indicators: QoL has been reported to be highly predictive of outcome in human geriatric patients with conditions such as myeloid leukaemia (Deschler et al, 2013). Several QoL factors were associated with increased risk

KEY POINTS

- Quality of life assessment in older horses should be a 'team effort', involving both veterinary and owner/carer appraisal.
- Although a validated equine quality of life assessment tool is not currently available, there is a wealth of available resources from human and small animal medicine, as well as several equine welfare assessment tools and pain scales, which can be used to inform quality of life evaluation in older horses.
- Multimorbidity is common in older horses, resulting in poorer health-related quality of life, but activities of daily living are also important factors to consider in any assessment, ideally tailored to the individual animal.
- Quality of life ratings can inform management and treatment decisions and provide a useful outcome measure of response to therapeutic interventions.
- Poor quality of life ratings are predictive for mortality in older horses, and having a measurable way to demonstrate compromised quality of life can aid decision making around euthanasia.

of mortality in geriatric horses (Ireland et al, 2011c). QoL assessment plays a vital role in decision making for euthanasia, as compromised QoL is a primary reason for equine euthanasia (Preshaw et al, 2018). Poor QoL was reported to be a major factor in euthanasia decisions for geriatric horses by 34% of owners, particularly for horses with lameness or chronic diseases where veterinary advice was less frequently identified as influential in the decision-making process compared with other health problems such as colic and acute injury (Ireland et al, 2011d). Having a measurable way of demonstrating that QoL is compromised may help to reduce owner distress (McGowan et al, 2012) or feelings of guilt surrounding this difficult decision.

Conclusions

Older horses may have different welfare issues and factors influencing their QoL than younger animals. Currently, there is no validated instrument for assessing equine QoL, in animals of any age. However, there is a wealth of resources from human and small animal medicine to help inform what domains should be included in QoL assessment for older horses. Veterinary surgeons should be proactive in discussing QoL with owners, and a comprehensive assessment of QoL in older horses should involve both the owner/carer and the veterinary surgeon. QoL assessment including evaluation of health-related factors, activities of daily living and mental wellbeing is beneficial for informing decision making regarding management, healthcare and euthanasia. EQ

Conflict of interest

The author has no conflicts of interest to declare.

References

Bar-On D, Amir M. Re-examining the quality of life of hypertensive patients: A new self-structured measure. Am J Hypertens. 1993;6(3 Pt 2):62S-66S. https://doi.org/10.1093/ajh/6.3.62s

Bijsmans ES, Jepson RE, Syme HM, Elliott J, Niessen SJM. Psychometric validation of a general health quality of life tool for cats used to compare healthy cats and cats with chronic kidney disease. J Vet Intern Med. 2016;30(1):183–191. https://doi.org/10.1111/jvim.13656

Blane D, Higgs P, Hyde M, Wiggins RD. Life course influences on quality of life in early old age. Soc Sci Med. 2004;58(11):2171–2179. https://doi.org/10.1016/j.socscimed.2003.08.028

Bowling A. Measuring disease: A review of disease specific quality of life measurement scales. 2nd edn. Buckingham: Open University Press, 2001

Broom DM. Quality of life means welfare: how is it related to other concepts and assessed? Anim Welfare. 2007;16(S):45–53.

Budke CM, Levine JM, Kerwin SC, Levine GJ, Hettlich BF, Slater MR. Evaluation of a questionnaire for obtaining owner-perceived, weighted quality-of-life assessments for dogs with spinal cord injuries. J Am Vet Med Assoc. 2008 15;233(6):925–930. https://doi.org/10.2460/javma.233.6.925

Bushell R, Murray J. A survey of senior equine management: owner practices and confidence. Livest Sci. 2016;186:69–77. https://doi.org/10.1016/j.livsci.2015.04.024

Carr AJ, Higginson IJ. Measuring quality of life: are quality of life measures patient centred? BMJ. 2001;322(7298):1357–1360. https://doi.org/10.1136/bmj.322.7298.1357

Chassany O, Sagnier P, Marquis P, Fullerton S, Aaronson N. European Regulatory Issues on Quality of Life Assessment Group. Patient-reported outcomes: the example of health-related quality of life—a European guidance document for the improved integration of health-related quality of life assessment in the drug regulatory process. Drug Inf J. 2002;36(1):209–238. https://doi.org/10.1177/009286150203600127

Deschler B, Ihorst G, Platzbecker U et al. Parameters detected by geriatric and quality of life assessment in 195 older patients with myelodysplastic syndromes and acute myeloid leukemia are highly predictive for outcome. Haematologica. 2013;98(2):208–216. https://doi.org/10.3324/haematol.2012.067892

Fabbri E, Zoli M, Gonzalez-Freire M, Salive ME, Studenski SA, Ferrucci L. Aging and multimorbidity: new tasks, priorities, and frontiers for integrated gerontological and clinical research. J Am Med Dir Assoc. 2015;16(8):640–647. https://doi.org/10.1016/j.jamda.2015.03.013

Favrot C, Linek M, Mueller R, Zini E; International Task Force on Canine Atopic Dermatitis. Development of a questionnaire to assess the impact of atopic dermatitis on health-related quality of life of affected dogs and their owners. Vet Dermatol. 2010;21(1):64–70. https://doi.org/10.1111/j.1365-3164.2009.00781.x

Freeman LM, Rush JE, Oyama MA et al. Development and evaluation of a questionnaire for assessment of health-related quality of life in cats with cardiac disease. J Am Vet Med Assoc. 2012;240(10):1188–1193. https://doi.org/10.2460/javma.240.10.1188

Freeman LM, Rodenberg C, Narayanan A, Olding J, Gooding MA, Koochaki PE. Development and initial validation of the Cat HEalth and Wellbeing (CHEW) Questionnaire: a generic health-related quality of life instrument for cats. J Feline Med Surg. 2016;18(9):689–701. https://doi.org/10.1177/1098612X16657386

Fortney WD. 2004. Geriatrics and Aging. In: Geriatrics and Gerontology of the Dog and Cat, 2nd edn. St. Louis, Missouri, Saunders: 1–4.

Haywood KL, Garratt AM, Fitzpatrick R. Quality of life in older people: A structured review of generic self-assessed health instruments. Qual Life Res. 2005;14(7):1651–1668. https://doi.org/10.1007/s11136-005-1743-0

Henry S, Fureix C, Rowberry R, Bateson M, Hausberger M. Do horses with poor welfare show 'pessimistic' cognitive biases? Naturwissenschaften. 2017;104(1-2):8. https://doi.org/10.1007/s00114-016-1429-1

Higginson IJ, Carr AJ. Measuring quality of life: using quality of life measures in the clinical setting. BMJ. 2001;322(7297):1297–1300. https://doi.org/10.1136/bmj.322.7297.1297

Hockenhull J, Whay HR. A review of approaches to assessing equine welfare. Equine Vet Educ. 2014;26(3):159–166. https://doi.org/10.1111/eve.12129

Ireland JL, Clegg PD, McGowan CM, McKane SA, Pinchbeck GL. A cross-sectional study of geriatric horses in the United Kingdom. Part 1: demographics and management practices. Equine Vet J. 2011a;43(1):30–36. https://doi.org/10.1111/j.2042-3306.2010.00145.x

Ireland JL, Clegg PD, McGowan CM, McKane SA, Pinchbeck GL. A cross-sectional study of geriatric horses in the United Kingdom. Part 2: health care and disease. Equine Vet J. 2011b;43(1):37–44. https://doi.org/10.1111/j.2042-3306.2010.00142.x

Ireland JL, Clegg PD, McGowan CM, Duncan JS, McCall S, Platt L, Pinchbeck GL. Owners' perceptions of quality of life in geriatric horses: a cross-sectional study. Anim Welf. 2011c;20:483–495.

Ireland JL, Clegg PD, McGowan CM, Platt L, Pinchbeck GL. Factors associated with mortality of geriatric horses in the United Kingdom. Prev Vet Med. 2011d;101(3-4):204–218. https://doi.org/10.1016/j.prevetmed.2011.06.002

Ireland JL, Clegg PD, McGowan CM, McKane SA, Chandler KJ, Pinchbeck GL. Disease prevalence in geriatric horses in the United Kingdom: veterinary clinical assessment of 200 cases. Equine Vet J. 2012a;44(1):101–106. https://doi.org/10.1111/j.2042-3306.2010.00361.x

Ireland JL, Clegg PD, McGowan CM, McKane SA, Chandler KJ, Pinchbeck GL. Comparison of owner-reported health problems with veterinary assessment of geriatric horses in the United Kingdom. Equine Vet J. 2012b;44(1):94–100. https://doi.org/10.1111/j.2042-3306.2011.00394.x

Katsura H, Yamada K, Kida K. Usefulness of a linear analog scale questionnaire to measure health-related quality of life in elderly patients with chronic obstructive pulmonary disease. J Am Geriatr Soc. 2003;51(8):1131–1135. https://doi.org/10.1046/j.1532-5415.2003.51363.x

Marengoni A, Angleman S, Melis R, Mangialasche F, Karp A, Garmen A, Meinow B, Fratiglioni L. Aging with multimorbidity: A systematic review of the literature. Ageing Res Rev. 2011;10(4):430–439. https://doi.org/10.1016/j.arr.2011.03.003

McGowan TW, Pinchbeck G, Phillips CJC, Perkins N, Hodgson DR, McGowan CM. A survey of aged horses in Queensland, Australia. Part 1: management and preventive health care. Aust Vet J. 2010;88(11):420–427. https://doi.org/10.1111/j.1751-0813.2010.00637.x

McGowan TW, Phillips CJC, Hodgson DR, Perkins N, McGowan CM. Euthanasia in aged horses: relationship between the owner's personality and their opinions on, and experience of, euthanasia of horses. Anthrozoos. 2012;25(3):261–275. https://doi.org/10.2752/175303712X13403555186091

McGowan CM, Ireland JL. Welfare, quality of life, and euthanasia of aged horses. Vet Clin North Am Equine Pract. 2016;32(2):355–367. https://doi.org/10.1016/j.cveq.2016.04.011

Mellor DJ, Reid SWJ, Love S, Walker R, Gettinby G. Sentinel practice-based survey of the management and health of horses in northern Britain. Vet Rec. 2001;149(14):417–423. https://doi.org/10.1136/vr.149.14.417

Moons P, Marquet K, Budts W, De Geest S. Validity, reliability and responsiveness of the "Schedule for the Evaluation of Individual Quality of Life-Direct Weighting" (SEIQoL-DW) in congenital heart disease. Health Qual Life Outcomes. 2004;2(1):27. https://doi.org/10.1186/1477-7525-2-27

Mullan S, Main D. Preliminary evaluation of a quality-of-life screening programme for pet dogs. J Small Anim Pract. 2007;48(6):314–322. https://doi.org/10.1111/j.1748-5827.2007.00322.x

Niessen SJM, Powney S, Guitian J, Niessen APM, Pion PD, Shaw JAM, Church DB. Evaluation of a quality-of-life tool for cats with diabetes mellitus. J Vet Intern Med. 2010;24(5):1098–1105. https://doi.org/10.1111/j.1939-1676.2010.0579.x

Noble CE, Wiseman-Orr LM, Scott ME, Nolan AM, Reid J. Development, initial validation and reliability testing of a web-based, generic feline health-related quality-of-life instrument. J Feline Med Surg. 2019;21(2):84–94. https://doi.org/10.1177/1098612X18758176

O'Boyle C, Browne J, Hickey A, McGee H, Joyce CRB. The Schedule for the Evaluation of Individual Quality of Life (SEIQoL): a Direct Weighting procedure for Quality of Life Domains (SEIQoL-DW). 1993. Administration Manual. Royal College of Surgeons in Ireland. Report. https://doi.org/10.25419/rcsi.10770263.v1

Office for National Statistics. Living longer: is age 70 the new age 65? 2019. https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/ageing/articles/livinglongerisage70thenewage65/2019-11-19 (accessed 24 August 2020)

Osborne R, Hawthorne G, Lew EA, Gray LC. Quality of life assessment in the community-dwelling elderly Validation of the Assessment of Quality of Life (AQoL) Instrument and comparison with the SF-36. J Clin Epidemiol. 2003;56(2):138–147. https://doi.org/10.1016/S0895-4356(02)00601-7

Öztürk A, Şimşek TT, Yümin ET, Sertel M, Yümin M. The relationship between physical, functional capacity and quality of life (QoL) among elderly people with a chronic disease. Arch Gerontol Geriatr. 2011;53(3):278–283. https://doi.org/10.1016/j.archger.2010.12.011

Peddle GD, Singletary GE, Reynolds CA, Trafny DJ, Machen MC, Oyama MA. Effect of torsemide and furosemide on clinical, laboratory, radiographic and quality of life variables in dogs with heart failure secondary to mitral valve disease. J Vet Cardiol. 2012;14(1):253–259. https://doi.org/10.1016/j.jvc.2012.01.003

Preshaw L, Abeyesinghe S, Burn C. Equine euthanasia - how do we know when the time is right? Equine Vet J. 2018;50 S52:34–35. https://doi.org/10.1111/evj.66_13008

Reid J, Wiseman-Orr ML, Scott EM, Nolan AM. Development, validation and reliability of a web-based questionnaire to measure health-related quality of life in dogs. J Small Anim Pract. 2013;54(5):227–233. https://doi.org/10.1111/jsap.12059

Skevington SM, Carse MS, Williams ACDC. Validation of the WHOQOL-100: pain management improves quality of life for chronic pain patients. Clin J Pain. 2001;17(3):264–275. https://doi.org/10.1097/00002508-200109000-00013

Sprangers MAG, de Regt EB, Andries F, van Agt HME, Bijl RV, de Boer JB, Foets M, Hoeymans N, Jacobs AE, Kempen GIJM, et al. Which chronic conditions are associated with better or poorer quality of life? J Clin Epidemiol. 2000;53(9):895–907. https://doi.org/10.1016/S0895-4356(00)00204-3

Taylor KD, Mills DS. Is quality of life a useful concept for companion animals? Anim Welfare. 2007;16(S):55–65.

van Loon JPAM, Van Dierendonck MC. Objective pain assessment in horses (2014–2018). Vet J. 2018;242:1–7. https://doi.org/10.1016/j.tvjl.2018.10.001

Varricchio CG, Ferrans CE. Quality of life assessments in clinical practice. Semin Oncol Nurs. 2010;26(1):12–17. https://doi.org/10.1016/j.soncn.2009.11.003

Welsh CE, Duz M, Parkin TDH, Marshall JF. Prevalence, survival analysis and multimorbidity of chronic diseases in the general veterinarian-attended horse population of the UK. Prev Vet Med. 2016;131:137–145. https://doi.org/10.1016/j.prevetmed.2016.07.011

Wessmann A, Volk HA, Parkin T, Ortega M, Anderson TJ. Evaluation of quality of life in dogs with idiopathic epilepsy. J Vet Intern Med. 2014;28(2):510–514. https://doi.org/10.1111/jvim.12328

Wettergren L, Kettis-Lindblad Å, Sprangers M, Ring L. The use, feasibility and psychometric properties of an individualised quality-of-life instrument: a systematic review of the SEIQoL-DW. Qual Life Res. 2009;18(6):737–746. https://doi.org/10.1007/s11136-009-9490-2

Wiggins RD, Higgs PFD, Hyde M, Blane DB. Quality of life in the third age: key predictors of the CASP-19 measure. Ageing Soc. 2004;24(5):693–708. https://doi.org/10.1017/S0144686X04002284

Wiseman-Orr ML, Nolan AM, Reid J, Scott EM. Development of a questionnaire to measure the effects of chronic pain on health-related quality of life in dogs. Am J Vet Res. 2004;65(8):1077–1084. https://doi.org/10.2460/ajvr.2004.65.1077

Wojciechowska JI, Hewson CJ, Stryhn H, Guy NC, Patronek GJ, Timmons V. Development of a discriminative questionnaire to assess nonphysical aspects of quality of life of dogs. Am J Vet Res. 2005;66(8):1453–1460. https://doi.org/10.2460/ajvr.2005.66.1453

World Health Organization. WHOQOL: Measuring Quality of Life. The Structure of the WHOQOL-100. 2020. https://www.who.int/healthinfo/survey/whoqol-qualityoflife/en/index4.html (accessed 24 August 2020)

Yeates J, Main D. Assessment of companion animal quality of life in veterinary practice and research. J Small Anim Pract. 2009;50(6):274–281. https://doi.org/10.1111/j.1748-5827.2009.00755.x