Identifying owner management decisions surrounding end-of-life care and euthanasia of geriatric horses in New Zealand

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Abstract

A geriatric horse is defined by its chronological, functional, or demographic age. Despite advancement on veterinary care and improved husbandry practice, death is inevitable, and geriatric horses will progressively have a decreased quality of life as they age. Regardless of a horses functional or productive benefit to humans, moral and legal responsibilities are placed on the owner to make management and end-of-life decisions in the best interest of the horse's welfare. Few studies have explored characteristics of New Zealand horse owners, identification of the national geriatric horse population, or factors which influence owner decision making. There is also greater attention needed on the common practice of euthanasia and disposal methods in New Zealand with increasing international legislation and regional restraints. Therefore, this study aimed to describe owner management decisions surrounding end-of-life care and euthanasia of geriatric horses in New Zealand. An online survey collected data from 1,207 respondents. Over half (53%) of owners were based in Auckland, Waikato, and Manawatu-Wanganui. Most respondents identified as female (n=1,178, 98%), and nearly two thirds owned a geriatric horse (60%). Geriatric horses (≥15 years) were a median of 17 years old (IQR 16-22) and were visited by their owner twice a day (n=454, 70%). Most respondents had thought about a euthanasia plan for their horse (n=821, 77%), with veterinary administered overdose of barbiturates (n=886, 83%), and burial (n=774, 72%) preferred methods for euthanasia and disposal. On a scale from 0–5 (with 5 most influential) pain and poor prognosis were rated by owners as most influential when making end-of-life decisions for their horse (median score = 5/5, IQR 5–5). This study highlighted that owners are driven by their emotional bond with their horse and are largely dependent on veterinarian support when making end-of-life, euthanasia, and disposal decisions.

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“The best thing we can do, as horse owners, is ask ourselves if our practices really are the best for our horses and educate ourselves to find out” – Professor Paul McGreevy, University of Sydney.

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List of Abbreviations

EOL – Equine End of Life

NZ – New Zealand

PPID – Pituitary Pars Intermedia Dysfunction

QoL – Quality of Life

NSAIDs – Non-Steroidal Anti-Inflammatory Drugs

MEDW – Movement, Eating, Drinking and Bodyweight

IV – Intravenous

BCS – Body Condition Score

EMS – Equine Metabolic Syndrome

UK – United Kingdom

USA – United States of America

AVMA – American Veterinary Medical Association

WTP – Willingness to pay

CoW – Code of Welfare

NFSCo – National Fallen Stock Company

List of Keywords

Demographics, welfare, companion, management, horse-and-human bond.

Chapter 1: Introduction

End-of-life decisions are inevitable for horse owners. Owners often have high emotional attachments to their animals therefore, the concept of killing their horse creates discomfort. (McGowan & Ireland, 2016).This challenges social license for euthanasia, with some owners believing keeping the horse alive is a better outcome than the animals death. However, where quality of life is in jeopardy, this causes greater detriment to the horse's welfare (Smith et al., 2021). Euthanasia translates to 'a good death' and is a way to end an animal's pain and suffering (Maharani et al., 2024). This study identified a geriatric horse based on their chronological age of ≥15 years. Other studies may also choose to define geriatric horses based on demographic, or physiological age (Paradis, 2002). Despite this generalized age threshold, little documentation has been made on this demographic in New Zealand. New Zealand's equine population is estimated at approximately 130,000, with nearly half comprising of unregistered recreational, pleasure, or companion horses (Rogers & Gee, 2023). Despite this, limited formal documentation exists on horse ownership patterns and demographics outside of the racing industry.

Owning and managing a geriatric horse can be timely, costly, and labour intensive. Relative management practices therefore are dependent on what owners can and are willing to do for their horse. This is also reliant on their knowledge which may stem from the owner's experience, understanding, or values (McGowan et al., 2012). The way one owner manages their geriatric horse differs to how other owners care for their horse, as each owner has their own level of constraints and beliefs curated by their ideologies and perspectives.

Geriatric horses progressively have a decreased quality of life as they age. This progression gives the owner time to set quantifiable milestones to measure the horse's quality of life and plan accordingly. Few data exists on whether owners have plans for their geriatric horse regarding end-of-life care, euthanasia method, disposal, and what influences them in making these decisions.

Planning the horse's death will not mitigate the pain the owner feels, however, it may help alleviate some of the barriers or burdens of decision making when the time comes. If owners are aware of the options available to them, and their implications, it may ease tension on an emotional and painful day (Lagoni et al., 1994).

Chapter 2: Literature Review

2.1 – The changing demographics of the equine population

The horse and human relationship was historically founded on utility, based on the horses key role in warfare, agriculture, and transport (Dashper & Brymer, 2019; Trentin & Sneed, 2018). Their physical strength represented in historical art symbolises power, wealth, and status (Baskett, 2006; Budiansky, 1997; Delpeut & Willekes, 2023; Edwards et al., 2011). Motorization and modernised technologies no longer require the horse to plough fields or be utilized for transport. Instead, the modern horse today amongst developed countries is predominantly used for sport and recreation (Rzekęć et al., 2020; Singleton, 1993). The global horse population was recorded by The Food and Agricultural Organization of the United Nations (FAOSTAT) in 2008 at 55.8 million (Khadka, 2015). Global numbers are now almost at 60 million (Orlando, 2020), with an estimated 8.8–9.5 million horses located in the United States of America (USA) (Kilby, 2007; Lord, 2019), and 6–7 million in Europe (Gavinelli, 2015; Rzekęć et al., 2020; World Horse Welfare, 2024). Australia has approximately 1 million domesticated horses, and several hundred thousand feral horses (Hemsworth, 2012; Smyth & Dagley, 2016). The closest data on New Zealand horse populations was estimated in 2022 at 130,112 (Rogers & Gee, 2023), a gradual increase from the 2017 estimate of 98,868 (Rogers et al., 2017). Three main industries being, Thoroughbred (17,511), Standardbred (9,244), and Sport horse (15,427) (Rogers & Gee, 2023). Horses used for recreation, sport, or as companions are not required to be registered with any governing body (Rogers & Gee, 2023). Absence of efficient equine identification, traceability and ownership regulations has resulted in little official, or formal documentation describing the national demographics. The lack of knowledge on the geographical spread and movement of horses poses threat to the national health of these horses should there be an outbreak of infectious disease (Rosanowski et al., 2013). The New Zealand Equine Health Association has sought to moderate this issue by leading the National Equine Identification and Traceability project. This project launching from the 1st of August 2025, calls for all foals born after this date to be microchipped. Effectiveness of this initiative will not be measurable for a few years, however, this response is certainly well overdue.

2.2 – Horse and human relationship

In recent decades, the social perception of horses has shifted toward viewing the horse as a companion animal, rather than production animal, prompting increased interest in equine

welfare, treatment, research, and their emotional and therapeutic benefits for humans (Fiedler, 2020; Fiedler, 2016; Ward, 2023; Wolframm et al., 2013). The bond between humans and companion animals has been compared to that of a child, family member, and loved ones (Veevers, 2016), with horses described as sources of emotional support and stress relief for those constrained by busy life, or physical or mental disabilities (Burgon, 2003; Loving, 2011; Scott, 2005). Therapeutic riding has also shown positive outcomes for children's self-esteem (Bauer & Woodward, 2007; European Equine Facilitated Therapy Network, 2023; Hardy, 2011; Punzo et al., 2022). The COVID-19 pandemic further emphasized the significance of horse-and-owner companionship, as owners reported distress when separated from their animals (Shoesmith et al., 2021; Williams et al., 2020).

2.3 – Marginal utility

The societal value of a horse can be conceptualised through marginal utility, representing both economic and emotional worth (Rogers et al., 2023). In production industries such as racing, horses hold high financial value, where their return-on-investment is a driver in decision making. Horses viewed more as a companion often provide little to no economic benefits such as financial gain. However, these horses may provide owners with a sense of belonging and emotional comfort. Ownership of these horses therefore, stem from emotional interest, rather than economic advantage. Anecdotally, geriatric horses are typically of lower financial value due to declining functional capacity and thus, have a lower purchase price than a horse at peak performance. Owners of geriatric horses often demonstrate high levels of attachment and emotional investment, suggesting emotional value may outweigh economic considerations in this demographic (Ballou et al., 2020; Fox & Gee, 2019; Ireland et al., 2011b).

2.4 – The geriatric horse

Within Western Europe and the United Kingdom the proportion of the horse populated defined as a geriatric horse is increasing (Ireland et al., 2011a). Within the literature the common definition for a geriatric horses is a horse of greater than fifteen years of age (Ireland et al., 2011a; McGowan, 2011; McGowan et al., 2010a; Mellor et al., 1999; Paradis, 2002; Ratz et al., 2021). This is known as the horse's chronological age, measured in numeric calendar years and against the horses expected longevity (McGowan, 2011). Many horses outlive their performance or reproductive capability regardless of their career (McGowan, 2011). There is

an expectation that many owners continue to manage their horse into retirement despite this decrease in production or functionality (McGowan, 2011). These measures are reflective of the horses physiological age; when a horse is deemed suitable to carry out a particular function relating to sport or performance (Paradis, 2002). A horse is considered geriatric in demographic age when the horse is in the upper 25% of the population (Paradis, 2002). A quarter (25%) of the equine population in the United Kingdom are ≥15 years old, 13% ≥20 years, and 2% ≥30 years of age (Ireland et al., 2011a). No data exists on the New Zealand geriatric horse population. Following these international measures, based on an estimated 130,000 national population, approximately 32,500 horses would be ≥15 years in New Zealand.

2.4.1 – Age-related health concerns of the geriatric horse

Geriatric horses have distinct health and management challenges compared to younger horses. Common age-related conditions include pituitary pars intermedia dysfunction (PPID), osteoarthritis, lameness, chronic orthopaedic issues, dental disease, equine metabolic syndrome (EMS), obesity, low body condition score (BCS), muscle wasting, swayback, low sloping pasterns, and ocular disorders (Ireland et al., 2012a; Ireland et al., 2012c; Kelemen et al., 2021; Malalana et al., 2019; McGowan, 2011; McGowan et al., 2013; McGowan et al., 2010a, 2010b; Welsh et al., 2016). These conditions often require tailored management approaches to daily routines, feeding, and veterinary care.

Horses are continuous grazers (Mills & Redgate, 2017) but this behaviour can be disrupted by conditions that reduce grazing time such as lameness (Kelemen et al., 2021), and dental conditions causing horses to drop its food whilst chewing (Paradis, 2002). Reduced mobility or impaired vision can also prevent adequate feed intake (Pugh, 2002). Amongst studied populations, dental abnormalities such as loose teeth, tooth loss, and excessive wear were prominent across geriatric horses (Ireland et al., 2012c; McGowan, 2011). A significant finding to Ireland's (2012c) study on geriatric horses over 30 was the disparity between owner-reported issues, and the evidence of clinical findings, representing a gap between clinical diagnosis and owner recognition. While 10% of geriatric horses were overweight, only 3% were reported as such by owners (Ireland et al., 2012c). Conversely, underweight horses were overreported (23%) relative to clinical findings (16%) (Ireland et al., 2012c), suggesting that there are limitations surrounding owner knowledge on accuracy to assess and manage Body Condition Score (BCS). A solution to minimise this concern may be to enhance education for horse

owners on how to the body condition score system to asses bodyweight and highlight the welfare implications of a poor BCS. Health concerns of the geriatric horse have been reported in some international countries (Ireland et al., 2012a; McGowan, 2011), however to date, investigations on New Zealand geriatric horses are largely unexplored.

2.4.2 – Management decisions

Pasture availability is a major management consideration for geriatric horses. Domestication has reduced the roaming behaviours and distance a horse travels (Hampson et al., 2010), however, New Zealand's mild climate and absence of predators enables horses to live outside throughout the year which is beneficial for the locomotory behaviour of the horse (Rogers et al., 2017). A horses diet should comprise of 50–100% forage (Fernandes et al., 2021) and horses turned out in large paddocks to retire will likely have sufficient forage available to reach this quota. Horses in pasture-based systems are less likely to be monitored (Rogers et al., 2023), enabling predisposed health issues to arise and go unnoticed (McGowan, 2011). Overseas, there is greater use of intensive management practices such as stabling, which increasing monitoring, but the reduction of paddock size prevents adequate locomotory behaviour (Hampson et al., 2010).

Oral joint health and vitamin supplements are commonly provided to horses with osteoarthritis (Oke & McIlwraith, 2010) as nutritional, pharmaceuticals, and nutraceutical additives are given at a greater prevalence with geriatric aged horses (Smith et al., 2021). However, with inconsistencies amongst horse owner reporting's and clinical findings on geriatric horse BCS, it suggests many owners of geriatric horses either do not recognise the signs of declining health in their horse, or are aware and not reporting these findings (Ireland et al., 2012b; McGowan et al., 2010b). As a result, it remains unclear how many horses may require these supplements, compared to those who are actually receiving them.

Acknowledgment of current husbandry practices is necessary to assess welfare and measure improvement and behaviour change initiatives (Thompson et al., 2018), however there is currently no research exclusively monitoring the owner decisions of the geriatric horse in New Zealand. Age has been associated with a decline in the provision of routine health care checks including frequency of hoof care, vaccinations, and veterinary visits in the UK (Ireland et al.,

2011b; Ireland et al., 2012c; Mueller et al., 2018) and 18% of geriatric horses in the same UK based study did not receive regular dental checkups (Ireland et al., 2011b).

2.5 – Quality of life

Equine Quality of Life (QoL) is defined as "an individual's subjective evaluation of their [horses] life, which in turn is assumed to involve a balance of positive and negative states" (Long et al., 2022). Littlewood (2021) recognised there is no shared universal measures for the term QoL, therefore, assessing QoL is subjective to the country, practice, veterinarian, and owner observing the animal. However, despite this subjectivity, Quality of Life is a driving factor in decision-making within veterinary medicine (Long et al., 2022; McGowan & Ireland, 2016).

Every decision made by an owner impacts the welfare of a horse; these are catered to an owners financial position, available health care, resources, support, time availability and their level of knowledge (Dashper & Brymer, 2019; Smith et al., 2021; Ward, 2023). Human perception of mortality often influence feelings of guilt and fear felt by owners when making end-of-life decisions for their horse (McGowan et al., 2012). Euthanasia is typically considered when a horses negative states begin to outweigh positive ones. While QoL is usually conducted by a veterinarian, further research is needed to evaluate owners capabilities to recognise and assess QoL in their own horses. Owners of aged horses in the UK have shown to perceive QoL of their horse through factors such as nutrition, comfort, and company of other horses (Ireland et al., 2011c). Evaluating QoL should not be limited to only ill or older horses, and instead should become habitual practice for all horse owners. Owners have both a moral and legal duty of care to make decisions in the best interest of the horses welfare (McGowan & Ireland, 2016). In New Zealand, this duty encompasses meeting the horses physical, health, and behavioural needs, as outlined in the Animal Welfare Act (1999). Owners are required to meet minimum standards of practice, and encouraged to offer best practice of care as cited in the Code of Welfare: Horses and Donkeys (Ministry for Primary Industries, 2018). Greater attention is needed however on the tools available for supporting owners in making these evaluations for their horses in New Zealand.

A simple analogy was developed in the USA for horse owners' daily monitoring for their geriatric, or disabled horse; the acronym 'MEDW' stands for Movement, Eating, Drinking, and

Bodyweight (Stull, 2013). Stull (2013) also notes horses should be able to rise on their own after a sleep, or roll, as those unable to stand on their own are more susceptible to colic. A scientifically backed assessment of animal welfare can be measured using the Five Domains Model, which accounts for the horses needs from nutrition, physical environment, health, behavioural interaction and mental state (Mellor et al., 2020). Uneducated, or naïve horse owners may overlook pain responses which is a major welfare concern (Golding et al., 2023), New Zealand horse owners may learn to understand and interpret the behaviours of their horse in relation to the Five Domains Model, or similar models to MEDW to assess their animals welfare. However greater research is needed on horse owner awareness and knowledge of these resources, along with their accuracy to measure this.

2.6 – Equine Euthanasia

2.6.1 – What is equine euthanasia

Euthanasia comes from the Greek '*euthanatos*', meaning 'good death' or 'easy death', and is a humane killing method with the aim of minimal suffering and pain (Maharani et al., 2024). Euthanasia is recommended when there is threat to an animals welfare (Machado et al., 2013), but an owner may also opt for equine euthanasia due to a degenerative condition, safety of horse and handlers, loss of use, or convenience (Goodwin et al., 2012). Extensive research has been completed on the humane death of production animals, mostly on cattle and poultry, where decisions are reliant on the animals productive life (De Vries & Marcondes, 2020; EFSA Panel on Animal Health and Welfare et al., 2019; Gibson et al., 2009; Gibson et al., 2015; VanRaden & Wiggans, 1995). Euthanasia decisions for companion animals are highly dependent on QoL and are influenced by the emotional attachment of the owner (Millar & Mills, 2000; Stull, 2013). The practice of euthanasia in animals has sparked debate for euthanasia across the human species and is a political debate. A brief discussion of this topic is provided in Appendix C.

2.6.2 – Lethal injection

The most common method of veterinarian assisted equine euthanasia is through an overdose of barbiturates (Aleman et al., 2015; Dybdal et al., 2023). Sedation is first administered to the horse to minimise movement and response to environmental stimuli as absence of sedation can

cause distress to the owner and may present safety concerns for the veterinarian (Richards, 2024). The lethal dose of barbiturate is then administered via intravenous (IV) injection through a needle or catheter. Once administered, the horse loses consciousness and will collapse on the ground. The horse may gasp, this is known as the agonal breath, and is a natural reflex to the procedure. Although this can be distressing to owners who are unaware of the body reflex, this is not considered a true breath due to the absence of brainstem reflexes (Aleman et al., 2015; Underwood & Anthony, 2020). Death is pronounced based on lack of heartbeat, lack of respiration, and lack of corneal reflex (Federation of Veterinarians of Europe, 2021). Due to the high concentrate of chemicals involved in a chemically induced euthanasia, the carcass cannot be used for consumption or scavenging, therefore, method of carcass disposal may influence, or be influenced by the method of euthanasia.

Euthanasia using an injection of barbiturates is commonly used amongst companion animals (Cooney & Kipperman, 2023). Owners may choose to stay for the onset of death, or say their goodbyes before the sedation and lethal injection is administered (Endenburg, 1999). The involvement of the owner in the procedure has not been reported within the literature, however, the significant impact of stress and grief during and following euthanasia of an animal on the veterinarian, veterinarian staff, and owners involved has been documented (Cooney & Kipperman, 2023; Fawcett, 2013; Hewson, 2014; Kogan & Erdman, 2019; Lagoni et al., 1994; McGowan et al., 2012; Moir & Van den Brink, 2020; Rollin, 2011; Scotney et al., 2015). Grief is commonly reported after equine euthanasia (Endenburg, 1999). The level of distress experienced by an owner during euthanasia may be influenced by the owners personality (McGowan, 2012). Collaboration between veterinary and mental health professionals may also help owners feel emotionally supported during a period of vulnerability (Lagoni, 2011; McGowan, 2012).

2.6.3 – Firearm

Use of a firearm is recognised as a humane method of killing a horse (Blackmore, 1985). Correct placement – centred on the forehead and angled towards the brainstem is critical to destroy specific brain structures, resulting in immediate, irreversible unconsciousness and death (Dybdal et al., 2023; Lenz, 2004; Machado et al., 2013). Inaccurate aim can lead to incorrect disruption of the brain, inducing further pain to the animal; this is considered a welfare issue (Dybdal et al., 2023). Firearm usage has been minimally reported in the literature in

relation to horse euthanasia, however, farm owners with horses who live a great distance from a veterinary clinic, or those with little access to another form of euthanasia procedure may rely on the use of a firearm for equine euthanasia to prevent further suffering of the animal. Cost may also be a driver in use of this method. In New Zealand, a firearm license is required for the ownership and use of the weapon and the user must comply with the Arms Act 1983. However, unlike veterinary-administered euthanasia where drug dosage is recorded, there is no requirement for owners to report firearm use or the resulting death. This lack of formal reporting limits available data on the prevalence of this euthanasia method.

2.6.4 – Captive bolt

Captive bolt is another recognised method for humane euthanasia. The captive bolt is a spring or air loaded stunning device powered by a cartridge and it is used for short, rapid action (EFSA Panel on Animal Health and Welfare et al., 2019). Instant unconsciousness is achieved after an explosive charge penetrating the skull (Richards, 2024). Certification is not needed for the handling and use of a captive bolt, and it is considered safer than a firearm due to the absence of a ricochet. Incorrect positioning of the captive bolt may poorly achieve unconsciousness, hence, correct handling is required to prevent compromise to the animals welfare (EFSA Panel on Animal Health and Welfare et al., 2019). Additionally, captive bolt is commonly used for the slaughter of production animals used for human consumption (Butterworth & Richardson, 2013; EFSA Panel on Animal Health and Welfare et al., 2019).

2.6.5 – Influential factors which may lead to an equine euthanasia

Catastrophic injuries and accidents whilst being ridden, in a paddock, during transportation, natural disasters, or during mundane daily procedures require euthanasia decisions to be made immediately (Dubbink et al., 2024; Marsh, 2007). Euthanasia procedures for these horses are often based on what is readily available, as delaying euthanasia may lead to ethical and welfare implications (Clough et al., 2021; Rollin, 2011). Decisions to euthanise geriatric horses and those with chronic illnesses are often made with less urgency compared to cases involving fatal injuries (Glassey, 2020). Greater time availability provides owners the opportunity to plan their animals end-of-life. However, as the value of geriatric horses is driven by their emotional worth, there is potential for welfare issues to arise through a delayed euthanasia (Rioja-Lang et al., 2020). Studies have also identified that an owners ability to assess pain or QoL may be

unsatisfactory which further complicates end-of-life decision making (Ireland et al., 2011b; Rioja-Lang et al., 2020).

2.7 – End of life plans

Existing resources on end-of-life planning tends to focus more heavily on dogs and cats than of horses (Eps et al., 2017; Parker & Yeates, 2012). The concept of an end-of-life plan is quite broad, with some publications presenting step-by-step checklists, whilst others are based on author recommendations (Parker & Yeates, 2012; Pierce & Shanan, 2017; Rioja-Lang et al., 2020; Rohrer Bley, 2018; Shaw & Lagoni, 2007). A recent study has identified a need for decision making models in veterinary practice to address all stages of euthanasia, including making the decision, enacting the decision, and aftercare (Cameron et al., 2022). However, Cameron (2022) also identified inconsistencies in terminology and records across existing publications, which poses difficulties for researchers when interpreting findings.

World Horse Welfare has comprised a suite of resources designed to support owners during end-of-life decisions (World Horse Welfare, n.d.). The 'Just in Case' leaflets are accessible through their website and provide owners with available options, quality of life assessment, insurance and legislative issues, and consideration for owner presence during euthanasia and disposal. There is currently no similar initiative available for New Zealand horse owners.

2.8 – Factors which influence euthanasia in companion animals

Littlewood (2021) identified seven factors that impact euthanasia decisions of domestic cats including pain, poor or hopeless prognosis, owner relationship, veterinarian advice, anticipated burden or cost to the owner, previous experience with the disease or death, and the animal itself. Due to the similar view of horses as companion animals with a high emotional investment, it is fitting to apply this perspective when exploring the influences and decisions on euthanasia made by horse owners.

2.8.1 – Pain

Pain is a state experienced by animals measured through behavioural and physiological indicators (Harding et al., 2004; Mendl et al., 2010). As a prey species, horses have evolved a strong fight-or-flight response, and demonstrations of pain in feral environments are often

suppressed to avoid attracting predators. Signs of pain in horses can include swishing of the tail, pinned-back ears, restlessness, decrease in appetite, and physical trauma (Maurício et al., 2023; Pearson et al., 2021). Pain behaviour signs are also greatly misinterpreted by humans as unwanted behaviours, causing further suppression of these human deemed 'undesirable traits'.

2.8.2 – Poor or helpless prognosis

A poor prognosis is an unfavourable prediction regarding the progression or outcome of a condition or illness. Receiving a poor prognosis can be disheartening to owners, and was the most important factor in decision making for dog euthanasia (Mallery et al., 1999). Poor prognosis, along with veterinary advice, prolonged pain/stress, and anticipated quality of life were ranked by owners as the most important factors which influenced decisions to euthanise their geriatric horse (McGowan et al., 2012). Sick animals with a poor prognosis often amount to greater caregiver burden with owners showing symptoms of depression, anxiety, and stress (Slater et al., 1996; Spitznagel et al., 2019). Risks of the recovery from anaesthetics may lead veterinarians to euthanise on the surgical table as a result of poor prognosis (Mair & Smith, 2005; Young & Taylor, 1993).

2.8.3 – Owner relationship / emotional attachment

The human-animal bond is defined by the American Veterinary Medical Association (AVMA) *"as a mutually beneficial and dynamic relationship between people and other animals that is influenced by behaviours that are essential to the health and well-being of both. This includes, but is not limited to, emotional, psychological and physical interactions with people, other animals, and the environment"* (Committee on the Human-Animal Bond, 1988).

The horse-and-human relationship is highly dependent on the responsibility and care decisions of the owner, similar to that of a parent and child (Fine, 2014; Kogan & Erdman, 2019). Guilt, anxiety, pressure, and feeling of overwhelm have been recognised in owners when having to make the decision to euthanise their horse (McGowan et al., 2012). This high level of attachment can complicate end-of-life decisions, as human ego and emotion may delay euthanasia, (Clough et al., 2021; Long et al., 2022; Rioja-Lang et al., 2020; Rollin, 2011), which can be greatly detrimental to the horses welfare (Bell & Rogers, 2021; Springer et al., 2019).

2.8.4 – Veterinary advice

Euthanasia can be a challenging time between the veterinarian and client relationship (Manktelow, 2024). The role of a veterinarian is to treat illnesses and conditions, make diagnoses and evaluate the welfare status of patients. The veterinarian presents the diagnosis to the owner and remains neutral, advocating for the welfare of the horse without telling the owner what choice to make, hence, the euthanasia decision is ultimately made by the owner based on the medical findings presented to them by the veterinarian (Park & Royal, 2020). In New Zealand, for cases where QoL is threatened and owners do not give permission for euthanasia, governing bodies such as SPCA or MPI may be approached.

2.8.5 – Anticipated burden or cost to the owner

Anticipated burden or cost can influence an owner in their decision to continue treatment or euthanise an animal (Egenvall et al., 2006; Littlewood, 2021; McGowan et al., 2012; Slater et al., 1996). The average annual cost of owning a sport horse in New Zealand was measured in 2012 at $12,500 (Matheson & Akoorie, 2012) where the cost to purchase, and ongoing maintenance is influenced by horse type and management decisions (Harris, 1999). When end-of-life decisions must be made, the owner's financial situation can play a significant role (Egenvall et al., 2006; Springer et al., 2019). Owners personal and financial situations including redundancy or health status may limit a person's ability to care for their horse (Green, 2022).

Following the COVID-19 pandemic, Thompson et al. (2023) identified a 14% increase in horse owner willingness to pay (WTP) in equine care in USA, indicating greater emphasis on horse wellbeing during times of uncertainty. In contrast, during the 2005–2008 economic crisis in Ireland, abattoirs experienced an influx of horses, highlighting that financial hardship led owners to reduce their financial burden in response to the changing economic climate (Rogers et al., 2023). To ease financial burdens, some countries, and states including the Equine Protection Fund in New Mexico, Equine Voices Rescue and Sanctury in Arizona, and Equine Welfare Grant Program in California have euthanasia funds due to the high costs involved and to educate owners on humane euthanasia (Goodwin et al., 2012). Insurance of a horse can also influence euthanasia decisions, with horses of higher insurance values having an increased risk of euthanasia (Egenvall et al., 2006). The prevalence of New Zealand horse insurance has not

been cited in the literature; anecdotally however, insurance is less common than overseas and there are limitations based on the age of horses, and types of coverage offered.

2.8.6 – The animal itself

The value of a horse is reflected in both societal views and the owner's perception of its economic or emotional worth (Rogers et al., 2023). Owner personalities and perceptions are individualised based on their ideologies shaped by their upbringing, culture, and society (McGowan et al., 2012). The majority of horses are seen as a commodity, bought and sold relative to their particular performance or benefit they can provide to the owners life. This raises ethical concern for the decisions made for the geriatric horse population; their age related concerns may deem them less desirable than the non-aged population. Many older horses in USA are exposed to chaotic auction house experiences, rather than peacefully living out their final years due to the emotional and financial burden associated with a geriatric horse (Goodwin et al., 2012). In contrast, there is also ethical concern of delayed euthanasia decisions due to emotional attachment to the animal (Batchelor & McKeegan, 2012; Rebuelto, 2008; Sandøe et al., 2015; Springer et al., 2019). Ethical dilemma regarding the animal itself is, therefore, a major influence in the euthanasia decision process for horse owners.

2.8.7 – Previous experience

Previous experience of the loss of a companion animal may influence owner behaviour regarding euthanasia of their future animals (McGowan et al., 2012). Aversive experiences such as an unsuccessful treatment of a poor prognosis case, or difficulty during euthanasia, may cause anxiety amongst owners when considering euthanasia for their next horse. In contrast, entering horse ownership with positive prior experience may provide comfort and certainty to an owner. Due to the lack of regulation surrounding euthanasia, there are limited reports on the variation of experiences felt by owners, those that are, are mostly negative states (Endenburg et al., 1999). Whilst veterinarians and researchers identify euthanasia as an advantageous tool to remove a horse from pain and suffering (Cooney & Kipperman, 2023), many horse owners regard this decision as the worst outcome. A shift in public perceptions from viewing euthanasia as the worst outcome, to acknowledge that death is not the worst state an animal can be in and the privilege in efficient removal of the horse from pain and suffering will enhance social license.

2.9 – Equine Disposal

There are many forms of equine carcass disposal reported within the international literature including, rendering, slaughter plants and composting (Bonhotal et al., 2012; Goodwin et al., 2012; McGee et al., 2001; Meeker, 2009; O'Connor et al., 1985; Woodgate & Van Der Veen, 2004). To accompany legislative restraint on certain disposal methods, a country must provide appropriate solutions. For example, closure of Texas state slaughter plants in 2007 resulted in an influx of horses from the USA shipped to Mexico and Canada, and encouraged cases of horse smuggling and illegal exports (Cowan, 2012; Goodwin et al., 2012; World Horse Welfare, 2024). Therefore, greater awareness is needed on the available disposal methods as lack of this negatively impacts sustainable behaviours and decision making (Dahlstrom, 2011). Acceptance and compliance of equine disposal should be closely monitored as legislative and regional restraints continue to grow in response to environmental, ethical and societal concern. Disposal methods are described in the following sub-sections.

2.9.1 – Land availability

Land availability is a critical factor in the decision-making process towards chosen disposal methods. Without land, composting, offal pits, and burial are unavailable to horse owners, therefore, disposal methods may be influenced by available options. Whilst New Zealand is known for its high pasture availability (Bolwell et al., 2017), there is little information about the use of land for horse burial.

Many New Zealand horse owners live on lifestyle blocks where reporting ownership of horses is not required while some horse owners in New Zealand graze their horses at agistments or leased land. Permission granted by landowners on burying a horse on their property, whether that be a grazer or family friend where the horse has resided is unknown. While landowners are not required to provide burial space, horse owners without access to their own land may have limited options for carcass disposal. Furthermore, the method an owner chooses for disposal is often influenced by the options they are aware of, and the accessibility and availability to the owner.

2.9.2 – Burial

Burial is a common form of carcass disposal for horses in Western cultures but the burial of stock is prohibited or controlled by some regional councils due to environmental concerns, particularly risk of contamination from barbiturates in groundwater (Federated Farmers of New Zealand, 2020; Rogers et al., 2023). Prevention of leaching into surface water and waterways is essential when burying carcasses. In New Zealand, a person may dispose of a dead animal lawfully by burial that is kept on the same premises (Auckland Council, 2023). Burial depth, soil, vegetation, and distance from waterways should be considered (Haskell & Ormond, 2003). Additionally, the growing prevalence for pet dedicated cemeteries and crematories (Blazina et al., 2011) suggests owners prefer similar practice to that of humans.

2.9.3 – Offal pits

Offal pits are large holes dug into the ground as a common form of disposal of animal waste and byproducts on farms, are cost effective, and simple to maintain (Greater Wellington Regional Council, n.d.). National guidelines are structured by the Ministry for Primary Industries, however, resource consent may not be needed for offal pits amongst some district and regional council rules if they meet distance requirements away from houses, wetlands, property boundaries or inhibit water or air quality (Federated Farmers of New Zealand, 2020; Ministry for Primary Industries, 2023). The bottom of the offal pit should be no less than 0.5 meters above the average winter level of groundwater. (Ministry for Primary Industries, 2023). There is limited information on communal offal pits, their use for equine carcass, and their standards of practice.

2.9.4 – Landfills

Landfilling is a lower cost process of disposal that involves the compression, and embarkment of waste at an engineered location, surrounded by a liner system to prevent polluting the groundwater (Mishra et al., 2018). In New Zealand, approximately one-third of biosolids are disposed into landfill (Murdoch, 2015). Anecdotal evidence suggests there are between seven to ten horses entering one of the larger New Zealand landfills each week, however, appropriate use of carcass disposal through landfill is needed to prevent scavengers.

2.9.5 – Environmental concern

Overdose of lethal injection through barbiturates is the most common form of veterinarian assisted equine euthanasia (Aleman et al., 2015). Toxicosis is a pathological condition caused by exposure to a poison or toxin and can have adverse effects when ingested (Bischoff et al., 2011). Therefore, carcasses of animals euthanised with barbiturates must not be consumed by scavengers, pets, wildlife, or enter the human food chain. Horses medically euthanised also pose risk to environmental contamination through residual drug leaching (O'Connor et al., 1985) as pentobarbital remains in the tissue of the animal, surviving the rendering process (O'Connor et al., 1985), and has been detected in soil after 17 weeks (Bagsby et al., 2018). There is limited knowledge on the survival rate of pathogens in burial sites; however, cold and wet conditions help to prolong their success (Brglez & Hahn, 2008). Thus, burial away from water sources is recommended and regulated across farm practices to prevent contamination of surrounding soil which may harm human and environmental health. There is limited research into the long-term significance of pentobarbital leaching in the soil and the potential environmental effects.

2.9.6 – Hunt clubs and pet food

Some owners in New Zealand dispose of their horse through the hunt club or to a pet food manufacturer (Rogers et al., 2017; Rogers et al., 2023). New Zealand has approximately 27 pet food manufacturers with one reported to receive 25-30 horses annually (Rogers et al., 2017). Record keeping on horse turnover for petfood is not required and online resources about donating horses for pet food in New Zealand is limited. As a result, this may constrain the number of horses used for pet food as owners are unaware of this disposal method.

The New Zealand's Hunts' Association governs 28 Hunt Clubs across the country (Hunting with Hounds, n.d.). Most hunt clubs require signed approval forms from the owner before accepting horses, however, to the authors knowledge there is no regulation regarding formal reporting of horse numbers disposed through the hunt. Requirements must be met upon donating to the hunt club including withholding periods for certain medications including Nonsteroidal Anti-Inflammatory Drugs (NSAIDs) due to the carcass being scavenged by the harrier hounds. Horses donated to the hunt, therefore, cannot be chemically euthanised. An owner may choose to send their horse to the hunt club as it provides both a form of equine

euthanasia (shot with a firearm) and disposal. Others may choose this method as horse meat provides a high protein diet for the harrier hounds, and some owners may feel the carcass can be utilized. Again, limited information is available online of this disposal method, possibly to reduce content that could spark negative discussions as some owners find the idea distressing or uncomfortable. Anecdotal evidence from a long-time horse owner stated that owners do not know they have as many options as there are (Dahlstrom et al., 2011), therefore, exposure to available disposal options is limited, leaving owners unaware of their choices.

2.9.7 – Slaughter plants

There are currently no operating slaughterhouses licensed to produce horse meat for human consumption in New Zealand (Rogers et al., 2023). Meat produced from New Zealand's only slaughter plant was exported internationally, however, the plant has not renewed their license for human consumption since 2020 (Rogers et al., 2023).

2.9.8 – Disposal through sale

To the authors knowledge, no official literature has addressed the role of sale as a form of disposal for geriatric horses. The closest resemblance would be that of the auction houses seen internationally (Goodwin et al., 2012). Disposal through sale transfers the burden and responsibility of the horse onto another person. Dogs are often purchased from the breeder during their puppy juvenile period and kept by the owner for the duration of the animals life (Howell et al., 2015), conversely, McGee et al. (2001) identified it was common for horses in sale yards to be owned by five or six separate people by the age of 6 years old. The high turnover rate expressed in horse ownership represents the normality of buying and selling horses in contrast to the traditional companion animal (dog).

When sold, geriatric horses in work are commonly advertised as 'schoolmasters' providing education to younger riders and those new to the sport. Schoolmaster horses are reliable, safe, and have forgiving nature when the rider is unable to follow the horses movements or may provide inconsistent aids (Piper & Uttley, 2019). Geriatric horses are appealing as an introductory first horse due to this forgiving nature, along with their low economic worth due to their reduction in functional age (Rogers et al., 2023). This does however result in sales to naïve owners who are not educated on the welfare and health concerns associated with the

geriatric horse (Ikinger et al., 2016; Marlin et al., 2018). In the wrong hands, inconsistent cues may lead to confusion or learned helplessness (Piper & Uttley, 2019), and a lack of knowledge on age-related health conditions may deplete the horses quality of life.

Popular selling pages are overloaded with older horses that are advertised for sale, or to rehome as a paddock mate, companion, and commonly specified 'to a forever home'. Often these are horses predisposed to injuries who can no longer be ridden or are no longer fit for purpose to the existing owner. Owners may promote this concept of a 'forever home' to conceal the feeling of guilt and abandonment during this sale process. However, if an existing owner, who has had the time to bond and love the horse is not willing to provide an ample retirement home or decision making during its less desirable stages of life, why would a stranger? (Dennis, 2024). Some owners do not have the means in finance, time, or knowledge to cater to the needs of the horse (Golding et al., 2023; Goodwin et al., 2012; Watney et al., 2024). For these cases, sale may place the horse in a home which can provide them with an improved welfare state, however, there is no guarantee when a horse is sold that the new owners will understand the needs and requirements of the horse. Therefore, the new home may place greater stress and a diminished quality of life on the horse.

2.9.9 – Cremation

Cremation of pets has become a convenient and increasingly used method of disposal in companion animals (Blazina et al., 2011). Social movements and changing lifestyles have meant families no longer remain in one residency for their lifetime where disposal by cremation allows the animals ashes to be transported which is appealing to some owners. Early literature identified forms of cremation as a form of disposal with small towns offering disposal of small animals through a furnace free of charge (Shaw, 1903). Recognized across the UK, the National Fallen Stock Company (NFSCo) is a not-for-profit organization that collects and disposes of farm animals including horses. Their specific Equine End of Life service provides online information to support horse owners regarding end-of-life decision making (NFSCo, 2024). There are few major crematoriums in New Zealand which cater to the horses with a common choice to have just the head and heart cremated. Ashes can be presented in urns, in special keepsakes, or made into jewellery. Disposal by cremation is usually priced by kilogram and will vary across New Zealand crematoriums. In the UK, communal cremation where ashes are

not returned costs approximately £210 ($475 NZD), while cremation with ashes returned to the owner is usually £600–£800 ($1,350–$1,800 NZD) (Green, 2022).

2.9.10 – Postmortem examinations

Horse owners, where availability permits, may want their horse to be examined postmortem. These should be completed by an educated individual, although no licensing currently restricts who can complete these procedures in New Zealand. Completion of a postmortem examination, therefore, may be investigated through an officiated corporation or private individuals. Interaction with the carcass should be treated ethically and respectfully with the aim to understand the pathology which lead to the spontaneous or elective death of an animal (Whitwell, 2009). A postmortem procedure may be requested by an owner, for disease surveillance, to evaluate reproductive loss, as a clinical audit, or if there are welfare and/or legal concerns (Whitwell, 2009). Postmortem examinations may also be performed for the purpose of insurance claims, where diagnosis findings determine if the owner receives a payout. Owners may also choose to donate their horse for the purpose of science and teaching, with many veterinary schools implementing a client donation program for the purpose of teaching veterinary students with cadavers to practice relevant skills (Littlewood et al., 2018; Tiplady et al., 2011).

It is possible for a veterinarian to complete a postmortem procedure on farm for an owner, however, the procedure may be timely without support as it is very physically demanding to manoeuvre a carcass single-handed (Frank et al., 2015). Following an onsite postmortem, carcass remains may be discarded through burial, offal pit or donated to the hunt club, granted that the horse was not chemically euthanised. Investigations carried out in postmortem and in teaching facilities are usually incinerated. Biosecurity risks, therefore, are present when postmortem examinations are completed in a non-compliant location such as on farm or by private persons.

2.10 – Conclusion

There is a need for targeted research on the geriatric horse population of New Zealand as current literature lacks this representation. Greater research is also needed regarding the influences of owner management decisions.

The geriatric horse is at an increased risk of age-related disease and health concerns with a discrepancy between clinical findings and owner reports casing raised concern on how owners assess their horse's welfare. Strength of the emotional value an owner has for their geriatric horse is evident across their chosen management decisions, however, may introduce complications with emotional care burdens when making euthanasia decisions.

The disposal of aged horses through sale, rather than owners opting for euthanasia, raises significant welfare concerns. This practice stems from the public perception that euthanasia is a negative outcome, and suggested improvement on social license is needed. While these decisions may make the owner feel kinder, some horses are exposed to greater suffering if the home sold to results in neglect, abandonment or misunderstanding causing learnt helplessness. The use of sale should not be disregarded as a form of disposal; however environmental and ethical concerns are also raised among carcass disposal and is dependent on the country, euthanasia, and viable methods.

International studies suggest owner end-of-life care and euthanasia decisions are influenced by owner knowledge, the horse's quality of life, and the emotional value owners place on the horse (McGowan & Ireland, 2016). For any beneficial change to be made across the welfare of aging horses in New Zealand, identification of existing influential factors impacting owner decisions are needed.

2.11 – Aim

The aim of this study was to describe owner management decisions surrounding end-of-life care and euthanasia of geriatric horses in New Zealand.

2.12 – Objective and hypotheses:

This aim was achieved with the following objectives:

- To describe the demographics of New Zealand horse owners.
    - Hypothesis: New Zealand horse owners are mostly female, who visit their horse at least once a day and own their horse for recreation or pleasure.
- To identify existing management practices amongst New Zealand geriatric horses.
    - Hypothesis: Most New Zealand geriatric horses are retired and fed a marketed 'older horse' feed.
- To identify existence of euthanasia plans in New Zealand.
    - Hypothesis: New Zealand owners of geriatric horses are more likely to have a euthanasia plan than owners who have a horse under the age of 15.
- To identify New Zealand horse owner preferred method for euthanasia and disposal.
    - Hypothesis: New Zealand horse owners prefer veterinary administered overdose of barbiturates and burial as their choice of method for euthanasia and disposal.
- To identify the most influential factors impacting New Zealand horse owners during end-of-life and euthanasia decisions.
    - Hypothesis: Bond and emotional value influence New Zealand owners in how they manage their horse during end-of-life and euthanasia decisions.

Chapter 3: Materials and Methods

3.1 – Survey design

This study collected data from New Zealand horse owners through an online survey on the Qualtrics platform. Most questions were radio button format where respondents were able to select one option from a predefined set of answers. Few questions were multi-selection, where respondents were asked to select all relevant options. Where the author deemed necessary, in combination with predefined answers, an open text box was used with 'other' to allow respondents to express what best fits their practice. One stand-alone text-box question asked the age of horses above 15 years.

The survey was comprised of 31 questions. Only the first question of the survey, requesting owner consent was required, all other questions were voluntary. The survey was separated into three sections where all respondents began at Section 1, which addressed demographics and their relative management practices. These included owner gender, age, location, where they keep their horses, and how they use and view their horse. Respondents who had a horse aged ≥15 completed Section 2, covering geriatric horse management, and owner perceptions. In this section, respondents were asked about their geriatric horse' workload status, management practices, healthcare, and their own knowledge on the ageing horse. All respondents completed Section 3 which addressed end-of-life planning and euthanasia. This section identified preferred methods, plans, and factors which impact New Zealand horse owners during euthanasia. The survey was structured with a systematic flow to ensure respondents only completed relevant sections to the horse they were representing.

3.2 – Survey promotion

Admission into the survey was granted through a social media post, either by following a URL link in the caption, or through scanning a QR code provided in the image (Figure 3.1). The survey was available between the 13th of September 2024 and the 24th of October 2024. Responses were recruited using a snowball technique via social media posts on New Zealand

equestrian Facebook pages with organic social media promotion (unpaid promotion) through being shared in popular New Zealand equestrian Facebook pages.

The online promotion of the survey was used with a soft launch and seeding tactic. The author initially posted the image and caption to their personal Facebook page and was shared amongst friends and associates. A separate post was then made onto the official Equestrian Sports New Zealand Facebook page on the 17th of September at 8am. From here, popular equestrian persons shared and reposted, resulting in a significant increase in engagement. Followers of the official Equestrian Sports New Zealand site shared the post to their own pages which also enhanced the survey exposure. In the following weeks, the author trickled the posts through relevant Equestrian Facebook pages to reach the desired target audience. Engagement with the survey was voluntary and took approximately 5 minutes to complete.

Eligibility to participate in the survey was restricted to those above 16 years of age and owning or leasing a horse or pony in New Zealand at the time of the survey. The study was approved by the Massey University Human Ethics committee as low risk (Ethics Notification Number: 4000029424).

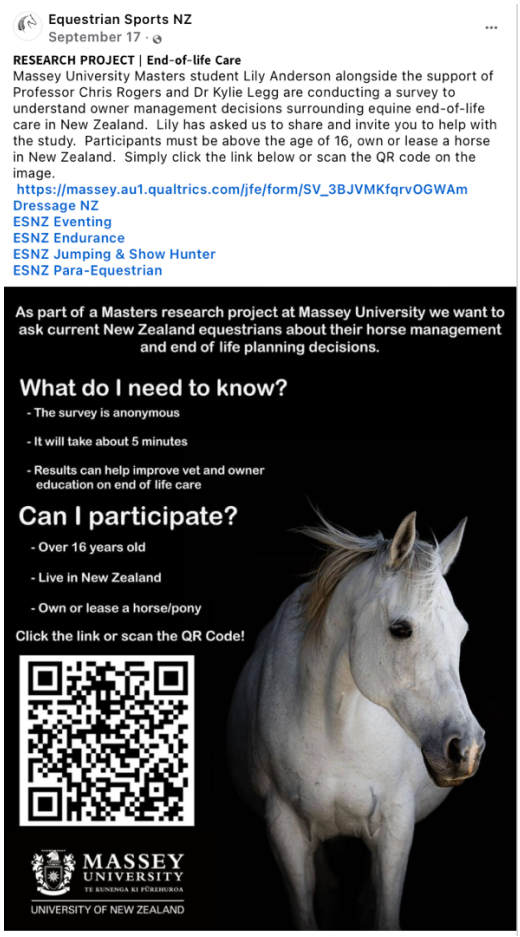

Figure 3.1 Social media post on ESNZ Facebook page (17 September 2024)

3.3 – Data analysis

Data was exported from Qualtrics (Qualtrics Survey Software, Provo, USA, 2024) as a CSV file at closure of the survey and preliminary data visualization and data cleaning were completed in Microsoft Excel (Microsoft Corporation, Version 16.99, 2025). Medians and interquartile ranges were reported and analyzed in R-Studio (Version 2023.12.1+402, Boston, USA, 2024). All statistical analyses were completed with a significance level of 0.05.

Respondents were grouped based on the age of their horse with those with a horse ≥15 years were classified as owners of a geriatric horse. Horses below this age were deemed non-geriatric. Respondents who owned a geriatric horse were asked to provide a specific age in the open textbox, if an age range was provided, the lowest value was used.

Associations between categorical variables were measured using Chi-square or Fisher's Exact tests. Kruskal Wallis tests were used to assess whether the age of geriatric horses differed

between owners who would consider surgery or intensive care to owners who would not consider this. This non-parametric test was chosen due to the non-normally distributed nature of the age data, based on a test of normality using a Shapiro-Wilk test.

A Spearman's correlation matrix examined the relationship between variables related to end-of-life decision making in New Zealand horse owners. A heatmap created with the ggplot2 package visualized each variables strength in correlation to one another. Colour gradients were centered at zero to highlight both positive and negative correlations.

The author utilized Generative AI (Open AI, 2025; Grammarly, 2025) for assistance in program coding and general edits in proof reading. Assistance with AI was not used to replace critical thinking, original research, or attribution of sources.

Chapter 4: Results

4.1 – Response characteristics

Survey responses from 1,207 New Zealand horse owners were recorded. Of these, 89% (n=1,073) fully completed the survey, 3% (n=37) partially completed, and 8% (n=97) started but failed to complete the majority of the questions.

4.2 – Demographics of respondents

The demographics of the survey respondents are summarized in Table 1. Most survey respondents identified as female (n=1,178, 98%). There was a broad and even distribution of the age of respondents, which reflects a diverse respondent sample. Across most ages approximately 2/3 of respondents were owners of geriatric horses. There was an association between respondent age category and ownership of geriatric horses, with owners aged 16-20 having the lowest proportion of geriatric horses (n=63, 44%), compared to the other age categories (56-64%, $p<0.001$).

There was a broad regional spread in the geographical location of respondents. However, the top three geographical regions for responses (Auckland, Waikato and Manawatu – Whanganui) accounted for 53% of all responses. Most horses were kept at the respondent's own property (65%) or at DIY grazing (23%). The majority of horses had a pasture-based management system with most being kept at pasture (71%) or a combination of pasture and stables (23%).

The purpose of horse ownership was reflected in how owners described their horses. Most respondents owned horses for recreation and pleasure (58%) and described their horse as recreation animals (n=575/696, 83%). Similarly, horses that were owned for the purpose of sport and competition were generally described as a competition animal (n=377/435, 86%). Of the horses the owners described as companion horses, 67% were geriatric horses. This percentage distribution of geriatric horses was not greater than observed in the recreation category. Horses described as competition animals showed an almost equal split between geriatric and non-geriatric horses.

Table 1: Characteristics of New Zealand horse owners (n=1,207) and their management practices comparative to owning a geriatric horse.

Category	Description	Non-Geriatric*	Geriatric	Total of Category	P Value
Gender (n= 1,207)	Male	18 (78%)	5 (22%)	23 (2%)	0.002
	Female	465 (39%)	713 (61%)	1178 (98%)	
	Nonbinary	1 (25%)	3 (75%)	4 (0%)	
	Prefer not to say	1 (50%)	1 (50%)	2 (0%)	
Age (n= 1,207)	16-20	80 (56%)	63 (44%)	143 (12%)	0.001
	21-30	100 (41%)	141 (59%)	241 (20%)	
	31-40	67 (36%)	117 (64%)	184 (15%)	
	41-50	87 (36%)	168 (64%)	255 (21%)	
	51-60	94 (37%)	157 (63%)	251 (21%)	
	61-70	49 (44%)	62 (56%)	111 (9%)	
	71+	8 (36%)	14 (64%)	22 (2%)	
Region (n= 1,207)	Auckland	87 (39%)	137 (61%)	224 (19%)	0.4
	Bay of Plenty	24 (43%)	32 (57%)	56 (5%)	
	Canterbury	54 (41%)	78 (59%)	132 (11%)	
	Gisborne	2 (40%)	3 (60%)	5 (0%)	
	Hawkes Bay	16 (46%)	19 (54%)	35 (3%)	
	Manawatu-Wanganui	75 (39%)	116 (61%)	191 (16%)	
	Marlborough	0 (0%)	4 (100%)	4 (0%)	
	Nelson	4 (100%)	0 (0%)	4 (0%)	
	Northland	17 (36%)	30 (64%)	47 (4%)	
	Otago	22 (36%)	39 (64%)	61 (5%)	
	Southland	15 (58%)	11 (42%)	26 (2%)	
	Taranaki	22 (33%)	45 (67%)	67 (6%)	
	Tasman	7 (35%)	13 (65%)	20 (2%)	
	Timaru-Oamaru	4 (29%)	10 (71%)	14 (1%)	
	Waikato	92 (42%)	128 (58%)	220 (18%)	
	Wairarapa	9 (35%)	17 (65%)	26 (2%)	
	Wellington	34 (47%)	39 (53%)	73 (6%)	
	West Coast	1 (50%)	1 (50%)	2 (0%)	
Where horses are kept (n=1,252)	DIY Grazing	146 (51%)	138 (49%)	284 (23%)	0.03
	On my own property	291 (36%)	520 (64%)	811 (65%)	
	Livery	20 (51%)	19 (49%)	39 (3%)	
	Rent / Lease land	35 (42%)	49 (58%)	84 (7%)	
	Other	15 (44%)	19 (56%)	34 (3%)	
Grazing management (n= 2,508)	Paddock	1191 (66%)	601 (34%)	1792 (71%)	0.002
	Paddock and Stable	401 (69%)	182 (31%)	583 (23%)	
	Stable	5 (83%)	1 (17%)	6 (0%)	
	Other	108 (85%)	19 (15%)	127 (5%)	

Role and purpose of horse ownership (n=1,207)	Sport and Competition	178 (41%)	257 (59%)	435 (36%)	0.4
	Recreation and Pleasure	281 (40%)	415 (60%)	696 (58%)	
	Racing	5 (63%)	3 (37%)	8 (1%)	
	Breeding	6 (27%)	16 (73%)	22 (2%)	
	Other	15 (44%)	19 (56%)	34 (3%)	
Owners perceived view of their horse (n=1,915)	Competition	213 (42%)	292 (58%)	505 (26%)	<0.001
	Companion	149 (33%)	309 (67%)	458 (24%)	
	Recreation	305 (38%)	488 (62%)	793 (41%)	
	Working Animal	21 (46%)	25 (54%)	46 (2%)	
	Production	15 (31%)	33 (69%)	48 (3%)	
	Other	44 (68%)	21 (32%)	65 (3%)	

*Values are presented as counts with row percentages. Percentages reflect ownership distribution within each respondent category.

4.3 – Geriatric horses

Table 2 provides an overview of the workload and sport use of the geriatric horse. The median age of geriatric horses was 17 (IQR 16-22), with the oldest recorded as 37 years old. Most horses were retired (n=290, 45%). Among the geriatric horses still in work (n=407), half were worked 1-3 times per week (n=205, 50%).

Owners were asked whether they competed in equestrian sports and to indicate their level of participation (low, medium, or high level). At lower levels, pleasure/recreational riding and dressage were the most commonly reported disciplines, whereas showing was the most frequently selected at higher levels.

Table 2: Horse owner management and activity: Status, workload frequency, and sport involvement among geriatric horses in New Zealand.

Category	Description	Count Percentage*	P Value
Status (n=644)	In work	239 (37%)	<0.001
	Out of work (out of season)	115 (18%)	
	Retired	290 (45%)	
Workload frequency (n=642)	None	235 (37%)	<0.001
	Less than once a week	53 (8%)	
	1-3 times a week	205 (32%)	
	4-7 times a week	149 (23%)	
Involvement with sport (n=1,219)	Dressage	188 (15%)	<0.001
	Driving	11 (1%)	
	CTR/ Endurance**	80 (7%)	
	Eventing	128 (11%)	
	Mounted Games	20 (2%)	
	Para Equestrian	5 (5%)	
	Pleasure / Recreational	283 (23%)	
	Pony Club	105 (9%)	
	Show Jumping / Show Hunter	172 (14%)	
	Showing	93 (8%)	
	Western	22 (2%)	
	Working Equitation	50 (4%)	
	Other	62 (5%)	

*Percentages represent the proportion of respondents within each management or activity category.

**Competitive Trail Riding (CTR)

4.3.1 – Management decisions of geriatric horses

Decisions surrounding routine visits, and management practices made by owners of geriatric horses in New Zealand are presented in Table 3. Most respondents visited their horse twice a day (n=461, 70%) and did not feed a specifically formulated “older” horse feed (n=492, 76%). However, the use of feed marketed for older horses increased as horse age increased (p= 0.006).

Respondents selected from predefined frequency options (e.g. ‘every 6 months’) to indicate how often their horse received dental care. A predefined frequency selection was also provided for farrier work (e.g. ‘every 5 weeks’). Dentistry was most often done annually (n=422, 69%). Trimming or shoeing was most commonly selected for six-weekly appointments (n=284, 44%).

For those respondents whose practices did not align with the listed options, an open-text field labelled 'Other' was provided. Qualitative responses for farrier visits included 'every 10-12 weeks', 'when lame', twice a year', and 'when I get around to it'.

Most owners of geriatric horses did not trim their horses' feet themselves (n=517, 81%), and over half of the owners had the vet visit their geriatric horse in the last 12 months (n=420, 64%).

Table 3: Management practices of New Zealand horse owners on their visitation, feeding practices, and healthcare regularity of geriatric horses.

Category	Description	15-20 years (n=444)*	21-25 years (n=166)	26-30 years (n=56)	31+ years (n=24)	All ages	P Value
How often owners visit their horses (n=642)	2+ a day	297 (67%)	109 (66%)	28 (50%)	20 (83%)	454 (70%)	0.7
	Once a day	90 (20%)	33 (20%)	14 (25%)	3 (13%)	140 (22%)	
	Once every few days	14 (3%)	8 (5%)	4 (7%)	0 (0%)	26 (4%)	
	Once a week	1 (0%)	2 (1%)	0 (0%)	0 (0%)	3 (0%)	
	I am not their primary caregiver	7 (2%)	2 (1%)	1 (2%)	0 (0%)	10 (2%)	
	Other	6 (1%)	2 (1%)	1 (2%)	0 (0%)	9 (1%)	
Do you use a feed marketed to 'older' horses? (n=641)	Yes	86 (19%)	43 (26%)	18 (32%)	10 (42%)	157 (24%)	0.006
	No	328 (74%)	113 (68%)	30 (54%)	13 (54%)	484 (76%)	
Do you feed any of the following supplements (Yes) (n=1,548)	Joint Supplement	205 (46%)	87 (52%)	25 (45%)	10 (42%)	327 (51%)	0.7
	Vitamin / mineral mix	294 (66%)	114 (69%)	33 (59%)	16 (66%)	457 (71%)	0.9
	Toxin Binder	155 (35%)	61 (37%)	11 (2%)	5 (21%)	232 (36%)	0.5
	Gut Health	179 (40%)	67 (40%)	14 (25%)	9 (38%)	269 (42%)	0.8
	Oil	143 (32%)	45 (27%)	19 (34%)	8 (33%)	215 (33%)	0.4
	Other	36 (8%)	7 (4%)	4 (7%)	1 (4%)	48 (7%)	0.4
Frequency of dentist visits (n=642)	Every 6 months	22 (5%)	9 (5%)	4 (7%)	0 (0%)	35 (5%)	0.02
	Every 9 months	16 (4%)	3 (2%)	1 (0.2%)	2 (8%)	22 (3%)	
	Every 12 months	296 (67%)	106 (64%)	27 (48%)	13 (54%)	442 (69%)	
	Every 15 months	11 (2%)	4 (2%)	3 (5%)	2 (8%)	20 (3%)	
	Every 18 months	23 (5%)	14 (8%)	5 (9%)	3 (13%)	45 (7%)	
	Every 24 months	30 (7%)	9 (5%)	5 (9%)	1 (4%)	45 (7%)	
	My horse has never had the dentist	0 (0%)	5 (3%)	0 (0%)	0 (0%)	5 (0%)	
	Other	16 (4%)	6 (4%)	4 (7%)	2 (8%)	28 (4%)	

Frequency of trimming or shoeing (n=643)	Every 4 weeks	37 (8%)	21 (13%)	4 (7%)	0 (0%)	62 (10%)	0.04
	Every 5 weeks	96 (22%)	36 (22%)	5 (9%)	1 (4%)	138 (21%)	
	Every 6 weeks	180 (41%)	69 (42%)	22 (39%)	13 (54%)	284 (44%)	
	Every 7 weeks	33 (7%)	6 (4%)	4 (7%)	3 (13%)	46 (7%)	
	Every 8 weeks	41 (9%)	19 (12%)	10 (18%)	3 (13%)	73 (11%)	
	Other	28 (6%)	5 (3%)	4 (7%)	3 (13%)	40 (6%)	
Do you trim/shoe your horse yourself? (n=641)	Yes	78 (18%)	25 (15%)	10 (18%)	6 (25%)	119 (19%)	0.7
	No	336 (76%)	130 (78%)	39 (70%)	17 (71%)	522 (81%)	
Has your horse had a vet visit in the last 12 months? (n=643)	Yes	268 (60%)	99 (60%)	34 (61%)	10 (42%)	411 (64%)	0.2
	No	147 (33%)	57 (34%)	15 (27%)	13 (54%)	232 (36%)	

*Counts with column percentages are shown. Percentages represent the proportion of horses within each horse age category.

4.3.2 – Geriatric horse owner knowledge on aging horse signs

Owners of geriatric horses (n=722) were asked to identify which physical attributes they associated with the ageing horse from a provided list. Most respondents recognised age related presentations including sway back (n=556, 77%), Cushing's (PPID) (n=536, 74%), lameness (n=522, 72%), decreased coat condition (n=522, 72%) and loss of muscle tone (n=512, 71%).

4.3.3 – New Zealand owners of geriatric horses and their willingness to complete care-related tasks

Respondents were provided with a list of tasks related to the care of geriatric horses that may be timely, costly, or labour intensive. Respondents were asked to indicate whether they would be willing (yes) or not willing (no) to perform these tasks for their horses (Table 4). Most owners were willing to complete daily routine tasks including administering daily medication (n=535, 84%), and hay soaking (n=451, 71%). Tasks requiring greater effort, cost, or time received less support from owners. Seventy-one percent would consider short term box rest for their geriatric horse (n=452), but only 32% would consider box rest for a longer than three

months (n=198). Long term box rest, and consideration of surgery or intensive care were the least frequently selected options by owners of geriatric horses (n=198, 32%; n=200, 32%).

Table 4: Identifying timely, costly, and labour-intensive tasks New Zealand horse owners would be willing to complete for their geriatric horses.

	Yes (%)*	***No (%)***	***Total***
Hand walking	368 (59%)	252 (41%)	620
Rehab several times a week	439 (70%)	188 (30%)	627
Provide daily medication	535 (84%)	105 (16%)	640
Daily hay soaking	451 (71%)	186 (29%)	637
Consider Surgery or intensive care	200 (32%)	425 (68%)	625
Short term box rest (under 3 months)	452 (71%)	185 (29%)	637
Long term box rest (over 3 months)	198 (32%)	427 (68%)	625
Monthly vet visits	349 (56%)	278 (44%)	627

* Counts with row percentages are shown. Percentages represent the proportion of owners willing (Yes) or not (No) to complete each task.

4.3.4 – Geriatric horse age influence on owner consideration for surgery or intensive care

Figure 4.1 shows the distribution of horse age in relation to their owners' willingness to consider surgery or intensive care for their geriatric horse. The median age of horses owned by those who would not consider surgery or intensive care was 19 years (IQR 16–23), compared to 18 years (IQR 16–21) for owners who would consider surgery or intensive care ($\chi^2(1) = 6.21$, $p = 0.013$).

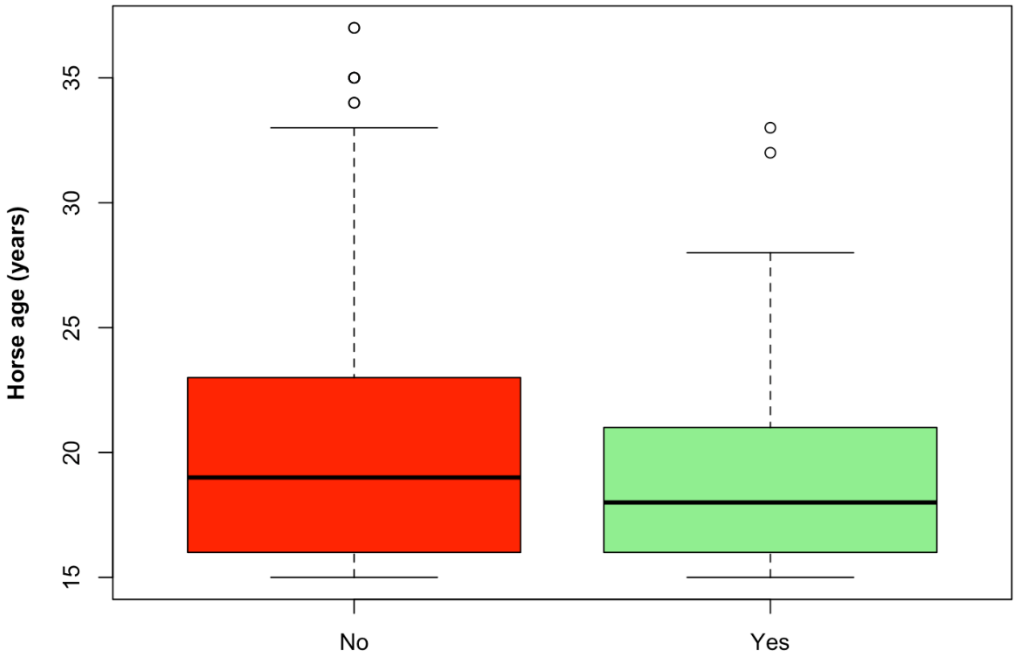

Figure 4.1 Owner consideration of surgery or intensive care of their geriatric horse in New Zealand.

4.4 – Variables influencing end-of-life decisions of New Zealand horse owners

On a scale from 0–5 (with 5 most influential) horse pain level (n=1,067, 100%), and receiving a poor prognosis (n=1,066, 100%) were the most influential variables for all New Zealand horse owners when making end-of-life decisions, each with a median score of 5 (IQR 5-5) (Figure 4.2). Veterinary advice and the bond with a horse also had a median score of 5 (IQR 4-5). In contrast, cost had the greatest variability, with a median of 3 (IQR 1-4) indicating financial influence is individualized amongst owners. Comparisons between the factors which influence owners of non-geriatric and geriatric horses during end-of-life decisions are presented in Figure 4.3.

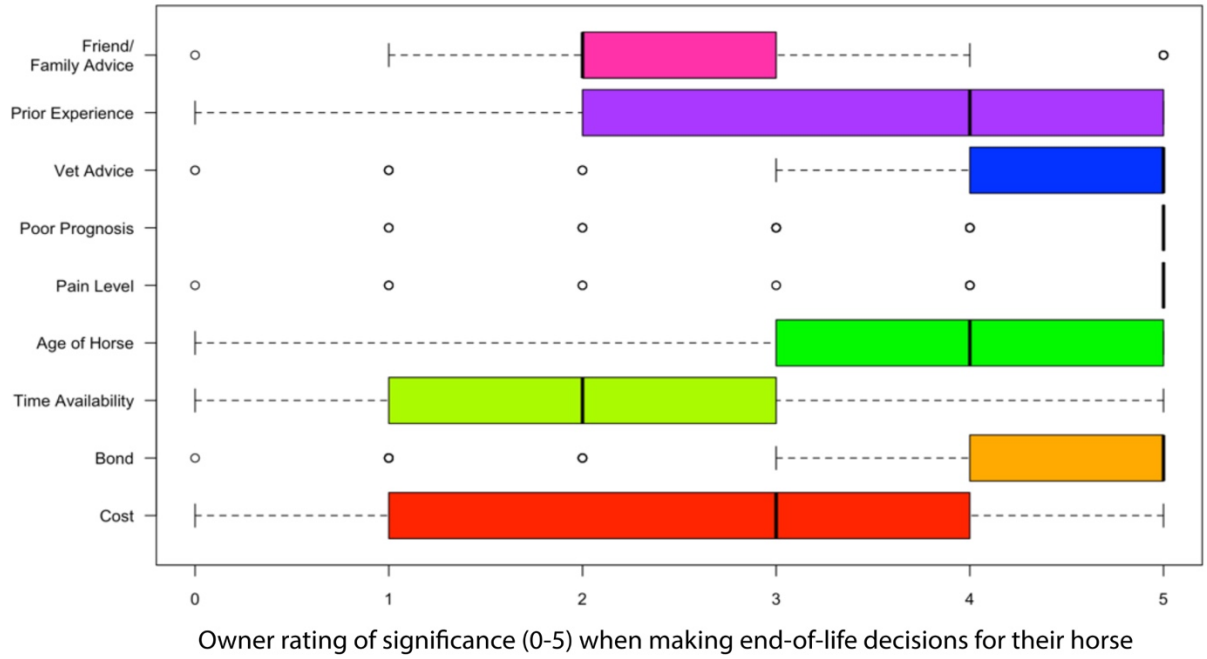

Figure 4.2 New Zealand horse owner responses to presented variables they feel would influence them during euthanasia decisions for their horse (0-5 from least to most influential).

Pain level (p=0.02) was consistently rated as the most influential factor for both owners of non-geriatric, and geriatric horses, with a median score of 5 (IQR 5-5) rated from 0-5 from least to most influential. Factors perceived more influential in end-of-life decisions between owners of non-geriatric and geriatric horses were time availability (p<0.001), cost (p<0.001), veterinary advice (p<0.001), poor prognosis (p<0.001), and prior experience (p<0.001). The horses pain level (p=0.06), owners bond with a horse (p=0.2), advice from friends or family (p=0.5), and age of the horse (p=0.6) had the same influence between owners of non-geriatric and geriatric horses.

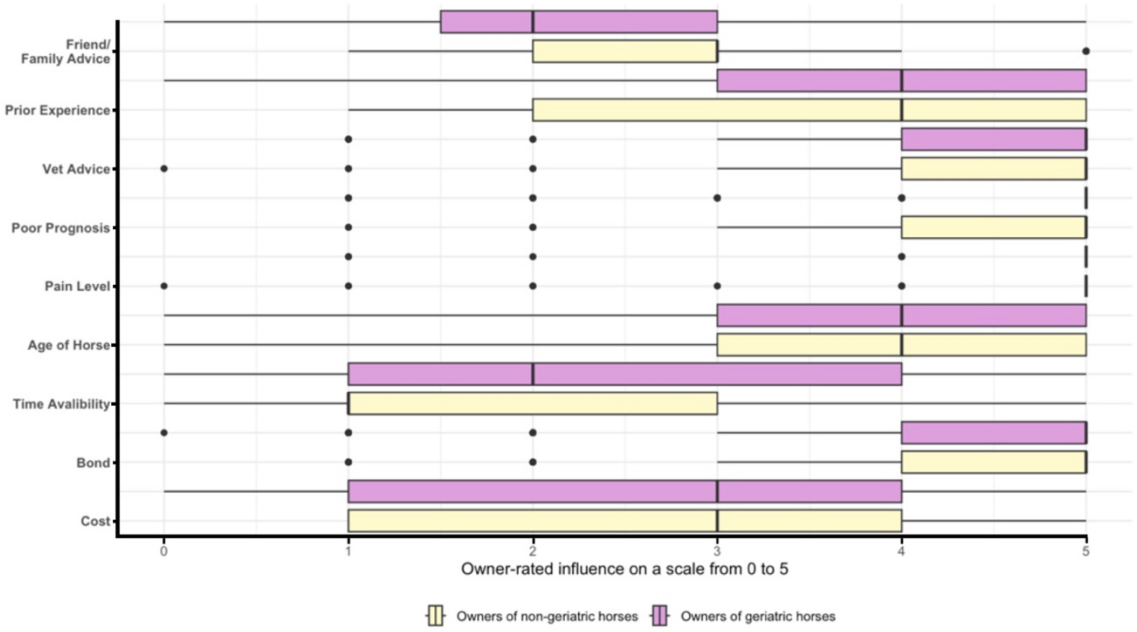

Figure 4.3 Comparison of New Zealand horse owner responses to presented variables they feel would influence them during euthanasia decisions for their horse (non-geriatric [yellow] and geriatric [purple]).

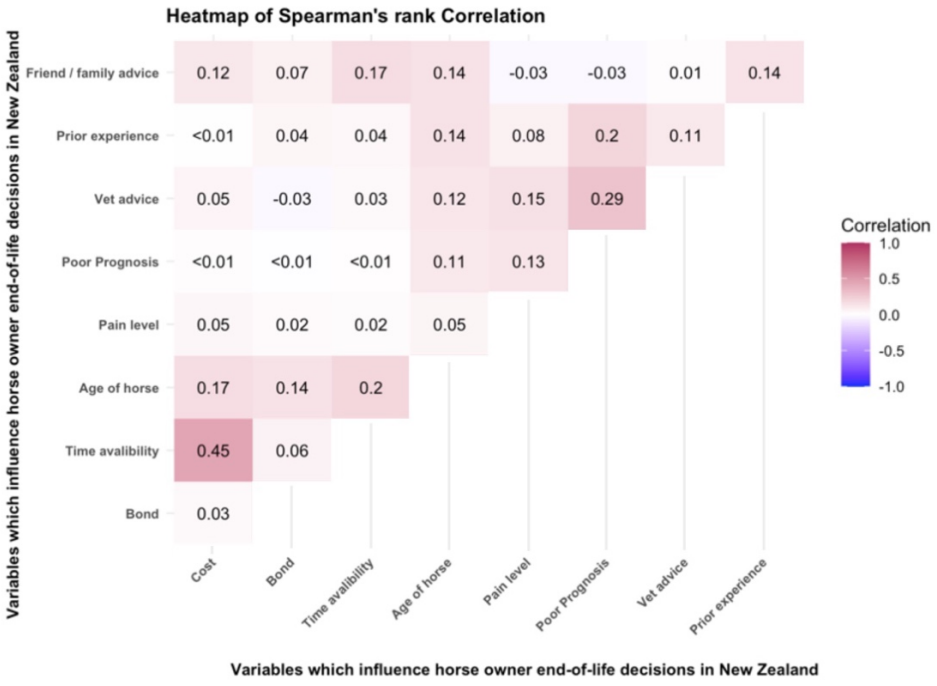

Figure 4.4 Heatmap of Spearman's rank correlation (R) between variables influencing New Zealand horse owners during euthanasia decisions for their horse. Darker shades represent stronger associations.

There were no strong associations between any of the variables which may influence horse owners in their end-of-life decisions (Figure 4.4). There was a moderate association between the amount of time an owner would be willing to devote to their horse and the cost of a procedure or management (R= 0.45).

4.5 – Euthanasia and disposal decisions

Most owners of geriatric horses (n=523, 81%), and non-geriatric horses (n=298, 70%) had previously considered a euthanasia plan (Table 5). The majority of respondents identified that their preferred method of horse euthanasia was an overdose of barbiturates administered by a veterinarian (n=886, 83%).

Prior experience was the most common reason for choice of disposal method for all horse owners (n=637, 61%). Respondents were more likely to follow a veterinarian's recommendation (n=238, 23%) than advice from friends and family (n=39, 4%, p = <0.001).

Most respondents across all horse ages selected 'yes' to receiving a keepsake from their horse (n=900, 85%). There was no significant association between owner desire to receive a keepsake and if their horse was geriatric or not.

Table 5: Euthanasia and disposal planning amongst New Zealand horse owners of geriatric and non-geriatric horses.

Category	Description	Non-Geriatric*	Geriatric	Total	P Value
Prior to this survey had you thought about a Euthanasia plan for your horse? (n=1,068)	Yes	298 (70%)	523 (81%)	821 (77%)	<0.001
	No	128 (30%)	119 (19%)	247 (23%)	
What procedure will you most likely choose for your horse	Vet Euthanasia	342 (80%)	544 (85%)	886 (83%)	0.03
	Sell for pet food	0 (0%)	2 (0%)	2 (0%)	
	Hunt Club	24 (6%)	18 (3%)	42 (4%)	

(n=1,071)	Shoot / Captive Bolt	45 (11%)	66 (10%)	111 (10%)	
	Other	17 (4%)	13 (2%)	30 (3%)	
Do you have a plan for your horses' disposal? (n=1,071)	Burial	278 (65%)	496 (77%)	774 (72%)	<0.001
	Cremation	21 (5%)	31 (5%)	52 (5%)	
	Postmortem / Donation to teaching	19 (4%)	13 (2%)	32 (3%)	
	Hunt Club	26 (6%)	20 (3%)	46 (4%)	
	Other	13 (3%)	22 (3%)	35 (3%)	
	No	71 (17%)	61 (9%)	132 (12%)	
Why was this method of disposal chosen? (n=1,043)	Don't know any other option	46 (11%)	44 (7%)	90 (9%)	0.004
	Friend/ Family recommend	21 (5%)	18 (3%)	39 (4%)	
	Vets recommend	99 (24%)	139 (22%)	238 (23%)	
	What I've done before	230 (55%)	407 (65%)	637 (61%)	
	Other	21 (5%)	18 (3%)	39 (4%)	
Will you receive a keepsake? (n=1,062)	Yes	365 (86%)	535 (84%)	900 (85%)	0.5
	No	61 (14%)	101 (16%)	162 (15%)	

*Counts with column percentages are shown. Percentages represent the proportion of respondents within each geriatric or non-geriatric horse ownership category.

4.5.1 – Horse disposal

Disposal methods in relation to management systems are shown in Figure 4.5. Owners who did not have a disposal plan selected 'No' (steel blue). Burial was the most common disposal method across all categories, accounting for 72% of responses (n=774). Most people that chose burial had their own properties (n=575, 80%). Among respondents who grazed their horses on leased or agisting land, 60% (n= 156/260) had already contacted landowners regarding burial on the grazing land. Cremation was chosen by 5% of respondents (n=52).

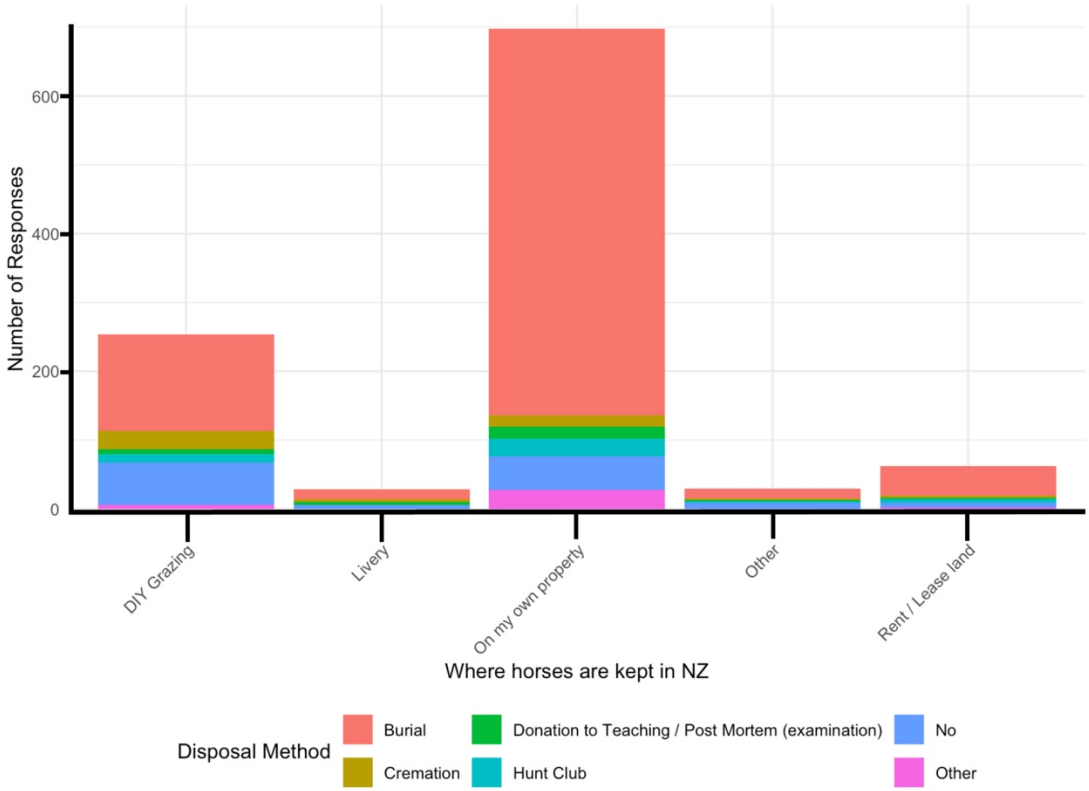

Figure 4.5 Disposal methods selected by New Zealand horse owners in relation to where horses are kept.

Chapter 5: Discussion

This study has provided baseline data in describing horse owner management decisions surrounding end-of-life care and euthanasia of geriatric horses in New Zealand. Although the decline in survey completion was minor, a slight drop-off in responses was expected and aligns to patterns of survey fatigue (Deutskens et al., 2004). The demographics of respondents were similar to previous survey-based studies of horse owners, with a strong female presence represented both in equestrian sport, and in survey response trends (Fernandes et al., 2014; Jaqueth et al., 2019; Porter & Whitcomb, 2005). Younger respondents (16-20 years) owned proportionally more non-geriatric horses, likely due to an interest in riding and competition. In contrast, respondents aged 21-30 and above were more likely to own geriatric horses. This may be due to the differing lifestyles with respondents older than 21 more likely to be working full time, potentially providing the income needed to support a geriatric horse.

There was a broad distribution of horse owners across New Zealand, with over half of the owners based in Auckland, Waikato, and Manawatu-Wanganui, with a previous study of similar respondent rate (n=1,044) reported 52.7% of horses from non-commercial horse properties were based in Auckland, Waikato, Manawatu, or Canterbury regions (Rosanowski et al., 2012). This assortment in the current study is also supported by the estimated distribution of the total national horse population (Rogers & Gee, 2023). Responses collected within the current study therefore are representative of the New Zealand horse owner demographic. Most horses were kept in paddocks and lived on the owner's property. This reflects New Zealand's utilization of a pasture-based management system as a result of the temperate climate and land availability (Bolwell et al., 2017; Rogers et al., 2023). Horses were mostly owned for the purpose of recreation and pleasure, or for sport and competition, reflective of estimations of recreation and sporting use (Rogers & Gee, 2023). The survey was distributed through Equestrian Sports New Zealand, whose audience primarily comprises of equestrians involved in recreation and competitive riding, hence, respondents are reflective of this audience.

Sixty percent of respondents owned a geriatric horse with the number of geriatric horses that were viewed as companion were almost twice that of the number of non-geriatric horses. Almost half of the geriatric horses were retired, suggesting for many owners, riding was not a primary focus for their horse, and therefore, less likely to see their horse as a competition animal. The high proportion of twice-daily visits suggested owners were dedicated and

continued to engage regularly with their geriatric horse for feeding and general care, regardless of ridden work. Notably, 18% of geriatric horses were out of work (but not retired) at the time of the survey, which reflects the natural spell period around the New Zealand winter between competition seasons (Bolwell et al., 2015).

Dietary vitamin supplementation is often recommended in older horses (Pellegrini-Masini, 2010) and its use was evident among respondents in this study. In recent years, there has been an increasing number of marketed supplements and feeds made for older horses claiming to improve welfare despite limited scientific evidence. In the companion animal industry, marketers have successfully utilized owners' emotional attachments to promote products through a caring and nurturing lens (Vänskä, 2016). Marketing strategies often reflect the owner's desire to provide optimal wellbeing to their animal, creating the notion of 'if you love your dog, then you will feed them the best' (Melkko et al., 2018). Given the strong emotional bond and the role of pain level influencing owners in their geriatric horse's end-of-life decisions, it is likely that this demographic may be susceptible to emotionally driven marketing strategies. The use of joint supplementation may also reflect this dynamic, as arthritis is common in aged horses (Ireland et al., 2012b; Ireland et al., 2011a, 2011b) and owners may feel compelled to relieve this discomfort (Oke & McIlwraith, 2010). Further research is needed to examine the influence of emotional branding in equine products.

The self-selected nature of this sample likely represents the structured frequency of routine care practice comparable to international clinical studies. Inadequate dental care of geriatric horses has been reported in Australia (Thompson et al., 2018), and the UK (Ireland et al., 2011b). In the current study, 77% of geriatric horses received dental exams at least every 12 months. Quality including excessive teeth wear or dental concerns were not included in the scope of this study and should be an area of focus for future work. Dental care frequency in New Zealand horses was measured through a population of Pony Club horses (n=502, median age 12, IQR 8-15), in 2014 where 90% of horses received annual dental care (Fernandes et al., 2014). Whilst the scope of the study was also on owner reportage, rather than a measure on clinical findings, it provides a metric of the practice of dental care amongst the New Zealand non-geriatric population. Based on the increased prevalence of dental abnormalities with age, it would be expected that geriatric horses should receive more frequent dental care (Ireland et al., 2011b). Existing regularity of routine care practice observed in this study likely reflects the

strength of the owner's commitment to managing their geriatric horse's health and minimizing discomfort, either out of routine, or to manage existing dental concerns.

Studies have highlighted a decline in hoof care maintenance as horses age and enter retirement (Ireland et al., 2011b; McGowan et al., 2010a; Mellor et al., 2001). Despite this trend, most of the geriatric horses in this study received farrier visits a minimum of every six weeks. This frequency aligns to findings by Sinnige (2016), who reported a median hoof care interval of 5.5 weeks (IQR 3.5-8 weeks) among New Zealand sport horses, with hoof maintenance, rapid hoof growth, farrier recommendation, and hoof problems as key reasons for this routine (Sinnige, 2016). This frequency was also reported by 41% of Australian owners, however only 10% of these respondents owned a horse above 20 years of age (median =9, IQR 6-13) (Thompson et al., 2018). The higher rate of hoof care observed in the current study may reflect a more engaged and health-conscious sample, with respondents potentially more proactive due to the specific needs of geriatric horses. This finding suggests that for many New Zealand horse owners, routine hoof care remains a priority even after retirement from ridden work.

Most respondents (81%) did not trim their horses' hooves themselves. Similar findings in an Australian based study reported 80% of horse owners relied on others for hoof care (Thompson et al., 2018). It is reasonable therefore, to assume that most respondents in the present study engaged with a farrier, aligning to best practice guidelines. The New Zealand Code of Welfare: Horses and Donkeys recommends that "hooves must be trimmed as required to permit normal mobility and to maintain hoof health, shape and function", and that horses should receive "regular expert care from a qualified and competent hoof care professional" (CoW, 2014). Despite this, a minority of respondents provided inconsistent, or limited information regarding farrier visit frequency, citing intervals such as "when I get around to it", "when lame", or "twice a year". Such irregular cases raise potential welfare concerns, especially for geriatric horses. The conflicting views on best practice have already been highlighted in the literature (Visser & Van Wijk-Jansen, 2012).

Sixty-two percent of geriatric horses in this study had seen a veterinarian within the last 12 months, more than the 40% reported in McGowan's (2011) Australian based study. Veterinary visits were relatively consistent across geriatric age ranges from 15-30 years. However, a notable decline occurred in the oldest age group (31+ years), where only 42% of these horses had veterinary visits in the last 12 months. Although this group is a small sample size (n=24),

given the importance of maintaining geriatric health, it would be expected that veterinary engagement would have maintained this frequency, if not increased in this oldest age category. While the survey did not request reasons for veterinary visits, these may have been preventative care, or treatment of health.

Existence of euthanasia plans for horses in New Zealand had not previously been reported. Most respondents had thought about a euthanasia plan for their horse and preferred for their horse to be chemically euthanized by a veterinarian and buried, similar to common practice for smaller companion animals (cats and dogs) (Cooney & Kipperman, 2023). Guidelines currently permit horses to be buried in New Zealand, however as environmental concerns grow, there is greater risk for this method to be restricted. Greater information is needed for New Zealand horse owners on the available euthanasia and disposal options and their limitations to enable owners to make informed and educated decisions. Sixty-one percent of respondents stated their disposal method was chosen based on what they had previously done before. This suggests that many horse owners represented within this survey already had to navigate the end-of-life process with another horse. The influence of prior experience was later supported, with a difference amongst owners of non-geriatric and geriatric horses when rating what factors influence them in end-of-life decisions (on a scale from 0-5, with 5 being the most influential). Studies have identified a complex interrelationship between an owners personality, the human and horse bond, and previous experience of the loss of an animal (McGowan et al., 2012). Despite the emotional weight of euthanasia these owners were willing to undergo this pain again for the love of the horse (Aleman et al., 2015; Cameron et al., 2022; Cooney & Kipperman, 2023; Lochner et al., 2021). This is significant as it suggests respondents are not unfamiliar or inexperienced with the realities of euthanasia decisions and have had to make end-of-life decisions for a horse before.

Owners cared about QoL the most when making end-of-life decisions. On a scale from 0-5 (5 being most influential), respondents were most influenced by the horse's pain and receiving a poor prognosis. This agrees with international studies where poor prognosis, veterinarian advice, prolonged pain/stress, and anticipated quality of life were ranked by owners as the most important factors in decision making for euthanasia of their geriatric horse (McGowan et al., 2012). In this study, poor prognosis was rated as a significant factor for end-of-life decisions for owners of both geriatric and non-geriatric horses ($p<0.001$). Suggesting, regardless of the

age of the horse, owners are considering the long-term welfare of their horses, and not just the immediate.

Veterinarian advice was highly influential amongst New Zealand horse owners (n=1,061). There was a significant difference between owners of geriatric horses and non-geriatric horses, with veterinary input having greater influence among those caring for older horses. This finding is expected as owners who are engaging with veterinarians for end-of-life decisions would most likely be those with older horses who may have chronic conditions. In such cases, decisions may be less timely (Glassey, 2020), allowing owners to form relationships and engage in ongoing discussions with their veterinarian. In doing so, veterinarians may be helping to bridge gaps in owner knowledge, particularly in cases where owners may not fully understand the health implications of aging horses. Therefore, whilst veterinarians contribute to enhancing owner knowledge, there remains a demand in improving education and resources to support owners in recognizing and managing geriatric health issues for prevention before end-of-life decisions are to be made.

There was significant variation among New Zealand horse owners regarding cost when making end-of-life management decisions. Factors including income, and outgoing expenses may limit owners' ability to pursue certain procedures, treatments, or care options. This financial variation was evident across both non-geriatric and geriatric horse owners, suggesting that cost is an individualized factor regardless of the horse's age. This is important for veterinarians to consider when interacting with owners as what may be considered achievable to one client is a limitation to another.

An owner's time availability was found to have significant difference between owners of geriatric and non-geriatric horses. The commitments and relative time an owner had available, therefore influenced their ability to care for their geriatric horse. For owners who are time poor, decisions to euthanise may be made sooner than an owner who may choose to and be able to commit to providing additional care to the horse. There is an expectation that older horses require more care and time because of these age-related health issues which may account for the greater variability within this group (Ireland et al., 2011b). Despite these demands associated with an older horse, the owner's willingness to engage in tasks to support their geriatric horse suggest these owners are willing to dedicate the time necessary to manage and care for their geriatric horse.

There was evidence of the emotional value respondents had for their horses throughout the study. Initial interaction with the survey, and the respondent's willingness to participate despite receiving no benefit for such involvement represents pride and confidence in their management practices. The majority of owners who had a geriatric horse showed dedication and commitment to caring for their horse through routine practice and showed willingness to complete daily tasks such as administering daily medication, and daily hay soaking. Fewer owners of geriatric horses would consider surgery or intensive care for their horse than the tasks which were less timely, costly, or intensive. However, as horse pain level was most important to owners and the risks associated to recovery in older horses this invasive procedure may cause hesitation for owners to proceed (Hector et al., 2020; Louro et al., 2021; Young & Taylor, 1993). Regardless of owning a non-geriatric or geriatric horse, most respondents wanted to receive a keepsake, which represents the sentimental attachment owners maintain after the death of their animal.

5.1 – Limitations

This study has provided baseline data in describing horse owner management decisions surrounding end-of-life care and euthanasia of geriatric horses in New Zealand. As participation was self-selected, respondents were likely to be individuals with particular interest in, or knowledge of geriatric horses, or end-of-life decision making. This was evident in the demographic profile as approximately two thirds of respondents owned a geriatric horse, and 61% of respondents had previously dealt with the disposal of a euthanized horse. Response bias exists as a potential limitation, as owners who are more invested in horse welfare and are confident in their management practices may have been more inclined to participate, compared to those who are less engaged and who provide minimal care to their horse. However, this may also be considered a strength in the validity of this data, as the respondent's familiarity with the topic suggests New Zealand horse owners were not naïve to the topic, minimizing likelihood of misinterpretation, and allowing owners to express their viewpoints built from both emotional and practical experiences.

No formal definition was provided in the survey to define terms such as euthanasia plan, poor prognosis, and end-of-life care. The intention was to avoid limiting participant response.

Previous studies have shown that end-of-life planning can vary widely, therefore, allowing respondent interpretation captures a broader range of perspectives.

5.2 – Future work

Future work should investigate the extent of owner knowledge and the development of education that influences New Zealand horse owner management decisions. In this study, many respondents placed strong emphasis on the pain level of a horse and poor prognosis when making end-of-life decisions for their horse. These factors are typically assessed by veterinarians, reinforcing the key role veterinarians play in supporting owners through these decisions, and in helping to bridge gaps in owner knowledge. Future studies could explore how to best educate and support New Zealand horse owners in both management and preventative health care, including assessing quality of life and recognizing less visual yet clinically important age-related diseases.

Secondly, further studies should explore the environmental impact on common forms of equine disposal. Concerns have previously been expressed on chemical leaching into soil from euthanized carcasses (O'Connor et al., 1985). Given that most respondents in this study selected chemical euthanasia and burial as their ideal form of euthanasia and disposal methods, there is potential for environmental risk if these practices are not managed appropriately. The current lack of scientific literature on this topic suggests attention is needed on the topic especially if these methods continue to remain widely used.

Chapter 6: Conclusion

This study aimed to describe owner management decisions surrounding end-of-life care and euthanasia of geriatric horses in New Zealand. Most New Zealand horse owners represented in this study were female, who own horses for recreation and pleasure purposes who are managed in paddocks. Owners of geriatric horses in New Zealand mostly keep their horse on their own property and visit them twice or more times a day. Willingness to complete daily tasks such as administering daily medication, and daily hay soaking was positively received amongst most owners of geriatric horses in New Zealand.

Key factors which influence the end-of-life decisions of horse owners in New Zealand include the horses pain level and receiving a poor prognosis. Veterinarians play a vital role in supporting owners through end-of life decisions, euthanasia, and disposal choices. This emphasizes the importance of supporting horse owners through educational, professional, and positive welfare minded practice.

Burial remains the most desired disposal method and is influenced by its common practice amongst New Zealand horse owners based on previous experience. As most owners keep their horse on their own property, there may be less limitations with completing this task, however, further studies should investigate the relationship between horse owners and landowners when making burial decisions at agisting or leasing properties. Further research is also needed to understand the environmental implications of pentobarbital remains in soil.

This study has emphasized that emotion drives many welfare and management decisions for geriatric horses in New Zealand and is underpinned by quality of life noted through the owner's concept of horse pain and receiving a poor prognosis. This study has reinforced the need to greater understand owner needs and knowledge to know how to best support owners when making decisions for their geriatric horse to promote a high standard of horse welfare.
Therefore, because emotion is highly important, that veterinarians should be empathetic to owners during these delicate situations.

This study has outlined the demographic characteristics of New Zealand horse owners, identified current management practices for geriatric horses, and identified factors which influence owners in their end-of-life decisions. Findings provided a strong sample size of horse

owners across New Zealand. There are few discrepancies between the decisions an owner will make based on if they own a non-geriatric and geriatric, however, ultimately regardless of age, findings emphasize the important role of veterinarian advice, emotional value an owner has with their horse, the owners experience, and individual owner financial consideration towards end-of-life decisions.

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Chapter 8: Appendices

Appendix A: Qualtrics Survey questions

Horse owner management decisions

Start of Section 1: Demographic Questions

Question 1*:

*** (Answer required)**

I understand and acknowledge the answers I provide in this survey are voluntary and that my survey response will be saved and used towards a Masters research study through Massey University. I acknowledge that my responses remain anonymous and I will not be identified or named within this study. I have read the brief and believe I meet the criteria of being over 16 years of age, and own, or lease, a horse in New Zealand at the date of completing this survey. **I understand this survey is collected per owner, not per horse. Therefore, if I have multiple horses only one survey completion is needed.**

- ○ Yes

Question 2: What region do you live in?

- ○ Northland
- ○ Auckland
- ○ Bay of Plenty
- ○ Waikato
- ○ Gisborne
- ○ Hawkes Bay
- ○ Taranaki
- ○ Manawatu- Wanganui

- ○ Wairarapa
- ○ Wellington
- ○ Nelson
- ○ Tasman
- ○ Marlborough
- ○ West Coast
- ○ Canterbury
- ○ Otago
- ○ Timaru- Oamaru
- ○ Southland

Question 3: Please select your age range

- ○ 16-20
- ○ 21-30
- ○ 31-40
- ○ 41-50
- ○ 51-60
- ○ 61-70
- ○ 71+

Question 4: Please specify your gender

- ○ Male
- ○ Female
- ○ Non-binary

○ Prefer not to say

Question 5: What best describes you as a horse owner?

○ I own horses for recreation/pleasure

○ I own horses for sport/competition

○ I own horses for breeding

○ I own horses for racing

○ Other _____

Question 6: Which best describes where you keep your horses?

☐ On my own property

☐ At a livery stables (I pay for someone to complete the daily tasks ie feeding)

☐ At a DIY grazing (grazing offsite but cared for by me)

☐ I rent/lease land to keep my horses on

☐ Other _____

Question 7: Which label best describes how you view your horses

☐ Working animal (equine used for agricultural, farm stock management, farmhouse)

☐ Production animal (ie it is expected to generate a financial return ie to make money)

☐ Competition (expected to perform in sport, but not necessarily make money)

☐ Recreation (used generally for recreation activities hacking, rides etc)

☐ Companion / Pet (primarily kept as company for myself, or another horse/animal)

☐ Other _____

Question 8: Please enter how many horses you own and select what best describes their management system.

	Paddock	Stable	Paddock and Stable	Other
Foal to 3 year old	○	○	○	○
4-6 years	○	○	○	○
7-14 years	○	○	○	○
Over 15 years	○	○	○	○

Start of Section 2: Only respondents with horses over 15 years of age

Question 9: How old are your Over 15 year old horses?

_____

If you have multiple over 15 year old horses, please answer the following questions relating to one of your choosing.

Question 10: Please describe the status of your horse

○ In work

○ Out of work (turned out/ out of season)

○ Out of work (retired)

Question 11: What amount of ridden exercise does your horse complete on a weekly basis when they are in work?

- ○ None
- ○ Less than once a week
- ○ 1-3 times a week
- ○ 4-7 times a week

Question 12: Do you compete in sports?

	What level?		
	Low Level	Medium	High (top level sport)
Endurance / CTR's	☐	☐	☐
Eventing	☐	☐	☐
Show jumping / Show hunter	☐	☐	☐
Dressage	☐	☐	☐
Showing	☐	☐	☐
Mounted Games	☐	☐	☐
Western	☐	☐	☐
Driving	☐	☐	☐
Para-equestrian	☐	☐	☐
Working Equitation	☐	☐	☐
Pleasure / Recreational	☐	☐	☐
Pony Club	☐	☐	☐
Other	☐	☐	☐

Question 13: How long have you owned your horse for? (Years)

_____

Question 14: Which best explains your ownership experience level?

- ○ This is my first horse
- ○ I have had horses on and off throughout my life
- ○ I have owned horses consecutively for more than 5 years
- ○ I own horses for my job

Question 15: Do you feed any of the following supplements? Please tick all that apply.

- ☐ Joint supplement
- ☐ Vitamin / mineral mix
- ☐ Toxin Binder
- ☐ Gut health
- ☐ Oil
- ☐ Other _____

Question 16: Do you use a feed marketed to an 'older horse'?

- ○ No
- ○ Yes

Question 17: In the first selection box, please identify which of these age related health issues you have heard of. In the second box, identify, if any what clinical issues you are treating your horse for.

	I know of this	I am treating my horse for
PPID (Cushings)	☐	☐
Arthritis	☐	☐
Eye disease	☐	☐
Teeth decay/loss	☐	☐
Sway back	☐	☐
Loss of weight	☐	☐
Obesity	☐	☐
Lameness	☐	☐
Insulin dysregulation (EMS)	☐	☐
Low sloping pasterns	☐	☐
Decreased coat condition	☐	☐
Loss of muscle tone	☐	☐

Question 18: Has your horse had a vet visit in the last 12 months?

- ○ Yes
- ○ No

Question 19: How often does your horse have its hooves trimmed or shod?

- ○ Every 4 weeks
- ○ Every 5 weeks
- ○ Every 6 weeks
- ○ Every 7 weeks
- ○ Every 8 weeks
- ○ Other _____

Question 20: Do you trim/shoe your horse yourself?

- ○ No
- ○ Yes

Question 21: How often does your horse have the dentist?

- ○ Every 6 months
- ○ Every 9 months
- ○ Every 12 months
- ○ Every 15 months
- ○ Every 18 months
- ○ Every 24 months
- ○ My horse has never had the dentist
- ○ Other _____

Question 22: How frequently do you visit your horse?

- ○ 2+ a day
- ○ Once a day
- ○ Once every few days
- ○ Once a week
- ○ Less than once a week
- ○ I am not their primary caretaker and are checked regularly upon prior agreement (livery, grazing agistment etc)
- ○ Other_____

Question 23: Do you cover your horse in any of these seasons?

- ☐ Summer
- ☐ Autumn
- ☐ Winter
- ☐ Spring
- ☐ I do not cover my horse

Question 24: Older horses can require a large amount of an owners time, care, and financial support. Please identify which, if any of the following you would consider for your horse.

	Yes	No
Hand walking 2x a day	○	○
Spend several hours a week completing exercise routines or rehabilitation activities	○	○
Daily medication administration	○	○
Daily hay soaking	○	○
Consider surgery or intensive care (i.e. colic surgery)	○	○
Short term box/stable rest (up to 3 months)	○	○
Long term box/stable rest (over 3 months)	○	○
Monthly check-ups at the vet	○	○

Start of Section 3: Equine end of life decisions

Question 25: Please rate from 0-5 Stars (0 = no significance, 5 = highly significant) what would influence you when considering end-of-life care and euthanasia decisions for your horse.

Cost	☆ ☆ ☆ ☆ ☆
Bond with the horse	☆ ☆ ☆ ☆ ☆
My time availability	☆ ☆ ☆ ☆ ☆
Age of the horse	☆ ☆ ☆ ☆ ☆
Horse pain level	☆ ☆ ☆ ☆ ☆
Poor or hopeless prognosis	☆ ☆ ☆ ☆ ☆
Vet advice	☆ ☆ ☆ ☆ ☆
Prior experience with euthanasia decisions	☆ ☆ ☆ ☆ ☆
Family / Friend advice	☆ ☆ ☆ ☆ ☆

Question 26: What procedure will you most likely choose for your horse when they need to be put to sleep?

- ○ Veterinarian euthanasia (sedation / injection)
- ○ Shoot / Captive bolt
- ○ Sent to the local Hunt Club
- ○ Sell for pet food
- ○ Other _____

Question 27: Do you have plans for your horse's disposal?

- ○ No
- ○ Donation to Teaching / Post Mortem (examination)
- ○ Burial
- ○ Hunt Club
- ○ Cremation
- ○ Other _____

Question 28: If burial, and are at an agistment property, have you discussed with the property owners about burial on their land?

- ○ Yes
- ○ No
- ○ Not Applicable

Question 29: Why did you choose this form of disposal?

- ○ Vet recommended
- ○ Friends/family recommended
- ○ Don't know any other option
- ○ What I've done before
- ○ Other _____

Question 30: Prior to this survey, had you thought about a euthanasia plan for your horse?

- ○ Yes
- ○ No

Question 31: Will you receive a keepsake ie tail. horseshoe, or cremation box of your horse?

- ○ Yes
- ○ No

Appendix B: Poster used for advertisement

Appendix C: The influence of animal euthanasia

Ethical concerns of euthanasia stem from the moral balance of quality versus quantity of life where life is a sacred human right (Huxtable, 2007). The use of medical assisted dying within animal species has encouraged conversation of euthanasia in humans. New Zealand was the first country to add euthanasia legislation to a referendum. The End-of-Life Choice Act (2019) legalizes voluntary euthanasia for patients with terminal illness with 6 months left to live confirmed by two doctors where the second is not required to check for coercion (New Zealand Government, 2019; Tsai & Menkes, 2020). The concept of euthanasia within humans remains highly topical and political (Baksheev et al., 2018; Chukwudebelulu et al., 2024; Grove et al., 2022; Karumathil & Tripathi, 2022; Opara, 2024; Shala & Gusha, 2016). Major opposition is drawn from religious standpoints in its conflict of morality and value of life after death (Chakraborty et al., 2017; Sharp, 2018). In Christianity, life is a gift and death is chosen only by God, therefore euthanasia is considered murder (Mystakidou et al., 2005). Conversely, arguments made against euthanasia of an animal instead greatly reflect the value placed upon the being's life. Frey (1988) argues the richness, quality, and value of an animal is not comparable to that of a normal adult human life. This perspective is supported by other researchers whereby the animals are not moral agents who can understand moral reasons and right and wrong actions (Johnson, 1983; Kagan, 2000; Musschenga, 2015; Sapontzis, 1980). Whilst companion animals have been identified by owners as providing emotional support, the absence of moral agency alters the weighted value of an animal's life. Anthropocentrism conceptualizes the belief that the human species are the most important, with plants, animals, nature and others never obtaining the same value (Sessions, 1974). This concept suggests the world revolves around humans and that all decisions are made in effect for or because of the human species.