

Quantification of animal disease burden; exploring the possibilities of a dog-health utility index



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Summary

This research explored the development and use of a Dog Health Utility Index (DHUI). A DHUI is a similar tool as the HUI (Human Utility Index) to support medical decisions. It will be used to give utility indices to different aspects of a dog's life to determine its Quality of Life (QoL). Utility indices are not yet widely used in veterinary decision science or in veterinary practices. While, reflecting on human practices, quantification of disease burden could be very useful, for decision making, priority setting and treatment comparisons in animal health care. Different treatments or preventive measures give a different reduction in QoL.

A main goal of the DHUI instrument is to limit the dog owner's emotional bias in difficult veterinary decisions. The DHUI can be used to improve the communication between a dog owner and veterinarian and the comparison of the effect of treatments on the QoL of the dog. By using the DHUI to estimate the dogs QoL before, during and after a treatment there will be minimal influence of the disability paradox. Another use is to help vets to improve their ability to accurately define health problems and lower the variation amongst each other, and thus lower the risk of under- or overestimation of pain.

The QoL score is build up by attributes that ideally all together represent the complete QoL of the dog without overlapping. The attributes can be divided in psychological, physical and external attributes; the external attributes are represented by basic needs, such as housing and nutrition. This research focuses mainly on the physical attributes mobility and pain. Within each attribute there is a levelling of symptoms linked to a utility score. The utility score represent the average interest of a dog and is estimated by a reference population. The reference scores in this research were obtained by answers on an electronic questionnaire which was sent to veterinarians, animal scientists and, 'animal & law' newsletter readers in The Netherlands. A total of 512 persons, of which mostly dog owners, participated in the questionnaires.

The questionnaire was set up in four topics, 1) the demographics of the participants, 2) the numerical scoring of the attributes, 3) the perception of participants of dogs and 4) the consideration of clinical symptoms. Demographics are used to check the relation in variation in scoring with demographical background information of participants. The numerical scoring is done to gain the weights for the attributes and the utilities scores for the levels within the attribute scores. The weights are indicated with a score from 0 to 100% in which 100% is very important and would thus result in a high weight of an attribute. The participants were asked to make a deviation of 100 between the attributes in any ratio desired. The utility scores represent a preference score and these ranged from 0 to 10, in which 10 is and the bestQoL. For every symptom level of pain and mobility participants were asked to give a utility score. The perception of participants of dogs is questioned to understand what people regard as the psyche of the dog, how they perceive pain in dogs and who they think is responsible for the dog. This information is to see where strengths and weaknesses are concerning the use of the DHUI.

The veterinarians scored overall higher utility scores as reference scores compared to the other participants. Animal scientist scored between the veterinarians and the other participants. This indicates that veterinarians report a lower impact on the QoL for the described symptoms compared to other questionnaire participants. When clear single dimensioned questions are used to describe an attribute no significant difference about the utility scores between the different participants groups is expected. Mobility is considered the more important attribute to determine the QoL in dogs, with an average score of 32.35%. Pain (27.89%), Memory (22.82%) and Emotions (17.35%) were respectively regarded as less important.

The DHUI is defined by a simple linear formulation, combining the utility scores from the different attributes into one overall QoL score. This is done by multiplying the utility score on each attribute by the weight of that attribute followed by a summation of all those weighted scores. From the QoL score an estimation can be made over time indicating Animal Disease Burden (ADB), similar to QALY's in human science

The Quality of Life is defined as a state of being during a certain point in time, while the ADB (Animal Disease Burden) reflects the change in quality of life during a time period. The overall QoL expectation

includes estimations of how much time will be spend on a certain QoL level during the treatment and the chance of treatment success.

By a comparison of different treatments for degenerative joint disease it is shown how the DHUI can be used to estimate the QoL and put it in perspective with other objectives when making a veterinary medical decision. The other objectives are amongst others based on emotions (e.g. guilt and empathy) and financial considerations. Based on this application it can be concluded that the DHUI functions as a transparent decision tool.

During this explorative study it became clear that it is difficult to form the attributes and their weights into one QoL score. Some variables such as different characters of dogs breeds and a lack of knowledge will increase the difficulty to form an well evidence based tool. Also the study about the attributes and the effect of overlapping attributes should be deepened out to be more reliable. Overall the hypothetical case clearly shows there is an objective health analyses resulting in the ADB and QoL scores. With clear guidelines the DHUI could certainly improve veterinary decisions. The development of a DHUI is regarded valuable, more even when all characteristics are taken into account.

The DHUI is expected to be able to become a useful tool in decreasing the subjectivity in difficult veterinary treatment decisions and increasing the importance of a good QoL for the dog.

Abbreviations

ADB	Animal Disease Burden
AHUI	Animal Health Utility Index
DHUI	Dog Health Utility Index
DJD	Degenerative Joint Disease
EQ-5D	European Quality of life 5 Dimensions
HUI	Human Utility Index
MADM	Multi Attribute Decision Making
SF-6D	Short Form 6 dimensions
QALY	Quality Adjusted Life Year
QoL	Quality of Life

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1. Introduction

Every time we ask a friend “*how are you?*” the answer gives us an impression of their interpretation of their health and state of mind. From the intonation of their voice, their gestures and our experiences of how we feel in certain situations we attempt to empathize with how others feel. It is more difficult to interpret someone who cannot answer you directly such as a young child or a psychiatric patient. In these situations a ‘proxy’ is asked to report about the health status of the patient. A proxy is someone who judges a patient’s quality of life (QoL), instead of the patient itself (Snow *et al.* 2005). For example, when a child is sick the family doctor will ask the parents to be proxies and help to estimate the amount of pain their child has. People are quite good at estimating the physical health status of others, but have more difficulties with estimating psychological features such as happiness or depression (Snow *et al.* 2005). Discrepancies occur when there is a difference between what a patient experiences, interprets and would report, and to what extent they express observable signs, interpreted and reported by the proxy (Snow *et al.* 2005). Usually indirect methods by a proxy result in lower scores for QoL compared to self-scoring methods (Arnold *et al.* 2009).

A proxy for an animal comprises even more challenges. Beside the discrepancies between expressed and observed states, there is also a danger of misinterpretation due to the species differences. When observing animals we have to keep in mind that they have their species specific, subjective manner of experiencing the environment, this is the so called *umwelt* by Von Uexküll (1909). This explains that the meaning of different aspects in that environment (e.g. food, social contacts, smells, predators...) is species specific. Humans view on animals, their *umwelt*, feelings and consciousness have changed a lot in the course of history. Biology, animal sciences and veterinary research have developed hypotheses about all kinds of impacts on the QoL of animals. However the application of and the determination of animals QoL is challenging and still in an early development phase.

In human sciences (e.g. medical, economical and ethical), QoL research is much more developed. Multiple instruments are regularly used (and evaluated) to determine humans’ QoL, like the EQ-5D (European Quality of life – 5 dimensions), SF-6D (Short Form – 6 dimensions) and HUI (Human Utility Index). These instruments are constructed by multiple attributes (sometimes named ‘dimensions’), for example pain, mobility, self-care and cognition. These attributes are individually weighted, determining their level of contribution to the final QoL score. An attribute contains multiple questions addressing main topics included in that particular attribute. The answers of these questions represent utility scores. The term ‘utility’ is indicating a ‘preference’; the more preferable an outcome, the more utility associated with it. The scale for utility scores in the HUI reaches from 0.0 (death) to 1.0 (perfect health). The weights in relation to the given utility scores can be converted by a formula into a single QoL score. Changes in quality and quantity in life can be represented in Quality Adjusted Life Years (QALYs). One QALY represents one year in perfect health, or two years in a health status half as desirable etc. (Torf 2003). The desirability or utility score of a certain QoL level is determined by a reference population. Through calculating QALYs a broad range of information on QoL changes is represented by a single value. This is very useful for cost-utility analysis, to compare the effectiveness and welfare implications of health care (Rasanen *et al.* 2006; McDonough and Tosteson 2007).

Surprisingly, utility indices are not yet widely used in veterinary decision science or in veterinary practices. While reflecting on human practices quantification of disease burden could be very useful for decision making, priority setting and treatment comparisons in animal health care or simply to get an impression of the QoL of the animal. This research explores the possibilities to develop an Animal Health Utility Index (AHUI), by which reductions in QoL can be quantified to indicate the ‘Animal Disease Burden’ (ADB) (i.e. the change in QoL during a time period), comparable to the quantification of QALYs in humans.

Currently there are many different interpretations of ADB and QoL. For example the estimated disease burden due to pain or mobility problems varies widely, even among veterinarians. This increases the risk of unnecessary negative consequences for the animal (Hugonnard *et al.* 2004). This is demonstrated among other studies, in research about anaesthesia and post-operational medicine use in the United

Kingdom (Coleman and Slingsby 2007), in Finland (Raekallio *et al.* 2003) and in France (Hugonnard *et al.* 2004). The variation among veterinarians seems to be mainly the result of a lack of training on pain perception and animal welfare, but there may also be a lack in knowledge on ethics and economics (decision science). This year (2012), the Federation for Veterinarians in Europe (FVE) started with the Animal Welfare Model Curriculum, which is likely to be implemented in 2014 to create uniformity and more complete the education for veterinarians about animal welfare (FVE 2012). An AHUI would create opportunities for more objective, well informed, decision making processes for veterinarians, animal owners, the pharmaceutical industry and other stakeholders.

This thesis focuses on the development of a generic AHUI for domesticated dogs or Dog Health Utility Index (DHUI), by focusing on the utility scores for functionality, mobility and pain in dogs. The usefulness of a DHUI as a decision support tool will be evaluated by ranking treatments for hip dysplasia and osteoarthritis, as these are common painful mobility problems in dogs (Hielm-Björkman *et al.* 2009).

The outline of the report is as follows; First a definition of QoL in dogs is given to generate common understanding, where after the attributes are described. By literature research a DHUI is proposed. After the consultation of stakeholders the practical implementation of a DHUI will be discussed. The preference scores to form reference utility scores, used in the DHUI, are gained by an online questionnaire. Dutch dog owners, veterinarians and animal scientists are asked to perform as proxies. The scoring for mobility and pain in dogs is quantified and worked out in detail. From these results a scoring system is proposed, which can be used to assess QoL in dogs in practice. Subsequently a qualification of the overall medical decision making process in animals will be performed to place the use of DHUI in a realistic perspective.

2. The Dog Health Utility Index

2.1 Definition of Quality of Life

In human research, the term quality of life (QoL) is widely used (Arnold *et al.* 2009) and the definition differs per context. In animals it is a relatively new concept and articles using the term QoL are found from 1994 (Bateman *et al.*) and become more frequently used from 2000 onwards (Hewson *et al.* 2007). A complete and general definition for QoL in companion animals is the definition of Taylor and Mills (2007): *"QoL is the state of an individual animal's life as perceived by them at any one point in time. It is experienced as a sense of well-being which involves the balance between negative and positive affective states and any cognitive evaluation of these, where the animal has the capacity. To some extent, QoL can be predicted by the fulfilment of basic and species specific health, social and environmental needs (and individual preferences for these) and is reflected in the animal's health and behaviour."*

This definition is idyllically used to determine the QoL of any animal. The QoL is a broader concept than 'animal welfare' or 'animal health'. Beside health status it also encompasses positive and negative experiences, such as enjoyment, frustration and anxiety (Yeates and Main 2008). Whereas animal welfare or health can be regarded as properties of the animal, QoL is a socially-constructed concept. QoL will reflect what society considers it to mean (Fraser 2003); in human populations it means that utility scores of a population are estimated to compare with individual scores. The QoL score defines the quality of an animal's entire relationship with its environment, how it lives its life as a dynamic notion (Wemelsfelder 2007). This broad definition is likely to be more difficult to use than 'only' a health assessment, however it will give a much more complete view of the QoL in veterinary context. A narrow definition may fail to identify aspects beside health, or on the long term, which may be affected by the disease and/or treatments. This can result in a conclusion in which a treatment is considered successful and welfare acceptable, while simultaneously difficulties experienced by the animal are overlooked (Christiansen and Forkman 2007). Schneider *et al.* (2010) confirms this by stating that obtaining a multidimensional QoL indication will help veterinarians and owners to understand whether diets or treatments are linked to better functioning and improved overall animal health.

2.2 Companion animal veterinary decision making

More than half of all Dutch households owns a pet and 36 % of these animals are dogs (TNS NIPO 2008). Most of these dogs are regarded as companions or family members and taken to the vet at least once a year for vaccination and checks (Klumbers and Endenburg 2008). People who do not take their animal to a vet claim their animal never gets ill and/or are not aware of the possibility of vaccination (Klumbers and Endenburg 2008). Background information is important to estimate if the DHUI use will be accessible, and thus a valuable implementation. This chapter explains the steps and main factors involved in veterinary decision making, and where the need for a dog health utility index (DHUI) arises.

2.2.1 Recognition of QoL implications

Environmental influences such as the housing (e.g. temperature, company, safety, and hygiene), pathogens (e.g. bacteria, viruses, parasites) and nutrition (e.g. food quality, amount and water) continuously influence the dog. The dog has a preference range for all behavioural and physiological processes. As long as all physiological processes and behavioural needs stay within this range the dog can control its homeostasis and satisfy behavioural needs. When no appropriate behaviour is known, or motivations cannot be met, abnormal behaviours such as conflict behaviours or stereotypes may occur. The state of the animal as it attempts to cope with its environment determines the welfare. If a dog not succeeds to cope with a situation this results in stress. Stress is the reaction of the body to an environmental influence creating a homeostatic disturbance. The better the animal can handle stressors the more flexible it adapts to its environment. The impact of the dogs' adaptation to the environment on the dogs' QoL is hard to reveal. This can be explained by an example in thermoregulation. A dog in a cold environment has multiple mechanisms to keep warm, the thermoregulation is challenged. A direct temperature measurement will not indicate a homeostatic problem as long as the internal body temperature is kept normal. The dogs' behaviour, shivering, rolled up posture, more hungry may indicate less optimal circumstances for this dog and likely a decrease in QoL, especially if the dog was not used to a cold environment before.

2.2.2 Owners differences

When a problem is recognised and determined as serious a vet will be requested for advice. The decision to go to a vet is subjective and influenced by for example education, culture, religion and economic status. Three different type of dog owners can be distinguished based on the dog owner relationship.

1) Dog owners who perceive the dog as a piece of themselves and those are highly attached to the animal. 2) Dog owners, who perceive the dog as a friend or family member, use to have a better balance between rational and emotional motivations. 3) Dog owners who perceive their dog as a possession, having the most rational relationship (Budke *et al.* 2008).

The first type of owners, often refer to the dog as a spiritual element with high personal relevance. In these cases it is unthinkable to NOT provide veterinary care, even when it is very expensive. These informants do provide treatment, even when it may not be the best option for the animal (Brockman *et al.* 2008). They cherish the animals as a part of themselves, and they will feel like losing a part of themselves when letting the animal go (Brockman *et al.* 2008). Owners who view their animal as family member or friend often have a deep emotional attachment, and feel guilty when not providing all the possible care. The other way around some people may feel guilty spending a lot of money on their pet when they could use this money to invest in their family. In this perception animals are viewed in a lower status than humans and more cognitive decisions are made (Brockman *et al.* 2008). When the animal is seen as a possession the decision is largely based on the financial impact (Brockman *et al.* 2008).

2.2.3 Decision factors

Normally the owner will describe the issue to the vet, who will perform general and specific health assessments. Vets depend a lot on descriptions from the owner, which has positive aspects by the fact the owners knows the dog, but it can also be false information due misinterpretations (Morgan 2007). For some vets the owners' opinion in what is best for the animal weights heavier than their own opinion, while others consider themselves to be the best assessors and felt justified in persuading clients to follow a certain course (Morgan 2007). Interestingly, Morgan (2007) states that vets have a responsibility to both clients and patients to assess QoL adequately and to apply these assessments to veterinary decisions. This implies that the owners' assessments should be ranked below those of the vet. Most vets make judgements mainly on whether an animal is in pain or suffering, when suffering means severe or chronic pain or other states like malaise, nausea etc. (Morgan 2007).

On the subject of euthanasia, society does not have the same morals for human or animal medical care; vets routinely euthanize dogs without moral controversy (Brockman *et al.* 2008). For dog owners, euthanasia is not routine and emotions may interfere with rational arguments in decisions about euthanasia. Therefore it is practical to assess an individual dog's preferences by using an DHUI before a critical situation occurs. Vets could be pro-active by making an outline of the animal's preferences and so weighting the attributes, easing the decision making process before suddenly difficult decisions have to be made (Budke *et al.* 2008). The animal's caregiver can help by providing information about the preferences of the animal when seeing a vet for checks or in an early disease stage, avoiding allowing emotions to lead decisions and avoiding a 'disability paradox'. In a study on horses, 95% of the horse owners reported that their horse had a good or excellent QoL, while actually 31% of the horses were suffering from a known disease (Ireland *et al.* 2011). So when owners get used to a certain situation they may overestimate the QoL of their animal, this is also seen in humans and called the 'disability paradox' (Ireland *et al.* 2011). Showing the multiple factors and the emotions involved in veterinary decisions it is clear a logical decision making process in which sacrifice is weighed against quality does not always occur (Brockman *et al.* 2008). Multiple studies are performed to indicate which decision factors are important when deciding to euthanize an animal. The following points were taken into account by horse owners: the QoL after procedure, how life threatening a disorder is, the pain / stress of procedures and the veterinary advice (Ireland *et al.* 2011). In zoo's, some decision factors are the additional breeding value, treatment possibilities, the QoL, history of the animal, financial situation and the outcome of radiological assessment as an objective measurement (Föllmi *et al.* 2007). The genetic value of zoo animals is something which can be taken into account for breeding dogs as well. The recovery expectations and treatment procedures need to be communicated well to owners. Finally sacrifices from the owner have to be taken into account. Sacrifices can be monetary, emotionally, but may be also time consuming and requiring the need of (temporarily) life style changes (giving medicines, extra care for the animal) (Mathews 2000).

2.2.4 Financial aspects in the decision

Pets are big business and there are more and more options to spend money on a pet. In the United States 38.5 billion dollars spent on pets every year, of which 18.5 billion is spent on veterinary care and medicines. More specialised treatments, previously only used in human medical care, become available for dogs. This high-cost veterinary care can confront owners with difficult decision problems. Unlike human medical care, most pet owners have no medical insurance for their animal (just 1% of dog and cat owners in 2002 had pet insurance) (Brockman *et al.* 2008). In the Netherlands the maximum amount spent on life-saving treatments for a cat or dog is unlimited for 14% of the pet owners and 22% decide by considering the QoL of the animal and their financial situation. The average to spend on life saving treatments is €787 (TNS NIPO 2008). How do these people decide concerning their financial situation?

Brockman *et al.* (2008) find that decisions for certain expensive treatments rely on emotional attachment, recovery expectations and financial sacrifice. This is influenced by guilt, external factors of family and the vet (Brockman *et al.* 2008). Holbrook *et al.* 2001 describe cases where great emotional attachment does not always lead to a decision to more expensive treatments. But if so, then thousands of dollars may be spent to prolong a dog's life, even when it is suffering from an incurable disease. In the United States, it seems that households with an income above \$81,000 are more likely to take their dog to the vet routinely, at least once a year. Households with a lower income (less than \$ 41,000) only visit the vet when their dog gets ill (15.9 % of 195 respondents) (APPMA 2007). When people have more pets, they are less likely to spend a lot of money on one case (Ellingsen *et al.* 2010).

Dog owners rely on vets' opinions and the trusts in their abilities influences a choice for treatment. In some cases a dog owner may look for another vet who can do the same procedure more cheaply or seems more experienced (Brockman *et al.* 2008). Feelings of guilt by the dog owner can be a powerful marketing tool for pharmaceutical industry and vets. To minimize overtreatment or under treatment a DHUI can be used to make treatment decisions beneficially for the QoL of the dog. Obviously the relationship between vet and dog owner is of major importance. A good relationship can be used as a comparative advantage and so the vet not only provides animal care but also guides the owner through the decision-making process.

2.3 The expected benefits of a DHUI in veterinary decision making

In this literature study, many aspects of dog health, assessment and QoL are discussed. Here follows a summary to indicate where the QoL assessments by the use of a DHUI could be useful.

The DHUI can indicate a dog's current QoL and estimate how the QoL will be in the near future and whether treatment or euthanasia is preferred (Morgan 2007). A DHUI can decrease the owner's emotional bias and personal bias in difficult decisions (Parker and Yeates 2011), especially when a veterinarian and owner estimate the dog's individual preferences before the dog gets ill, to avoid the disability paradox. The communication between vet and dog owner may be easier with the help of the questions and attributes of the DHUI. Helping vets to improve their ability to accurately define health problems, increasing the treatment success and create understanding from the dog owner (Schneider *et al.* 2010). Another gain is to lower the variance among vets in the use of pain medication, decreasing the risk of under or over treatment of pain. The DHUI provides the advantage of an individual approach (Taylor and Mills 2007) and the possibility to rank and evaluate treatments (Christiansen and Forkman 2007; Wojciechowska and Hewson 2005). The optimal use would be by the vet and owner together as the integration of a proxy-based and objective method will give the best result (Hewson *et al.* 2007).

2.4 Constructing a DHUI

The human utilities index, a health assessment tool for humans, will be used as an example for the DHUI. In figure 2 below you see the steps taken to form an HUI, estimate QoL and calculate QALY's. Similar steps taken in this research to form the DHUI, estimate the QoL for dogs and calculate the ADB are highlighted in red.

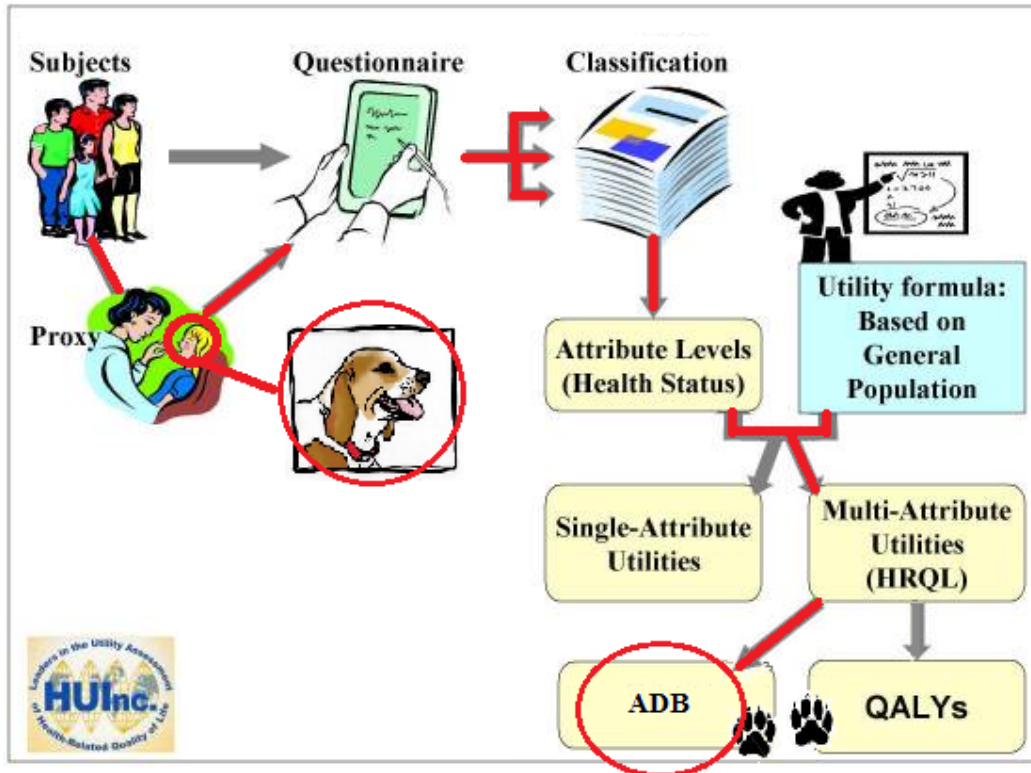


Figure 2. Components to form a DHUI and estimate ADB for dogs (Adjusted from Horsman *et al* (2003)). *HRQL* = Health Related Quality of Life

The formation of the DHUI consists of the following 6 steps, of which steps 1, 2, 3 are done before the process as presented in figure 2 starts.

- 1) Define the QoL of dogs.

Here the definition of Taylor and Mills (2007) is used because it is clear and it includes all positive and negative states, being dynamic and easily updated with new evidence based information.

- 2) Determine the attributes important for the QoL of dogs.

By studying the behaviour (needs and motivations) of dogs, a group of attributes is formed to cover the main topics considered in the definition important for dogs QoL. The attributes should be transparent and easily objectively scored. Inter specific overlap or substitution between attributes should be avoided.

- 3) Formulate questions to level an individual attribute.

An attribute is build up by questions which relate to the content of that attribute, levelling it in intensity, severity or by other characteristics. The impact of an attribute is determined by tree factors namely 1) the interpretation and levelling by the proxy and 2) the given reference utility scores related to this level, 3) the weight of importance of the attribute. The answers on the questions are represented by utility scores. The weights are given by ranking the different attributes (in %) on importance for the QoL. Both the utility scores and weights are estimated by a reference population of proxies, see point 4 below.

The lower the utility score and the longer the duration of such score the more unacceptable it is.

- 4)
 - a. Obtain reference utility scores from proxies to indicate the change in QoL by different impacts.
 - b. Obtain reference weights from proxies to determine the importance of the attributes in the DHUI.

The combination of a utility score multiplied by the weight gives the score of the attributes, which is part of the final score to indicate QoL. It is assumed the weights and scores will be socially acceptable, because they are given by a reference population. In the future this gives an opportunity to compare the socially accepted utility scores and attribute weights with scientifically proven knowledge on these subjects.

- 5) Formulate a DHUI to be used in practice.

Ideally the DHUI tool is transparent and easy applicable. To help proxy's with the assessments multiple tools are available. For example a decision tree can be used to assess for example the availability and quality of food and water, resulting in three levels; unacceptable, average and good. Also training videos can be provided to show the levels of mobility problems. A guideline going along with the video can explain the characteristics of the different attribute levels. This is already done in cows: <http://www.nationaldairyfarm.com/training-videos.html>. Both ordinal and continuous scales, such as the (Visual Analogue Scale (VAS) can be used.

- 6) Testing reliability (trainability) and feasibility of the DHUI

There are two ways to use the weights for attributes in the final DHUI: 1). by using the reference weights to score attributes, or 2.) to personalize those weights to the dogs breed and age. The last method is more precise, although this increases the risk of becoming more subjective.

2.4.1 The attributes

The attributes are also sometimes called the dimensions, and indicate the building blocks that together form the QoL. Yeates (2011) shows there are two mainstream points of view for forming the QoL, namely by biological functioning (Dantzer and Mormede 1983; Curtis 2007) and by naturalness (Bracke and Hopster 2006). Biological functioning represents the importance of physiology, pathology and productivity (Yeates 2011). Naturalness is the assumption that the most natural situation is best for the animal. The freedom to express natural behaviour is then considered to be very important. Except for productivity, the above indicators of QoL come together in the five freedoms for good animal welfare (FAWC 1979).

Table 1. The five freedoms (FAWC 1979):

1) Freedom from hunger and thirst
2) Freedom from discomfort
3) Freedom from pain, injury and disease
4) Freedom to express normal behaviour
5) Freedom from fear and distress

Officially these guidelines are developed for the welfare of farm animals; consequently they have no special focus on human-animal relationships. Additionally there are five opportunities (Anon 1993), which can be used to emphasize the positive states related to the five freedoms (Ireland *et al.* 2011).

Table 2. The five opportunities (Anon 1993):

1) Opportunity for selection of dietary inputs by provision of a diet that has been preferentially selected
2) Opportunity for control of the environment by allowing the achievement of motivations
3) Opportunity for pleasure, development and vitality by maintaining and developing beneficial inputs
4) Opportunity to express normal behaviour by providing sufficient space, a good quality environment and group housing for social animals
5) Opportunity for interest and confidence by providing conditions and treatment that lead to mental enjoyment

Schneider *et al.* (2010) and Wojciechowska *et al.* (2005) included relationships between owner and dog in their QoL assessments. This research does not include dog- owner relationships because they depend

on many subjective subjects and it will be reflected by the other attributes assessing the QoL of a dog. A lack of evidence make it difficult to determine if the human-animal relationship contributes to a net positive or negative influence on the QoL. For example the bond between owner and dog can be really good and the owners invests a lot of time in positive interactions with the dog, however when a dog is afraid to be abandoned this has a negative impact on the QoL.

So far a division in QoL attributes is found by:

- Freedoms and opportunities (FAWC 1979; Anon 1993)
- Physical, psychological, social and environmental influences (Schneider *et al.* 2010)
- Satisfaction of telos needs¹, opportunities for pleasure and minimal distress (Wojciechowska *et al.* 2005)
- Mobility, play or mental stimulation, health, companionship and other (Budke *et al.* 2008)

Compared to the human QoL assessments, the following attributes are still missing: The use of senses (mentioned in the HUI), self-care and the ability to perform usual activities (mentioned in the EQ-5D). Dogs can hear and smell a wider range than humans. They can detect odorous molecules at concentrations between a thousand and over a million times lower than corresponding human thresholds, and can resolve differences between odours that would seem identical to us (Bradshaw and Casey 2007). This greater sense of smell probably dominates the world of some dog breeds and should therefore be taken into account in the QoL.

It is unknown how important self-care and the ability to perform usual activities are for dogs. Most likely they vary per dog. It is difficult if not impossible to measure the motivation for a certain activity, especially when the dog is unable to perform the behaviour anymore due to a certain disease or treatment. This subject will not be elaborated in this research

Based on the attributes mentioned and a review of QoL assessments in companion and kennelled dogs by Hewson *et al.* (2007), a dogs QoL attribute scheme is formed, see figure 3.

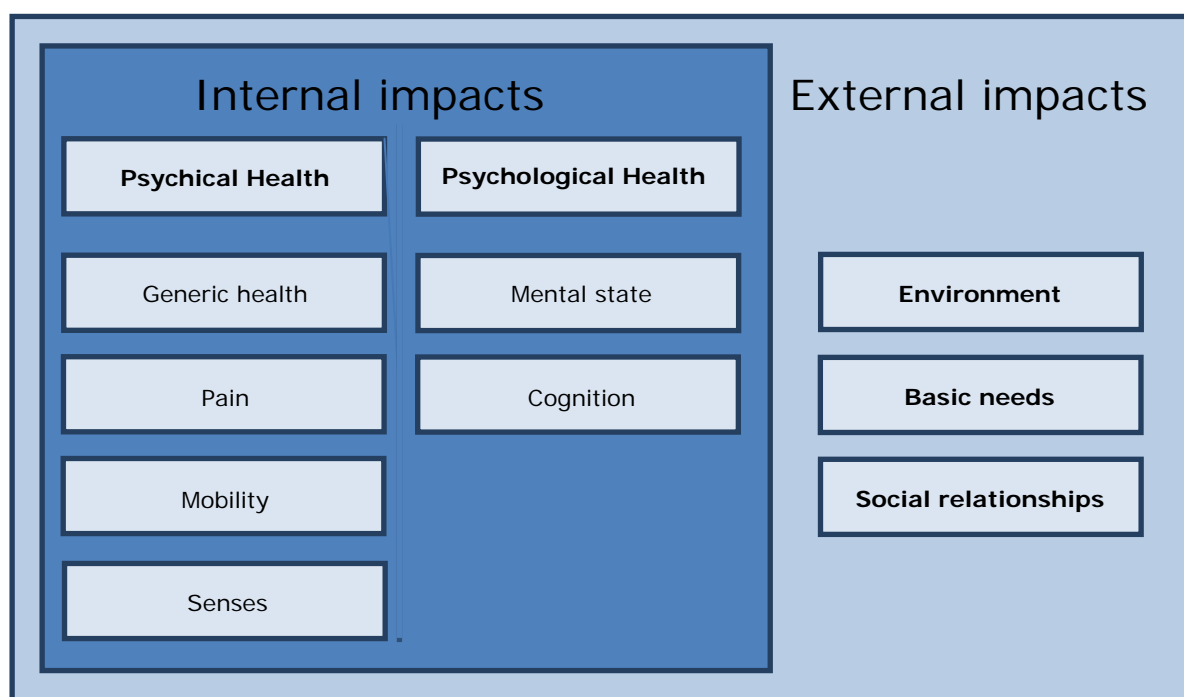


Figure 3. Dogs QoL attribute scheme

¹ Telos needs are manifested from breed and temperament specific genetic traits distress (Wojciechowska *et al.* 2005).

The attribute scheme shows a distinction between internal impacts on QoL and external impacts. The internal impacts are directly linked to the dog and can be assessed by dog-based indicators (e.g. by observing the dog). The external impacts concern the environment, basic needs and social relationships; they can be assessed by on location check. Information about good practices concerning environment (housing), social relationships (with humans and dogs), and basic needs (feed and water) are commonly available, however often not evidence based. The internal impacts are split up in a two-step assessment: an objective physical health assessment (done by the veterinarian) and (in cooperation with the owner) a psychological health assessment. Snow *et al.* (2005) shows that a proxy is usually better in estimating physical health compared to psychological health. To increase the objectivity of the DHUI the impact of the subjective psychological analysis should be minimized. This research will focus on physical attributes of the DHUI. The psychological health is not taken into account in the DHUI in this research, but explained separately in the chapter "Psychological health". Finally it is important to realize that attributes have may correlate to each other and that they enable the proxy to assess every kind of disease.

2.4.2 Physical health

Physical health is favourable objectively checked by a vet. In the DHUI the attribute physical health is divided in four topics, namely general health, pain, mobility and senses. Important health indicators are the body-condition score, the (colour of) the nasal and eye fluids and mucosal tissues, skin and fur condition, heartbeat and breathing etc. If there are clinical symptoms, more specific medical assessments will be done. The goal of the physical-health assessment is to see if the dog has pain, ailments or injuries which may cause suffering. Suffering is an unpleasant state of mind that disrupts the QoL; it is associated with unpleasant experiences and also relating to physical as psychological states (Föllmi *et al.* 2007). Whenever the dog experiencing distress or/and emotional numbness, this is considered to be psychological suffering (Gregory 2004 in Föllmi *et al.* 2007).

Pain is chosen as a separate scoring topic because it has a major direct impact on the dogs QoL (Föllmi *et al.* 2007) and therefore it is one of the most important factors to determine the well-being animals (Anil *et al.* 2002). Pain is an adverse sensory stimulus (Anil *et al.* 2002), characterized by duration and intensity. Long-lasting pain is called chronic, the opposite is acute pain which often has a clear cause and lasts for the duration of a healing process (Anil *et al.* 2002). Adoptions of pain-relieving protocols vary widely among vets (Föllmi *et al.* 2007). A better understanding of pain and the opinions for dogs in pain will help to develop better methods to assess and limit QoL reductions due to pain. Therefore it is necessary to know the variation and reasoning of vets and dog owners about pain in dogs. The most frequently used estimator for pain is behaviour (Rutherford 2002; Anil *et al.* 2002). Respiratory rate, cortisol levels, and heart rate are not only indicating pain but also fear, anger and arousal in general and therefore alone no good indicators (Holton *et al.* 1998). Especially in domesticated animals, stress measurement cannot give a reliable outcome on animal welfare (Barnard and Hurst 1996). Pain can be confirmed by using analgesics; when using them correctly the behavioural symptoms of pain may disappear and the sense of pain is confirmed (Anil *et al.* 2002). Behavioural cues for pain can be posture, facial expression, stereotypical movement, vocalisation and the absence of activity or play. Together with the above-mentioned indicators, they can be used to confirm pain; the intensity of pain will remain estimated.

Mobility is the third part of physical health assessment to observe. Lameness is a symptom of mobility problems and can occur in one or more legs at the same time (Quinn *et al.* 2007). Mobility is chosen as an indicator because activity levels may have a large impact on a dog's QoL. Force plate gait analysis can be used for an objective evaluation of the limb function of dogs (Quinn *et al.* 2007).

Finally the use of the senses (e.g. vision, smell, hearing, taste) is included in the QoL assessment. Senses may dominate the world of some dog breeds, as their sense of smell and capability to hear is much better than ours. Problems affecting one or more senses from the dog should be registered and included in the QoL assessments as they may seriously impair a dog's QoL.

2.4.3 Psychological health

In the DHUI the psychological health assessment is build up by the state and cognition. The mental state is determined by the experiences of the dog. Cognition concerns the actual functioning of the brain, e.g. the ability to memorize and concentrate. Yeates (2011) described very well how an experience can affect an animal's QoL both positively and negatively "*An animal's experience is a matter of the sensory inputs it receives and its engagement with those experiences. These engagements include conscious emotional*

experiences with qualities, such as pain or pleasure, as well as cognitive engagements (Boissy et al 2007), that may result in motivational states, as well as in psychological changes and behaviors (Denton et al 2009)”. These processes, the origin of motivations, strongly depend on the dog’s telos needs, environment and history. The impacts of telos needs on breeds are discussed in the discussion chapter 4.

2.4.3.1 Assessment difficulties

Due to a lack of scientific evidence about dogs’ preferences (Taylor and Mills 2005) the mental state of a dog remains estimated. There are three difficulties with estimating a dog’s preferences. The first is the quantification of mental experiences and the complexity of aggregating experiences into a single assessment (Yeates 2011). Second is the difficulty in evaluating and weighing positive or negative experiences in dogs. For example pleasantness and unpleasantness may not precisely opposite each other or use the same scale (Russell and Carroll 1999). The value of experience can be represented by the motivation of the animal to perform behaviour which relates to avoiding or reliving the experience. It is generally believed that emotions exist to help making decisions, unconsciously weighting the values of experiences, especially those that are important for the animal’s reproductive success (Medl *et al.* 2009). There is a lack of consensus on the basic needs to fulfil the motivations of companion animals (Taylor and Mills 2005). Our assumptions regarding affection, social contact, toys, exercise etc. may not be valid. Quick preference tests are lacking, therefore often owners are asked if a psychological assessment is necessary. The third difficulty in psychological dog-health assessments is whether dogs are conscious about their emotions and how sophisticated their emotions are. Evidenced based research should be used and social acceptance is necessary to improve the usability of the DHUI attribute concerning mental states.

2.4.3.2 Consciousness

Three levels of emotions are described in literature; primary, secondary and tertiary (Panksepp 2005). Primary emotions (e.g. hunger, anger and fear) are widely accepted to be present in many vertebrate species (Morris *et al.* 2008). In contrast to secondary emotions, which are only proven in humans and great primates. A difference is made in secondary emotions which require a consciousness of self – such as jealousy – and emotions which need self-conscious evaluation such as guilt or shame. With regard to the advanced flexible behavioural responses of dogs, it has been suggested that they have the appropriate neural pathways to have a ‘conscious’ awareness of feelings (Panksepp 2005). Currently there is no scientific evidence for secondary emotions in dogs, or even in chimpanzees (Mitchell 2005). Tertiary consciousness is the last step of evolutionary adaptation. It requires a large neo-cortex, as in humans, to link the internal and external events by language or expression. By this reasoning, a dog cannot be jealous or take revenge or reflect on something that happened in the past (Bradshaw and Casey 2007). However they may have feelings about the present, in the sense that they respond emotionally to external stimuli, such as an owner leaving. There is no evidence that those emotions are so complex or sophisticated that they can make assumptions or links (Bradshaw and Casey 2007). A study on social-cognitive abilities in dogs shows that dogs are very skilled to read human communicative signals, as pointing and eye movements (Hare *et al.* 2002). These social cognitive abilities in are present in puppies a few weeks old. It is believed dogs were selected for a set of social-cognitive abilities enabling them to communicate with humans in unique ways (Hare *et al.* 2002). Great apes or wolves do not understand similar signalling by humans. To conclude, dogs are very well able to communicate with humans, in a way that humans may interpret as the kind of emotions they experience themselves. However dog owners have to realize the *umwelt* of their dog is different from their own, as dogs have a different set of senses than humans (Bradshaw and Casey 2007).

3. Material and Method

As explained in detail in paragraph 2.4., the general outline of a DHUI consists of the following 6 steps;

1. Define the QoL of dogs.
2. Determine the attributes important for dogs.
3. Formulate questions to score these attributes.
4.
 - a. Obtain reference utility scores from proxies to indicate the change in QoL by different impacts.
 - b. Obtain reference weights from proxies to determine the importance of the attributes in the DHUI.
5. Formulate a DHUI scoring sheet to be used in practice.
6. Testing and evaluation

Step **1** and step **2** are performed in the literature study explained in chapter 2. In theory ideally the QoL is assessed using the broad definition; however in this research not all attributes are worked out in detail. External factors such as housing and social relationships and also general health are not included in this research. Step **3**, the formulation of questions to score the attributes is done for the impact levels of the attributes pain and mobility. Pain is levelled in intensity and duration and mobility by the impact on daily activities (see 3.2).

Various stakeholder groups (defining the reference population; see 3.1) are consulted to assess the reference utility scores and weights for the DHUI, step **4** of constructing the DHUI. The utility scores are indicators of a preference for certain levels within the attributes (Step **4a**). The weights will be given to psychological and physical aspects, respectively memory & emotions and pain & mobility to indicate the individual importance of those attributes (Step **4b**). The weights are given by ranking the different attributes (in %) on importance for the QoL.

Unless large significant differences exist between the utility scores and attribute weights given by the stakeholder groups the reference utility scores are formed by the mean scores of all participants. Step **5**, the utility scores are placed in a practical scoring form to be able to score the QoL. The final QoL score is a result of a linear summation of the attribute weights multiplied by the relevant utility scores. Step **6**, the testing and evaluation of the DHUI is done by an example of degenerative joint disease (Chapter 5).

3.1 The study population

To obtain reference utility scores and weights for the DHUI an electronic questionnaire was developed in Dutch. The website freeonlinesurveys.com was used to execute the questionnaire.

The questionnaire was e-mailed as an online link to vets, dog owners, animal scientists and a 'random' group of the Dutch population. It was accessible for a period of 3 weeks, namely from 29 February 2012 until 21 March 2012. The random group of respondents was reached by sending the questionnaire via the newsletter of association "Animal & Law" and via friends and family. Via the newsletter of "Animal & Law" around 4500 people received the link to the online questionnaire. From the other groups 350 vets and around 450 animal scientist students received the link (these are not all responders, see results). Dogs and their owners and vets are the direct stakeholders in this study. Indirectly the pharmaceutical industry, animal scientist (etiologists), animal welfare and rights organisations, researchers and policy makers can be identified as stakeholders. Animal Scientists and vets are included as participants, because the difference in education could give new insights in dogs QoL and use of the DHUI. The random citizens were involved in the questionnaire (dog owners and people without a dog) to include their vision and societal perspective on the subject. By the involvement of multiple stakeholder groups the social acceptance of the DHUI can be increased. The diversity in participants is chosen for multiple reasons: first of all it will lower the bias and hopefully gives a more proportional overview of what all these groups concerns important in the DHUI. Secondly the study of discrepancies and/or similarities between scorings of different stakeholder groups will give insight in the quality of indicators used to form the DHUI. Eventually the aim is to reach consistency in the scores and give single values for weights and utility's.

3.2 The questionnaire

The questionnaire consisted of 4 parts, viz. i) Demographics, ii) Numerical scoring, iii) Perception on dogs and iv) Perception of clinical symptoms, which are discussed per part. For the full questionnaire as how it was presented to the participants, see Attachment I.

Part 1: Demographics. The questionnaire starts with questions about the demographic profile of the participant. Participants were questioned how much they care about dogs and whether they own a dog or other animals (Question=Q, so Q 1-9 include demographics). The answers on these questions are in nominal scale and one question (Q5) at ordinal scale. The following questions were asked:

-
- | | |
|-----|--|
| Q1. | What is your year of birth? |
| Q2. | What is your gender? |
| Q3. | What is your level of education? |
| Q4. | How did you hear about this questionnaire? |
| Q5. | Do you have affinity with dogs? (1=none, 5 =very much) |
| Q6. | Do you have contact with dogs due to your profession? |
| Q7. | Do you own a dog now? |
| Q8. | Did you have a dog or took care for it longer than 3 days? |
| Q9. | Do you have other pets? |
-

These questions were asked to confirm or discuss the following hypothesis suggested by other studies:

- People with more affinity with dogs will score higher utility scores, meaning that they consider symptoms more quickly as severe compared to people with less affinity with dogs (Ellingsen, Zanella *et al.* 2010)
- Males and older veterinarians are known to give lower importance to pain (Williams *et al* 2005)

In general within this study it would be interesting to see if opinions about QoL in dogs differ between participant groups, based on differences in education, age, experience with pets or profession.

Part 2: Numerical scoring. The participants were asked to score the weights of the attributes and the utility scores of the levels within the attributes of the DHUI. Physiological and physical attributes were taken into account, as well as the attributes functionality, mobility and pain (Q10-14). Comparative rating scales were used for deriving relative judgements on the weights of the attributes, by dividing 100 points between criteria and indicators according to their importance. By means of comparative rating scales (Churchill 1995) respondents have to make judgements of each attribute with direct reference to the other judgements being evaluated. For the utility scores a score could be given from 1 to 10. This is a common scoring scale in schools in the Netherlands and therefore easily understood. Here 1 represents an unwanted state of very low QoL and 10 represents an ideal score of perfect health and happiness.

-
- | | |
|------|--|
| Q10. | How important do you think mental and physical health are for a dog?
<i>Please divide 100 point over the two attributes and make sure the total is 100 points.</i> |
| Q11. | How important do you consider the following issues for a dog?
<i>Divide 100 points over the 4 attributes, the total have to be 100 points.</i>
<i>Mobility (running, turning, swimming, walking, jumping, standing up, etc.)</i>
<i>Pain (as experience in itself, chronically and/or temporarily.)</i>
<i>Memory (the knowledge of the dog, such as itinerary, memories, trainability, etc.)</i>
<i>Emotions (showing happiness, joy, unhappiness, aggression, etc.)</i> |
-

The division of psychical and mental health in Q10 is made to see how important people rate those two in relation to each other. In literature there is minor attention given to mental health in dogs, it is interesting to know if this reflects societies interests. Q11 serves a double function; primarily the scores will give weights to the attributes in the DHUI. The second function is to reflect on Q10. Do mobility and pain reflect the physical health, or is there information missing. And do Memory and Emotions represent mental health or do participants have a different view on this? It was expected that if participants score 50:50 over respectively psychological and physical aspects, they would also score 25:25:25:25 over the four attributes.

-
- | | |
|-------|---|
| Q 12. | How important do you estimate the issue that a dog can continue to do what he/she always used to do?
<i>There is the possibility that due to a disease a dog cannot perform all the behaviour as he/she did before. For example if a leg is amputated, or when the dog becomes deaf.</i> |
|-------|---|
-

The next question asks you about the functioning for the dog, and how this influences his/her Quality of life.

Please score each item between 0 and 10, in which:

0 is extremely negative, the dog would be better off dead than this sick or unhappy.

10 is extremely positive, the dog is extremely healthy and happy.

The dog can do everything without having any problem

The dog has difficulties with certain situations or activities, but can still do all of them.

The dog avoids certain activities or situations

The dog has difficulties with certain situations or activities, which cannot be avoided.

The dog has difficulties with daily occurring situations or activities

The dog cannot perform all daily activities anymore

The dog cannot perform most of the daily activities

Dogs cannot tell you when they are in pain. To know whether they suffer from pain we watch for behavioural changes, like making a sound (crying, moaning) when being touched, or that he/she moves in a strange way. Other behavioural changes can be observed from acting more frightened, fearful, agitated or less active than before.

To estimate how much Quality of Life is influenced by pain the next question concerns pain intensity and pain duration.

Answer the question as for an adult dog.

In human indices the ability to continue the work, sports or other activities you have always done is quite important for the wellbeing. In dogs this is very hard to estimate and to know. This question is not included in the DHUI, but raised to check participant's opinion on the functionality of dogs.

Q13. What do you think of the following items regarding pain for a dog?

Give each item a score between 0 and 10. This score represents your opinion about the influence of pain on the Quality of Life for dogs. A low score indicates that pain has a negative influence on the Quality of life for dogs.

0 is extremely negative, the dog would be better off dead than this sick or unhappy.

10 is extremely positive, the dog is extremely healthy and happy.

No pain or discomfort

Occasional pain (1x month)

Often pain (1x week)

Continuous pain

Occasional intense pain (1x month)

Often severe, intense pain (1x week or more)

Continuous severe and intense pain

Q14. What do you think of the following items regarding the mobility of dogs?

In general we can state that dogs like to run, play and do something for their owner. Of course there are differences in activity levels between breeds. Here you are asked to make an estimation based on the interests of an average dog. Mobility is walking, running, getting up, lying down, turning the head, walking stairs, swimming etc.

Please score every point; your score represents your opinion on the influence of mobility on the dogs Quality of Life.

0 is extremely negative, the dog would be better off dead than this sick or unhappy.

10 is extremely positive, the dog is extremely healthy and happy.

The next questions are about the human dog relationship and how you observe dogs.

The dog moves easy and normal

The dog sometimes moves stiff or strange

The dog often moves stiff or strange

The dog always moves stiff or strange

The dog cannot make all movements anymore

The dog cannot make all movements anymore and needs a prostheses or wheels

The dog cannot move its legs anymore (only the body and head)

The dog can only lie down

Q13 and Q14 are raised to determine the utility scores for different levels in respectively pain and mobility. The levels for mobility and pain vary in intensity and duration of the symptoms, starting with perfect health and ending which was assumed total negative QoL (0 score). This is done to relate different levels of impacts on QoL to practical situations when using the DHUI.

Part 3: Perception of the participants on dogs.

To limit the subjectivity in the judgement process of the QoL it is important to increase understanding in the background and perception of people in relationship with their scoring of QoL in dogs. Therefore main extraneous variables (e.g. education, age, gender) are questioned as well as the perception on dogs emotions and pain in dogs. All the questions are answered nominally.

Q15. Do you assume dogs have the following emotions?

	I don't know	Yes	No
Fear			
Anger			
Loneliness			
Jealousy			
Proudness			
Guilt			

This question was raised to see if the assumption from emotions in dogs leads to different scoring of the QoL. In literature there is no proof for secondary emotions in dogs, such as proudness or jealousy. There is a research that states that the overall assumption of emotions in dogs is a proof of the presence those emotions in dogs. This question is raised to compare with Morris *et al.* (2008) in the discussion.

Q16. Who do you think is responsible for ending the life of a dog?

Nature (God, Destiny), The veterinarian, The owner, I don't know, Other

Q17. How do you think dogs experience pain in relation with humans?

Worse, The same, Less, Other

Q18. Who do you think is the best person to assess Quality of Life in dogs?

The owner, The veterinarian, A dog behaviour specialist, I don't know, Other

Question 16 was raised to detect who is generally accepted to be responsible for dogs life ending, a decision that may result after the QoL assessment.

Question 17 was included to see how people perceive pain in dogs. Are they aware of pain in dogs and if so, what is the bias of the pain attribute? The attribute weight and levelling of utility scores within the attribute are highly influences by proxies' view of pain in dogs. By literature there is no reason to assume pain in dogs is different than in humans, but as in humans there is a lot of variation in the expression of pain.

Question 18 was raised to see who the different participants consider best assessor for QoL, it is interesting to see if this differs from the person who is responsible for a humane life ending of the dog.

Part 4: Consideration of symptoms.

A list with impacts on dogs QoL was stated and participants were requested to score the impacts of these statements on the dogs QoL (Q19, see Attachment I). For the same statements participants were also asked to state whether they would take their dog to a veterinarian or gain advice in another way (Q 20, see Attachment I). In total two times 20 questions were asked about all kind of symptoms.

Extra attention was paid on formulating the questions and descriptions in the questionnaire to enlarge the correct interpretation of questions by all participants. On almost every question it was possible to post a reaction or choose "I don't know". This was done to lower 'guessing rate' if participants get bored or haven't got an opinion on the subject.

These questions were asked to gain an idea in what are frequent reasons for people to visit a veterinarian. The questions were more orientation related than giving a direct answer on one of the research questions. The questions may also give a second indication about how important physical symptoms and mental symptoms are, which can be compared with the weight of individual attributes. Also the opinion of people about abstract levels of attributes is checked in the previous questions. Here the more practical examples are given and we can see how these compare to the attribute levels.

3.3 Formulation of DHUI

The DHUI reflects the overall aggregated assessment of the individual attribute measures. There are many different aggregation methods to determine this overall value (Nijkamp et al, 1990). The selected aggregation method (or multi-attribute function) should be able to reflect the preferences for all possible combinations of attribute measures. In general there are two types of aggregation methods; compensatory and non-compensatory. Compensatory methods assume that one attribute can be traded off against any other attribute, while non-compensatory methods do not assume that such trade-offs can be made. The most often applied aggregation method is the simple linear additive valuation method (or expected value method). This compensatory method is however only suitable to aggregate scores within comparable measurement units (Dodgson *et al.* 2000).

3.3.1 Example HUI

In human practice a linear formulae is used to form a QoL score in a HUI. In this formulae the errors are included to compensate for discrepancies that may occur between the reference population and reality. Single attributes utility functions are defined as the levels identified within attributes in this research. The first two attributes are shown as example from the HUI method (Torrance *et al.* 1996). In table 3 you can see how two attributes, sensation and mobility, are formulated and described by different levels. Some attributes can have 4 levels, while others have 5. Table 4 implicates the scores given for these by the reference group. Table 5 indicates how the utility scores are multiplied by the attribute level.

Table 3. HUI 2 Multi-Attribute Health Status Classification System		
<u>Attribute</u>	<u>Level</u>	<u>Description</u>
Sensation	1	Able to see, hear, and speak normally for age.
	2	Requires equipment to see or hear or speak.
	3	Sees, hears, or speaks with limitations even with equipment.
	4	Blind, deaf, or mute.
Mobility	1	Able to walk, bend, lift, jump, and run normally for age.
	2	Walks, bends, lifts, jumps, or runs with some limitations but does not require equipment.
	3	Requires mechanical equipment (such as canes, crutches, braces, or wheelchairs) to get around independently.
	4	Requires the help of another person to walk or get around and requires equipment as well.
	5	Unable to control or use arms and legs.

Table 4. HUI2 Multi-Attribute Utility Function on Dead-Healthy Scale		
<u>Level</u>	<u>Sensation</u>	<u>Mobility</u>
1	1.00	1.00
2	0.87	0.92
3	0.65	0.61
4	0.00	0.34
5		0.00

Table 5. HUI2 Multi-Attribute Utility Function on Dead-Healthy Scale			
<u>Sensation</u>		<u>Mobility</u>	
<u>x1</u>	<u>b1</u>	<u>x2</u>	<u>b2</u>
1	1.00	1	1.00
2	0.95	2	0.97
3	0.86	3	0.84
4	0.61	4	0.73

In this example the **xn** is the attribute level and **bn** is the attribute utility score, resulting in the Formulae: (Dead - Perfect Health scale) $u^* = 1.06 (b_1 * b_2 * ...) - 0.06$

Where u^* is the utility of a chronic health state on a utility scale where dead has a utility of 0.00 and healthy has a utility of 1.00. Because the worst possible health state was judged by respondents as worse than death, it has a negative utility of -0.03. The standard error of u^* is 0.015 for measurement error and sampling error, and 0.06 if model error is also included (Torrance *et al.* 1996) These errors are expected to compensate for discrepancies between the model and reality. The average scores from the reference groups are used to account for everyone, however in reality individual preferences can be different as indicated by the standard deviation (SD) in statistics. Therefore the standard error is included referring to the fault in the model related to individual preferences. The sampling error refers to the relevance of the fault that is made by gaining the reference score not the whole population was questioned but random group out of the population. Finally the model error includes a change that xn denotes the *true* but unobserved value of bn . All the errors together make the model more realistic on multiple levels.

3.3.2 The DHUI

In this study the multi attribute utility function (DHUI) is defined by the simple linear formulation, combining the utility scores from the different attributes into one overall score by multiplying the utility score on each attribute by the weight of that attribute followed by a summation of all those weighted scores (Dodgson *et al.* 2000).

$$DHUI = (U_{A1} * w_1 + U_{A2} * w_2 + U_{A3} * w_3 + U_{A4} * w_4)$$

U = Utility score

A = Attribute, with number to indicate which attribute.

w = Weight, given to a certain attribute with the same number

The general formula for the DHUI is:

$$DHUI_t = \sum_{i=1}^n U_{Ai,t} * w_{i,t}$$

U_A = Individual utility score given to a certain attribute.

w = Individual weight of a certain attribute.

i = i-th attribute

t = at moment t

n = Number of attributes included

The scoring for a DHUI indicates a QoL state of the dog being on a certain moment. The maximum utility score is 10 and the minimum, representing dead, is 0.00. It is assumed that dogs are not familiar with the concept of dead, and cannot prefer to be dead as humans can be. Meaning no negative scores can be given. The utility scores are mutually independent (Clemen and Reilly, 2001; Hardaker *et al.*, 2004). This condition has to be met as the sum of the weighted averages is used to combine preference scores across attributes; otherwise more complex models for combining scores across are needed (Clemen and Reilly, 2001).

The DHUI indicates the QoL of a dog, by which the ADB can be calculated. The ADB is comparable with the QALY in the HUI calculations. Thus the ADB represents the QoL estimations multiplied by the factor time over a certain time period. The calculation of ADB with the DHUI can support complex veterinary treatment decisions in which treatment alternatives, cost effectiveness and owner sacrifices all play a role. Such complex decisions can be supported with Multi Attribute Decision Making (MADM) to meet best all of the (possible conflicting) interests (Hardaker *et al.* 2004). In chapter 5.3 you can see an example of an MADM to compare treatments with help of the DHUI and ADB.

3.4 Descriptive statistics

Data analyses were performed with Excel (Microsoft Office 2010) and IBM SPSS Statistics 19. The significance level of confidence intervals and performed tests was set at 5%.

Tests for normality and homogeneity of variances were done to check if parametric tests can be used to compare answers. Randomness cannot be assumed because the questionnaire was sent out selectively. Normality is controlled by drawing Q-Q plots in SPSS.

For the questions with a numerical scoring, (Q10 – Q14), the homogeneity of variances is checked with '**Levene test of homogeneity of variances**', testing the hypotheses

H0: The variance of the dependent variable is equal across groups.

Ha: The variance of the dependent variable is different between groups.

With a $p\text{-value} \leq 0.05$, the null hypothesis is rejected, concluding that variances are significantly different between groups. A p value lower than 0.05 means that there is a high change that the variation of answers is similar among questions. If the p value is higher than 0.05 questions are likely to have a different variance, meaning that the opinion of participants about the answer on this question varies.

The three points (homogeneity of variances, normality and randomness) for parametric tests cannot be met, therefore a nonparametric test is used to see if the numerical scored answers of different participant groups are significantly the same. This is especially important for question 13 and 14 to compare means of the utility scores. The **Kruskal-Wallis test**, one way analysis of variance will be used to compare numerical scores between groups. (*Analyse > Nonparametric Tests > K Independent Samples...*) The assumptions for this test are: The samples (participants) are relatively random and independent; a large number of answers per group is present; the groups have approximately the same configuration.

H0: M Vets = M Students = M Newsletter readers = M Others

(The median group scores are equal.)

Ha: Not all of the medians are equal.

The reliability is checked with **Chronbachs alpha** in SPSS: '*Analyse > Scale > Reliability Analysis ...*' If the reliability is above 0.7 the data is suggested to be consistent compared to answers given by the same person on other questions. This is done to see the consistency of participants to fill in the utility scores.

4. Results

The response rate is around 10% (513 responses out of ≈ 5300 links send) of which 49 vets, 103 animal sciences students, 330 "Animal & Law" newsletter readers and 85 others (contacted via friends and family). Two questionnaires responds forms are deleted due to incompatible answers. In total 403 forms were included in the results. All the questions concerning multiple numerical scorings are manually checked on incompatible answers. By excluding incompatible answers the relative influence of correct responses are increased. Multiple choice questions always had the possibility to score "I don't know" or "Unknown" and therefore all responses of multiple choice questions are included in the analysis.

The reliability is checked with Chronbachs alpha in SPSS. In table 3 you can see the functionality and mobility score have a alpha above 0.7, indicating that the answers given as utility scores are consistent within the attribute.

Table 6. Statistical results concerning reliability

	N	Chronbachs alpha	Chronbachs alpha based on standardized items	No of items (Levelling in attributes)
Pain	402	0.525	0.687	7
Functionality	403	0.820	0.800	6
Mobility	394	0.809	0.794	8

The levelling in pain is less consistent within the attribute; this is due to the inclusion of two variation factors, namely intensity and occurrence of pain. By testing validity it is evaluated how well the responses reflect reality and so how trustworthy participants answered the questions. Therefore multiple questions are asked, on which a similar outcome was expected. It was expected that if participants score 50:50 over respectively psychological and physical aspects, they would also score 25:25:25:25 over the four underlying attributes. The weights of physical and psychological aspects were supposed to be validated by asking the participants to weight the main attributes forming these two aspects. This was done by asking participants to divide a score of 100 over the physical and the psychological aspects, relatively represented by pain & mobility and emotions and memory (see Table 7, below).

The weighting factors of the underlying four attributes resulted in a slightly different division; mobility and pain obtained a summed preference weight of 60%, while emotions and memory summed together to 40%. (For exact scores see table 8 and 9, p. 27.)

Table 7. Deviation of attributes over psychological and physical features.

Mobility	} Psychological
Pain	
Emotions	} Physical
Memory	

The hypothetical validation method turned out to be incorrect. The attributes do not necessarily represent only psychological or only mental issues. The score of 50:50 was not represented by the attributes.

Part 1: Demographics.

The demographics of the respondents has been studied with descriptive statistics. A wide age range responded, which has a normal distribution calculated from the year of birth between 1940 and 2000, found by QQ plotting. In total 75% of the respondents are woman. The average level of education among participants is quite high, almost 46 % followed a university degree, 30% MBO and 23 % HBO (1 % did not follow higher education). Most respondents (46%) read the newsletter of animal and law, 19.6% of the respondents are animal sciences student and 9.2% veterinarians. 2% of the respondents have professional work with dogs, such as trainer or at a shelter. Almost all participants had a high to very high affinity with dogs and 70% owns a dog or cared for dogs at least 3 days. Only 3.6% declared to have less than average or no affinity with dogs and out of the 512 responders 3 people reacted that they

think it is unethical to own animals. 25% participants stated to have no animals, but they would like to have them. The Kruskal-Wallis test was used to see if the different types of respondents reacted differently. In attachment IV you can find an overview of the details of these tests. The main findings are: People with a low affection for dogs give a higher score for the importance of physical attributes such as pain and less importance to the emotion and mental attribute, compared to people with a high affection to dogs. People below 30 years of age score a higher weight for the importance of physical state, and lower on mobility. People over 30 score this exactly the other way around, higher on mobility and lower on physical scores. Men score the physical aspect and mobility higher than woman, and woman score pain of more importance than men. Dog owners scored the utility scores for all pain levels on average half a point lower than non-dog owners, which is a significant difference. Mobility utility scores from dog owners are significantly lower compared to what non-dog owners scored. There was no significant difference between groups of pet or farm animal's owners. Finally non dog owners score higher on physical aspects and lower on mental, emotional and memory attributes compared to dog owners.

Part 2: Numerical scoring.

According to the reference population of this project, both physical and psychological features should be included in the DHUI. Response results showed that all groups (N=463) regard psychological and physical aspects almost equally important, respectively 48.94 and 51.31 %. All scorings have been analyzed with descriptive statistics and the median scores between groups are compared with the Kruskal-Wallis test. Here table 8 and 9 indicate the scores for weights (importance) given to the different attributes, these weights are used as reference scores in the further research.

Table 8. Physical and mental health mean weight scores by all groups (N=463)

	Mean	Std. Deviation	Variance
Physical	51.31	8.184	66.983
Mental	48.94	8.116	65.869

Table 9. All attributes mean weight scores by all groups (N=451)

	Mean	Std. Deviation	Variance
Mobility	32.33	11.392	129.785
Pain	27.61	12.179	148.340
Emotions	22.80	7.848	61.597
Memory	17.33	7.633	58.257

The importance of the four attributes administered in the questionnaire is as in table 9. Attributes mean weight scores by all groups: Mobility 32.33% (SD 11.39), Pain 27.61% (SD 12.18), Memory 22.80% (SD 7.85), and Emotions 17.33% (SD 7.63).

Table 10. Functionality, levelling and mean utility scores (N=397)

	Mean	Std. Dev	Variance
The dog can do everything without having any problem	9.67	1.04	1.087
The dog has difficulties with certain situations or activities, but can still do all of them.	7.88	1.65	2.708
The dog avoids certain activities or situations	6.92	1.75	3.071
The dog has difficulties with certain situations or activities, which cannot be avoided.	5.53	1.90	3.618
The dog has difficulties with daily occurring situations or activities	4.69	1.97	3.893
The dog cannot perform all daily activities anymore	4.07	2.19	4.785
The dog cannot perform most of the daily activities	2.59	2.36	5.546

In Q12 about the functionality the variation amongst respondents increased when the severity increases. Table 10 shows the description of the functionality levels and their mean scores.

Table 11 and 12 show the description of respectively the attributes pain and mobility. See that the ideal score does not start at 10 and never ends with 0, as in the proposed scoring range.

Table 11. Pain, levelling and mean utility scores (N=402)

	Mean	Std. Dev	Variance
No pain or discomfort	9.81	0.82	0.672
Occasional pain (1x month)	7.84	1.76	3.090
Often pain (1x week)	5.38	1.97	3.894
Continuous pain	2.56	1.97	3.877
Occasional intense pain (1x month)	4.29	2.10	4.409
Often severe, intense pain (1x week or more)	2.25	1.80	3.256
Continuous severe and intense pain	0.62	1.40	1.953

Table 12. Mobility, levelling and mean utility scores (N=394)

	Mean	Std. Dev	Variance
The dog moves easy and normal	9.86	0.67	0.448
The dog sometimes moves stiff or strange	8.10	1.29	1.667
The dog often moves stiff or strange	6.30	1.53	2.342
The dog always moves stiff or strange	4.79	1.88	3.531
The dog cannot make all movements anymore	5.01	1.88	3.543
The dog cannot make all movements anymore and needs a prostheses or wheels	3.86	2.46	6.046
The dog cannot move its legs anymore (only the body and head)	1.33	1.69	2.872
The dog can only lie down	0.50	1.28	1.635

No differences in variances are detected in the utility scorings of the levels in functionality, pain and mobility, except for functionality levels 2, 3, 4. The Levene test indicates that there is a large variation among participants about the importance of functionality for dogs and that the different levels in the attribute functionality have different variation levels. There is also variation in the variance of answers for mobility levels 2 and 3, meaning that the importance of these levels differ in the vision of different participants, compared to the scores given on the other mobility levels.

Part 2: Numerical scorings, differences between stakeholder groups:

Table 13. Mean weights by different groups

(part of) attribute	Animal Sciences Students (N=94)	Veterinarians (N=43)	Newsletter readers (N=269)	Others (N=77)
<i>100 points were divided over two attributes:</i>				
Psychical	52.60	52.27	50.68	50.68
Mental	49.06	47.73	49.32	49.32
<i>100 points were divided over four parts of attributes</i>				
Mobility	31.76	33.07	32.51	32.51
Pain	29.07	30.23	27.34	27.34
Emotions	16.29	14.88	17.74	17.74
Memory	22.76	21.28	22.99	22.99

Tables 14, 15 and 16 present the mean utility scores per stakeholder groups on the attributes functionality, mobility and pain, respectively. On almost all utility scores veterinarians score higher compared to all the other participants. The only significant difference that can be made is for the utility score pain 4 and mobility 6. Were men scored an average of respectively 2.81 and 3.78, compared to 2.38 and 3.91 scored by woman. Between the studied groups there were remarkably low differences, however concerning the pain score 2 and 3 the animal sciences student group had much more variation compared to the other groups. There was also relatively more variance in mobility utility scored for the levels 4 and 5. Finally the perception of pain or emotions in dogs does not have a significant influence of

the scoring of pain, or any of the other attributes. See for detailed Kruskal Wallice test results between veterinarians and animals scientist students attachment III.

Table 14. Mean utility scores attribute functionality

Levels	Animal Students (N=87)	Sciences (N=37)	Veterinarians (N=257)	Newsletter readers (N=67)	Others (N=67)	Mean all groups (N=403)
1 (all ok)	9.90	9.92	9.62	9.76	9.71	9.71
2	8.07	8.14	7.78	8.06	7.87	7.87
3	7.00	7.30	6.78	7.27	6.86	6.86
4	5.52	5.68	5.40	5.52	5.42	5.42
5	4.61	4.70	4.50	4.69	4.51	4.51
6 (worse possible)	3.84	4.41	3.94	3.72	3.84	3.84

Table 15. Mean utility scores attribute mobility

Levels	Animal Students (N=87)	Sciences (N=39)	Veterinarians (N=243)	Newsletter readers (N=66)	Others (N=66)	Mean all groups (N=394)
1 (all ok)	9.85	9.69	9.80	9.94	9.79	9.79
2	8.39	8.13	7.85	8.29	7.98	7.98
3	6.62	6.41	6.08	6.47	6.20	6.20
4	5.09	5.33	4.51	4.89	4.68	4.68
5	5.65	5.31	4.65	4.68	4.90	4.90
6	4.95	3.44	3.47	4.21	3.78	3.78
7	1.64	1.31	1.17	1.32	1.25	1.25
8 (worse possible)	.62	.28	.41	.50	.43	.43

Table 16. Mean utility scores attribute pain

Levels	Animal Students (N=87)	Sciences (N=39)	Veterinarians (N=251)	Newsletter readers (N=67)	Others (N=67)	Mean all groups (N=402)
1 (all ok)	9.71	9.67	9.75	9.87	9.73	9.73
2	9.24	8.23	7.92	7.96	8.20	8.20
3	6.67	5.79	5.08	5.60	5.50	5.50
4	2.86	3.26	2.25	2.72	2.48	2.48
5	4.84	4.33	4.01	4.27	4.20	4.20
6	2.57	2.44	2.00	2.28	2.16	2.16
7 (worse possible)	.69	.85	.43	.45	.53	.53

Part 3: Perception of the participants on dogs.

In table 17 you can see how many % of the respondents believe that dogs have certain emotions. Beside one exception out of N=404, all respondents believe a dog can experience fear (99.5%), also loneliness (95.8%) and anger (78.2%) are accepted emotions in dogs. Believing that dogs have more complex emotions such as jealousy (70.2%), guilt (45.3%) and proud (67.6%) is also common among the participants. *In all the following tables the first nr is the direct count of responses and the number between brackets is the % of these responses relatively to the total amount of answers.*

Table 17. Assumption of emotions in dogs (The number is the amount of responses)

	I don't know	Yes	No	N
Fear	1 (0.25%)	402 (99.5%)	1 (0.25%)	404
Anger	41 (10.15%)	316 (78.22%)	47 (11.63%)	404
Loneliness	10 (2.48%)	387 (95.79%)	7 (1.73%)	404
Jealousy	32 (7.92%)	320 (70.21%)	52 (12.87%)	404
Proudness	53 (13.12%)	273 (67.57%)	78 (19.31%)	404
Guilt	65 (16.17%)	182 (45.27%)	155 (38.56%)	402

This believes in a dog's ability to express complex emotions makes it assumable that the mental states of a dog are considered when judging the QoL. Also assumable is that people think about the QoL as for themselves, subscribing the same emotions to dogs.

In literature three types of dog owners are described by their way of attachment to dogs and decisions to go to the veterinarian. In the questionnaire was asked who they find responsible for a good life ending of the dog, most dog owners did consider themselves. In table 18 you see the overview of answers given on question 16 from the questionnaire.

Table 18. Actors considered responsible for the life ending of the dog

	Nr and % of respondents
Nature (God, destiny)	85 (13.2%)
The veterinarian	151 (23.5%)
The owner	339 (52.8%)
I don't know	8 (1.2%)
Other	59 (9.2%)

In the category 'Other' there was the possibility to give a written answer. Open answers were specified as follows : 6 persons think it depends on the situation, all others mention the veterinarian and the owner should decide together, suggesting the dog should not suffer and the decision should be advised by the veterinarian.

On the question how do dogs sense pain compared to humans, 56.4 % of the people thinks dogs feel pain the same way as humans. Scientific literature confirms this is assumable. Table 19 below shows the results on question 17, on how the reference group expects dogs experience pain compared to humans.

Table 19 Expectations how dogs experience pain

Pain experiences compared to humans	Nr and % of respondents
Worse	24 (5.9%)
The same	228 (56.4%)
Less	53 (13.1%)
Other	99 (24.5%)

In the category 'Other' open answers mostly suggested that dogs may experience pain as subjective as humans, but show it less. Some people mention that dogs do not know where pain comes from and, nor how it stops: they just simply make the best of it. One person mentioned it behavioural cues indicating pain in dogs depends on the owner's reaction, in other words; the pain response is trainable.

In case people think a dog has the ability to feel less pain compared to humans this may result in the overestimation of a dogs QoL, (unknowingly neglecting problems). This subjectivity is a big problem for the DHUI because this group is less likely to visit a veterinarian with their dog and will never use the DHUI. When people think their dogs experience worse pains compared to humans they may underestimate the QoL and go to a veterinarian more quickly. If the veterinarian is up to date to current knowledge about pain estimation he or she corrects for the subjective interpretation of the owner. Most accepted is to think that dogs feel the same pains as humans do and as in human pain experiences there is a large variation within the experience and expression of pain.

The next question was who the respondents think is the best person to judge the QoL. This may indicate how certain dog owners are from their ability to assess the QoL in their dog. See table 20 below for the detailed results. Most persons consider the dog owner or the veterinarian as the responsible person to judge the dogs QoL.

Table 20. Who is responsible for judging the QoL?

	Nr and % of respondents
The owner	138 (34.2%)
The veterinarian	92 (22.8%)
An dog behaviour specialist	48 (11.9%)
I don't know	9 (2.2%)
Other	117 (29%)

In the category 'Other' open answers mostly suggested that the owner and veterinarian should score Quality of Life together. Some people state it depends on the owner or professional and if they are educated well.

Part 4: Consideration of symptoms.

To get an idea what the participants would consider as impacts on the QoL, different symptoms were listed and participants were asked to indicate how harmful they thought an impact would be on the QoL. The previous questions were abstract and did not include clear symptoms. In table 21 the results are shown. Between brackets is the percentage of people out of the total choosing a certain answer, the

other number in the cells is the real number of respondents. It was said that the symptoms would last 1-2 days. Major impacts on the dogs life such as drinking behaviour, senses, alertness, sleepiness are regarded a little harmful, while more easily observed behaviours, such as urinating indoors or howling are regarded as more severe.

Table 21. How the reference group think about symptoms

	Very harmful (QoL goes down)	Harmful	A little harmful	Neutral	Positive (QoL goes up)	I don't know	Responds (N)
The dog eats less	5 (1.31%)	37 (9.69%)	185 (48.43%)	151 (39.53%)	0 (0.00%)	4 (1.05%)	382
The dog eats more	6 (1.57%)	67 (17.54%)	145 (37.96%)	153 (40.05%)	4 (1.05%)	7 (1.83%)	382
The dog drinks less	20 (5.24%)	123 (32.20%)	162 (42.41%)	72 (18.85%)	0 (0.00%)	5 (1.31%)	382
The dog drinks more	14 (3.69%)	115 (30.34%)	124 (32.72%)	111 (29.29%)	6 (1.58%)	9 (2.37%)	379
The dog peeps or howls	78 (20.47%)	153 (40.16%)	95 (24.93%)	49 (12.86%)	0 (0.00%)	6 (1.57%)	381
The dog sees, hears or smells less good	13 (3.40%)	100 (26.18%)	214 (56.02%)	54 (14.14%)	0 (0.00%)	1 (0.26%)	382
The dog is ill (e.g. fever)	77 (20.16%)	230 (60.21%)	65 (17.02%)	8 (2.09%)	0 (0.00%)	2 (0.52%)	382
The dog moves strange or difficult	45 (11.78%)	220 (57.59%)	104 (27.23%)	11 (2.88%)	0 (0.00%)	2 (0.52%)	382
The dog has trouble standing up	34 (8.92%)	195 (51.18%)	134 (35.17%)	17 (4.46%)	0 (0.00%)	1 (0.26%)	381
The dog is less alert	12 (3.15%)	106 (27.82%)	206 (54.07%)	53 (13.91%)	0 (0.00%)	4 (1.05%)	381
The dog is less active	7 (1.83%)	92 (24.08%)	219 (57.33%)	62 (16.23%)	0 (0.00%)	2 (0.52%)	382
The dog is more active (restless)	6 (1.57%)	79 (20.68%)	208 (54.45%)	76 (19.90%)	6 (1.57%)	7 (1.83%)	382
The dog is in pain	116 (30.37%)	228 (59.69%)	36 (9.42%)	1 (0.26%)	0 (0.00%)	1 (0.26%)	382
The dog lays down more than usual	15 (3.93%)	115 (30.10%)	172 (45.03%)	75 (19.63%)	0 (0.00%)	5 (1.31%)	382
The dog has diarrhoea	46 (12.04%)	171 (44.76%)	143 (37.43%)	20 (5.24%)	0 (0.00%)	2 (0.52%)	382
The dog is dizzy	73 (19.16%)	221 (58.01%)	70 (18.37%)	4 (1.05%)	0 (0.00%)	13 (3.41%)	381
The dog sleeps a lot	11 (2.88%)	61 (15.97%)	144 (37.70%)	154 (40.31%)	3 (0.79%)	9 (2.36%)	382
The dog sleeps not a lot	7 (1.85%)	85 (22.43%)	163 (43.01%)	111 (29.29%)	4 (1.06%)	9 (2.37%)	379
The dog is fearful more quickly	14 (3.67%)	137 (35.96%)	195 (51.18%)	28 (7.35%)	1 (0.26%)	6 (1.57%)	381
The dog is angry more quickly	21 (5.51%)	140 (36.75%)	172 (45.14%)	30 (7.87%)	0 (0.00%)	18 (4.72%)	381
The dog is too fat	97 (25.39%)	220 (57.59%)	56 (14.66%)	7 (1.83%)	0 (0.00%)	2 (0.52%)	382
The dog is too thin	57 (14.96%)	194 (50.92%)	105 (27.56%)	22 (5.77%)	1 (0.26%)	2 (0.52%)	381
The dog appears unhappy	58 (15.30%)	175 (46.17%)	112 (29.55%)	22 (5.80%)	0 (0.00%)	12 (3.17%)	379
The dog seems to become a bit dumb (memory loss)	13 (3.42%)	86 (22.63%)	183 (48.16%)	91 (23.95%)	0 (0.00%)	7 (1.84%)	380
The dog suddenly eliminate indoors	54 (14.17%)	163 (42.78%)	134 (35.17%)	29 (7.61%)	0 (0.00%)	1 (0.26%)	381
the dog reacts different on touching	36 (9.47%)	175 (46.05%)	128 (33.68%)	35 (9.21%)	0 (0.00%)	6 (1.58%)	380

On page 32, table 22 indicates to which extent these symptoms would result in the action to visit a veterinarian. Again between brackets is the percentage of people out of the total choosing a certain answer, the other number in the cells is the real number of respondents.

The respondents could also indicate "Other" and explain where they would gain advice, a couple of times dog trainers, etiologists and pet shops were mentioned.

More than half of the participants consider it very harmful - to harmful when a dog gets more fearful or quicker angry than before. More harmful it is when a dog appears 'unhappy'. For these psychological

changes around half of the participants would go to a vet with their dog within 2 days or less than a week. Overweight and overeating are not regarded as problem in which a veterinarian plays a crucial role. The dog making sounds, being ill, being in pain or being dizzy are the main reasons to directly consult a veterinarian.

Table 22. Time indication whether action is taken to go to a vet by certain symptoms.

	Yes, I would go to a vet immediately or within 2 days.	Yes, if the symptoms last longer than 2 days I would go to a vet.	No help needed	I don't know	Responds (N)
The dog eats less	15 (3.97%)	269 (71.16%)	74 (19.58%)	20 (5.29%)	378
The dog eats more	4 (1.06%)	136 (35.98%)	204 (53.97%)	34 (8.99%)	378
The dog drinks less	40 (10.61%)	236 (62.60%)	84 (22.28%)	17 (4.51%)	377
The dog drinks more	32 (8.40%)	250 (65.62%)	82 (21.52%)	17 (4.46%)	381
The dog peeps or howls	176 (46.93%)	143 (38.13%)	45 (12.00%)	11 (2.93%)	375
The dog sees, hears or smells less good	49 (12.86%)	199 (52.23%)	120 (31.50%)	13 (3.41%)	381
The dog is ill (e.g. fever)	274 (72.30%)	94 (24.80%)	6 (1.58%)	5 (1.32%)	379
The dog moves strange or difficult	147 (38.79%)	210 (55.41%)	17 (4.49%)	5 (1.32%)	379
The dog has trouble standing up	92 (24.34%)	232 (61.38%)	44 (11.64%)	10 (2.65%)	378
The dog is less alert	44 (11.55%)	220 (57.74%)	96 (25.20%)	21 (5.51%)	381
The dog is less active	28 (7.39%)	206 (54.35%)	118 (31.13%)	27 (7.12%)	379
The dog is more active (restless)	22 (5.84%)	186 (49.34%)	143 (37.93%)	26 (6.90%)	377
The dog is in pain	287 (75.53%)	86 (22.63%)	2 (0.53%)	5 (1.32%)	380
The dog lays down more than usual	34 (8.97%)	200 (52.77%)	128 (33.77%)	17 (4.49%)	379
The dog has diarrhoea	138 (36.51%)	207 (54.76%)	27 (7.14%)	6 (1.59%)	378
The dog is dizzy	210 (55.26%)	137 (36.05%)	13 (3.42%)	20 (5.26%)	380
The dog sleeps a lot	13 (3.42%)	185 (48.68%)	149 (39.21%)	33 (8.68%)	380
The dog sleeps not a lot	13 (3.42%)	177 (46.58%)	155 (40.79%)	35 (9.21%)	380
The dog is fearful more quickly	16 (4.27%)	171 (45.60%)	146 (38.93%)	42 (11.20%)	375
The dog is angry more quickly	19 (5.11%)	170 (45.70%)	138 (37.10%)	45 (12.10%)	372
The dog is too fat	37 (9.81%)	105 (27.85%)	208 (55.17%)	27 (7.16%)	377
The dog is too thin	59 (15.61%)	163 (43.12%)	134 (35.45%)	22 (5.82%)	378
The dog appears unhappy	32 (8.58%)	159 (42.63%)	136 (36.46%)	46 (12.33%)	373
The dog seems to become a bit dumb (memory loss)	11 (2.93%)	159 (42.29%)	180 (47.87%)	26 (6.91%)	376
The dog suddenly eliminate indoors	110 (29.10%)	222 (58.73%)	37 (9.79%)	9 (2.38%)	378
the dog reacts different on touching	89 (23.99%)	211 (56.87%)	50 (13.48%)	21 (5.66%)	371

4.2 The Dog Health Utility Index

From the reference attribute weights and reference utility scores the following DHUI is defined. In table 23 a symptom check list is given which can be used to indicate pain, mobility problems, and the mental state and cognition level. The utility score has to be determined by observing the dog and categorizing it by table 24, Utility score per level of attribute pain, and table 25, indicating the utility score per level of attribute mobility. The mental and cognition score will be an estimated score between 0 and 10, in which in 10 the best possible QoL and 0 is the worse. The estimation is favourably done by the dog owner and veterinarian together. The four utility scores will then be multiplied with the weights from the column U in table 23 and multiplied by the weights in the last column.

Table 23. QoL scoring index example

A	Attributes	Symptoms check list	Score (U)	Weight(w)
Physical health				
1	Pain	Gesture , Changes in behaviour, Licking specific area, visible wounds, swellings, warm area, activity level	...	27.6
2	Mobility	Activity level, lameness, flexibility in movements, ease of standing up or jumping.	...	32.3
Psychological health				
3	Mental state	The relation between positive and negative experiences	...	22.8
4	Cognition	Brain function, consciousness, memory, trainability	...	17.3
Total				100%

Table 24. Utility score per level: Attribute pain

Level	Utility score
No pain or discomfort	9.81
Occasional pain (1x month)	7.84
Often pain (1x week)	5.38
Continuous pain	2.56
Occasional intense pain (1x month)	4.29
Often severe, intense pain (1x week or more)	2.25
Continuous severe and intense pain	0.62

Table 25. Utility score per level: Attribute mobility

Level	Utility score
Moves easy and normal	9.86
Moves sometimes stiff or strange	8.10
Moves often stiff or strange	6.30
Moves always stiff and strange	4.79
Cannot make all movements anymore	5.01
Cannot make all movements anymore and needs a prostheses or wheels	3.86
Cannot moves its legs anymore (only body and head)	1.33
The dog can only lie down	.50

The mental state and cognitive abilities can be estimated between 1 and 10 in cooperation with the owner to determine the mood of the dog. This is, however a very subjective step within the DHUI. In human science the emotional and cognitive attribute are given utility scores like the other attributes, based on the impact a state has on the subjects its life (Torrance et al. 1996).

A limit should be set on scores lower than 4.5 as this represents a serious implication of the QoL and the situation should be changed as soon as possible. In the questionnaire to gain reference scores by the Dutch stakeholders a utility score of 4.51 is given to a dog that has difficulties with daily occurring situations or activities (see table 14, page 29). This score can be used as an indication of serious negative QoL.

A final score indication based on the determined DHUI:

0-3 is a very poor QoL, euthanizing the dog may be proposed
 3-5 is a very low QoL, improvements must be made directly
 5-6 is a low QoL, improvement is strongly recommended
 6-8 is an acceptable QoL
 8-10 is a good to ideal QoL

5. Example professional use DHUI

5.1 Degenerative joint disease

Degenerative joint disease (DJD) is defined as the progressive and permanent long-term deterioration of the cartilage surrounding the joints. Arthritis is the medical term for inflammation of the joints, while osteoarthritis is the term referring to a form of chronic joint inflammation caused by deterioration of joint cartilage. It is a common disease especially in older dogs and large breeds. The specific cause is unknown, but the disease is heritable and can be easily worsen due to hip dysplasia and overweight. Especially the inflammations are very painful, but also the whole condition leads to chronic pain and functional impairment (Kapatkin *et al.* 2002). Dogs affected with DJD due to hip dysplasia show looseness in the hip joint while not all dogs with loose hip joints develop DJD (Remedios and Fries 1995). Due to hip dysplasia an abnormal wearing of the joint can increase the change and severity of DJD. Overweight creates extra forces on the joints, stressing them and also provoking abnormal wearing of the joints. There is not one treatment recommended and treatment does not guarantee recovery of normal functioning. Maintaining a healthy normal weight and regular activity are recommended. Medicines can be prescribed to treat symptoms as the inflammation and pain. Dogs with hip dysplasia and moderate to severe DJD that are non-responsive to conservative management are candidates for surgery (Remedios and Fries 1995). Treatment should be initiated only if there is a significant likelihood of improving the dogs QoL compared to that of an untreated patient (Kapatkin *et al.* 2002). Little is known about the benefits of non-surgical versus surgical treatments in dogs used for work or sport (Kapatkin *et al.* 2002). Dogs not responding to non-surgical treatment will need either a total hip replacement or femoral head and neck excision arthroplasty as saving procedures (Kapatkin *et al.* 2002).

The post-operative care of a total hip replacement is fairly extensive, requiring at least 6 to 8 weeks of cage rest. Post-surgical infection is a major concern with this procedure. This means that prophylactic antibiotics should be administered to the dog when other surgical or dental procedures are done, and its overall health should be monitored closely. After carefully considering the pro's and cons of hip surgery most clients do not continue with the procedure (Kapatkin *et al.* 2002). 75% of the dogs with hip dysplasia can live normal quality lives with thoughtful non-surgical management (Kapatkin *et al.* 2002). In these cases the current situation is compared to the benefits and contradictions of the treatment, in which costs are involved as well. The dogs preferences as in a DHUI are not included clearly.

5.2 Hypothetical case

Bella, a 30 kg German Sheppard, 8 years old, has severe DJD in both hind leg hips. She is reluctant to stand up and when going to lying down she is always hesitating. This shows by walking around a couple of times on her bedding before lying down. Her owner, an older lady is not strong enough to carry the dog. Bella has trouble walking stairs, therefore she stays downstairs. Previously Bella was always allowed to go upstairs, and sleep in the owner's bedroom. Since the DJD she cannot come upstairs anymore. The dog is a bit overweight and her fur looks shabby. They don't go out for long walks, as both owner and dog are tired quickly and the owner states; *"Bella does not really like to go out, especially not when the weather is cold and wet... she just walks so slowly."* When they meet other dogs Bella usually greets friendly but when another dog 'provokes' her to play or chase she gets agitated quickly.

The following pages illustrates how the DHUI can be used as independent tool, see table 26 for the function and descriptive overview. It is assumed that the dog will live only one more year, therefore the ADB will be used to determine the best treatment if only one extra life year is available for the dog.

Table 26 indicates the DHUI in use when relating to the example of Bella. In the symptom check list now more descriptive notes are given to indicate what could be taken into account. The weights were derived from the results of the reference questionnaire and the score U is new in this example.

Table 26. QoL scoring index example				
A	Attributes	Symptoms check list	Score (U)	Weight (w)
Physical health				
1	Pain	<i>The low activity level and the reluctance to stand up and walk stairs are indications the dog has pain. Also the agitation shown to other dogs can indicate that she is afraid to be hurt and does not feel secure around them. By radiographic research, palpitation and stretching of the joint painful areas can be identified. Level 4 continuously pain would be identified.</i>	2.48	27.6
2	Mobility	<i>The low activity level and the reluctance to stand up and walk stairs show the mobility level of the dog. Also the shabby fur can be a sign that the dog has problems to scratch and clean her own coat. Level 5 the dog cannot make all movements anymore would be scored.</i>	4.9	32.3
Psychological health				
3	Mental state	<i>The dog has almost all day time company of the owner, of which are positive interactions. The dog does not like walking but has to go outside this may be an implication on the QoL. The dog isn't used to being alone; after the owner goes to bed Bella is restless.</i>	5.0	22.8
4	Cognition	<i>The dogs cognitive abilities are ok, she is still aware of all what is happening around her.</i>	9.0	17.3
Total				100%

$$\text{DHUI} = U_{A1} * w1 + U_{A2} * w2 + U_{A3} * w3 + U_{A4} * w4$$

$$2.48 * 0.276 + 4.9 * 0.323 + 5 * 0.228 + 9 * 0.173 = \mathbf{4.96 \text{ out of } 10}$$

The mental state and cognitive abilities are estimated in cooperation with the owner. Because there is a score (pain) below 5 reconsideration of this dog's QoL is strongly recommended. The overall scoring or the DHUI is 4.96 which is correct concerning the description of symptoms and the score given for a similar functionality level by participants of the questionnaire:

The dog has difficulties with daily occurring situations or activities.

The final decision to undertake action depends on the risks that come with a treatment. If the risks are unknown probabilities for certain QoL outcomes can be estimated and presented in a decision tree.

5.3 DHUI use in context

Now the DHUI is placed in a complex veterinary medicine context, by using a scheme similar to a Multi Attribute Decision Making (MADM) tool a better overview off all interests is presented (Mourits *et al.* 2010). Multiple decisions factors related to the ADB and the owner can be included. Here the first priority is given to the improvement chance of the dogs QoL.

If the dogs QoL is not the first priority the outcome of the MADM depends on owner preferences and external factors such as the financial situation. It also depends on which alternatives are selected. Perhaps another veterinarian would do the treatment cheaper or offers more solutions. The changes are estimations and the uncertainties around these estimations are unknown. For example by not adjusting any treatment the future risk that the dog falls or gets secondary illnesses increases. The more precise information is used to set up equations, the more realistic will be the outcome. In table 27 the hypothetical example from the previous case with Bella the German Sheppard is presented in a more complex decision context. The 3 treatment solutions include surgery, medicines and no treatment. The chance for success on these treatments, the duration and improvement are estimated. The QoL scores are determined with the DHUI. The treatments are compared over the resting lifespan of the dog, which is 1 year. Consequently the ADB will be calculated over one year, starting the treatments on day 1.

Table 27. Application of DHUI in a decision overview

Treatment	Chance for success	Duration of the treatment	QoL during treatment QoL	Expected QoL outcome QoL	Changes in QoL within a year when successful <i>1 month is 8.33 % of the coming year (2 months*QoL₁)</i>	Overall QoL expectation within a year
Surgery both hips	0.7	2 months	3.5	8	$0.1666 * 3.5 = 0.5831$ <i>(10 months*QoL₂)</i> $0.8334 * 8 = 6.6672$ $0.5831 + 6.6672 = 7.25$	$0.7 * 7.25 = 5.071$ $0.3 * (0.5831 + 0.8334 * 4.48) = 1.295$ $5.071 + 1.295 = \mathbf{6.366}$
Sedative Medicines	0.95	continuous-ly	6.5	6.5	$6.5 * 1 = 6.5$	$0.95 * 6.5 = 6.175$ $0.05 * 4.48 = 0.224$ $6.175 + 0.224 = \mathbf{6.399}$
No treatment	1	none	4.96	4	The symptoms of the disease will increase in time $4.96 * 0.5 = 2.48$ $4 * 0.5 = 2$ $2.48 + 2 = 4.48$	4.48

Individual animal disease burden is calculated, by the estimated QoL over a period of time. In human practices the term 'disease burden' is often used for environmental and societal issues, including costs, morbidity and mortality (WHO 2003). In this research ADB relates to individual cases. Figure 4 shows the changes in QoL indicated by the surfaces in the graph. The overall QoL expectation is indicated in figure 3 by the surfaces of the graphs, which represents the development from the ADB per treatment.

The ADB here is determined by the *Ideal QoL - Expected QoL*; indicating the empty area above the graphs columns.

The following ADBs play a role:

ADB for the surgery is:

$$10 - 6.366 = 3.634$$

ADB for sedative medicines is:

$$10 - 6.399 = 3.601$$

ADB for no treatment is:

$$10 - 4.48 = 5.52$$

The lowest disease burden is created by the treatment with sedative medicines, therefore based on QoL this would be the most animal friendly treatment choice.

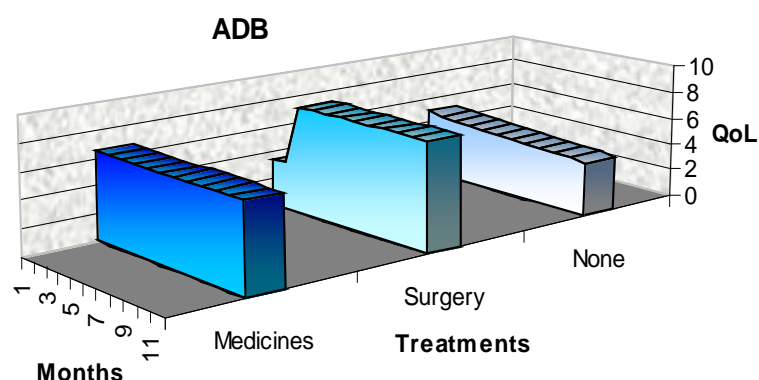


Figure 4. Graphical representation of ADB

The previous calculations for ADB in table 27 were done exclusively on the importance of QoL and the dog's welfare. Below in table 28 more factors influencing the medical decision are discussed. The MADM organizing method for complex decisions is used as example to organize the decision. Again the calculations are done for the treatments (respectively from high to low in table 28), surgery on both hips, sedative medicines and no treatment over a period from 1 year.

Table 28. investments by owner in a decision overview

Costs treatment	Personal sacrifices	OUTCOME
<i>(Extra costs related to the treatment, spread over expected lifetime) Expecting she will live 1 more year</i>	<i>(Weight for: Care, Time, Guilt feelings etc.)</i>	<i>This is a personal decision based on all the information available.</i>
2*1500=€ 3000 3000/365= € 8.2 per day	The treatment demands 8 weeks of intensive care, afterwards it will be easier. This lady has to have someone else help her during this time.	Concerning the circumstances that the owner cannot provide the care this option does not seem preferable
365*0.5= €182.50 €0.5 per day	The dog has to get medication 2 times a day the rest of its life.	Most likely outcome
Free, but an increased risk for unexpected costs, such as when the dog falls and breaks a toe or leg.	Guilt feelings for not treating the dog.	Unsustainable solution

Regarding owner investments and the assumptions (such as that the animal will only live one more year) again the treatment with sedative medicines would be the best treatment solution.

In this case €182.50 is worth an increase of 1.849 ADB. (ADB (*treatment with sedative medicines*) - ADB (doing nothing) = 6.399-4.48 = 1.849.)

What happens if Bella lives two year after the day that treatment decisions are taken?

Costs:

For the surgery, treatment 1, the costs can be spread over another year. $3000/730 = € 4.1$ per day.

The sedative medicines, treatment 2, have to be given another year extra. This treatment will than costs €365 m still 50 ct a day.

For doing nothing the QoL will decrease more than 4.48 and there is a higher risk for additional complications.

Benefits, compared to doing nothing stays QoL 4.48.

Treatment 1 creates an increase in 2 years of starting 6.366 + another year QoL 8 = $(6.366 + (0.7 * 8 + 0.3 * 4.480))/2 = 6.655$; so over 2 years the average QoL 6.655 is 2.175 higher than doing nothing

Treatment 2 has the same QoL for year one and two, 6.399, which is an increase of 1.919 compared to doing nothing.

Treatment 1 gives a QoL increase of 2.175 for € 3000.

Treatment 2 gives a QoL increase of 1.919 for €365.

Also with a lifespan of two more years from the day of treatment start, treatment two, the sedative medicines are the best option from an economical point of view.

6. Discussion

The aim of this study was to start the development of a DHUI and to see how a DHUI can be applied. As well during the literature study as during the conversion from the questionnaire into the HUI index discussion points became apparent.

The first point is to find the right definition for the term QoL. The definition used by Taylor and Mills (2007) describes QoL as a moment in time. While the actual name "Quality of Life" may be mistaken for a 'lifetime', it has to be clear that the QoL is point estimation. When defining ADB it was also difficult to give a definition. In human medical science disease burden is a term used to indicate morbidity, mortality, environmental and social impact (WHO 2003). Here ADB are compared to QALY's giving the decrease in QoL due to a disease over a period of time on an individual animal level. Social and environmental issues are not included in the DHUI, because they do not directly consider the QoL of the dog. However they can be included in overall MADM tool. Because the goal of the DHUI is based on QoL estimations the use of this term is continued. It is practical to be able to assess at 1 moment in time, this is a practical approach also supported by Taylor and Mills (2007); Schneider *et al.* (2010)).

To increase the objectivity the DHUI challenges to minimize subjectivity in judging the dogs QoL. This is done by using a reference population from the Netherlands and standardized utility scores. The major challenge is to create uniform behavioural observations using the DHUI description which is coming along with the different levels within the attributes. This point is not worked out in this research and certainly needs attention in the future. By for example let a case as in this research be scored by multiple veterinarians and minimize the insecurities to increase scoring reliability. Options for increased observer objectivity are by video based levelling indicators and to make veterinarians and dog owners score the different attributes together.

A major challenge when making a DHUI concerns the differences in Umwelt between humans and dogs. Discrepancies can occur between the interpretation (and certain level of consciousness of experiences) by the dog, their expressed behaviour and the observations and interpretations of humans as proxy. Additionally Taylor and Mills (2005) state there is still a lack of evidence on the preferences of companion animals. Most researchers consider all dog breeds to have breed specific motivations and needs. Hewson *et al.* (2007) remarked that selective breeding not definitely influences the emotional adaption as well. Meaning that all breeds may have the same needs and motivations, however some breeds are bred to react docile in situations that they may actually experience as frightening. More research is needed to know if breeds are emotionally adapted, or that this implies that dogs can control their emotions and that they can choose to express a behaviour that does not corresponds with their emotions. Therefore dogs should have a certain consciousness of themselves in the environment. To estimate how much emotions and consciousness going along with this emotions people were asked which emotions they thought dogs can have. Another research uses this method as evidence that dogs actually can have complex emotions. However this is not a scientific sound method, nevertheless Morris *et al.* (2008) don't agree with the assumption that this is no more than a reflection of what (anthropomorphic) people believe. When dog owners (N=337) were asked to score emotions in their dogs, primary emotions were reported by 88% of the dog owners and secondary emotions by 55%. In particular jealousy and guilt stand out as reported respectively by 81 % and 74% of the dog owners (Morris *et al.* 2008). In this research the secondary emotions as jealousy and guilt are supposed by respectively: 79.2% and 45.3 % of the participants. Behavioural analysis of owners' observations of jealousy suggest that dogs can actually be jealous about sharing affection, and dogs try to get attention by moving between the owner and the second subject. The consciousness of dog's and its emotions remains unclear therefore the QoL estimation never can be 100% objective.

The attributes are chosen to give a more objective view of the QoL, the main important attributes, such as pain and mobility are treated. The attributes are formulated as the simplest approach by a linear function, which does not represent reality. Symptoms may overlap different attributes and these interspecific relations are ignored. Multiple attributes will score the same issue. This problem can be overcome by asking questions concerning single dimensioned symptoms, independent of the cause.

In the questionnaire pain was given by two variables namely duration and severity, which caused more variation in answers than necessary. Intensity, severity and duration of symptoms should been taken

into account separately. The aspects of duration and intensity of a motivation or symptom has not been taken into account in any previous QoL assessment tool for dogs yet. It should be questioned if duration should not be taken into account per attribute as the QoL is a moment indication. In this research reference weights are gained to weight the attributes importance in the formule. However Budke *et al.* (2008) and Wojciechowska *et al.* (2005) state that there is no golden standard for the weight of the QoL attributes, recommending that dog's individual preferences are determined by the vet and owner together. If this is done before a dog gets ill this can be a good option, however when the dog is already diseased it may increase the subjectivity in the decision due to the disability paradox. Budke *et al.* 2008 showed by a study between healthy dogs and dogs with spinal cord injuries that owners give different weights to attributes. So the humans view on what is important for the animals QoL changes when the animal gets ill, this is called the disability paradox. Also the animal relationship may be influenced by the dog illness (Scheider *et al.* 2010). Especially companionship is regarded much more important (39 out of 100) compared to (29 out of 100) for healthy dogs. Play and mental stimulation is concerned much more important for healthy dogs. In a study about QoL in geriatric horses it was seen that horse owners do not observe all diseases as relevant, and may score relatively high QoL for sick horses, probably also due to the disability paradox (Ireland *et al.* 2011). It is currently unclear how this change in observation effects the QoL estimation for the dog in future medical decisions. Here it is shown that dog owners consider problems involving mobility or pain worse than non dog owners. Veterinarians give higher utility scores, indicating they regard the same issues as less negative for the QoL. By allowing owners to give weight to the attributes of the QoL you get a more personalized approach. However it should be very well explained to them what the different attributes concerned and the scoring could be done best in cooperation with a vet. Vets score more clinical signs, while owners see other aspects such as recovery time and social behaviour (Christiansen and Forkman 2007). The DHUI should encompass good observatory guidelines, perhaps including pictures and video's, to help the vet and owner to score by the same perspective and for example limiting underestimations. Beside the observatory guidelines also the scoring should be guided very well to minimize error of central tendency and to motivate people to use the whole scoring scale to get a most objective impression of QoL as possible.

Another point of discussion is the age of the dog related to the questionnaire. the reference scores are not age related. People may perceive a veterinary medical decision differently for a young or elder dog. The investments done for a treatment and the direction of symptoms are perceived differently with the age of the dog. A frequent comment on the questionnaire was that people would score differently for an elderly compared to a young dog. It was not clear what exactly would be the difference. In this study the age was reflected in the case study by indicating the lifespan still left alive. However A lifesaving surgery may for example be more 'worth' in respect to life lengthening for a young dog compared to an elderly dog. This can be visualised by ADB as in a graph such as figure 4 on p. 36. Consequently young animals are likely to have a higher final QoL score. Overall it seemed that people easily give their opinion on paper, logically when financial or emotional aspects do not play a role.

The results gave a good indication in the development of utility scores by certain levels of symptoms. The variation in the utility scores for pain, for which deviation was made in duration and intensity, illustrates how participants know that attributes effect on QoL are not linear. Currently the application of non linear utility scores is not researched. Not only are preferences not linear, positive and negative states may also not be the opposite of each other. Meaning that for example loneliness can be experienced as a much more negative, than company is positive. For now there could be a deviation made in positive and negative experiences and the severity of symptoms and link them to the decrease or increase of QoL. Here the mental state is left to be judged by someone who knows the dog, which is a highly subjective judgment. The weights of the utility scores indicated that mobility was regarded as more important than pain. This is surprising as in multiple literature study's pain is given as the main influence for euthanasia decisions and QoL assessments. An explanation that lower pain scores are relatively high among vets can be that they see pain more regularly than the other participants of the questionnaire and are therefore more used to it. Remedios and Fries (1995) and Kapatkin *et al.* (2002) state in studies about DJD that treatment that results in lameness is preferred above pain. An explanation may be that participants consider mobility as most important because they think good mobility comes without (severe) pain. The other way around, a dog without pain may not be assured of good mobility.

In human health indices there sometimes is also a possibility to score below zero, meaning that the QoL is very negative, and the assessed person prefers to be death. This is not done in any index for animals

and it was decided not to be introduced here. Yeates (2011) stated that death represents a state without experiences and as such may be said to be neutral. Not worth living or avoiding in itself. Death may therefore be a preferable to life in which the overall balance of unpleasant experiences outweighs the pleasant experiences across an animal's lifetime. In other words there is a certain point in which the rest of the animals QoL is not worth living anymore. QoL is currently humanized concept which used valued terms, such as acceptable, good, bad, judging animals by a human like perspective. Yeates (2011) describes in the future terms in the animals' perception should be used. This could be described in a life worth living or a life not worth living. However there is no evidence that dogs can think in states, values or preferences which consider life or death. There is a moment that dogs may separate themselves from the pack or stop eating, which in human perception may lead to the idea that the dogs know their death is near, we just do not know. The score zero in this research was presented to the participants as a state in which the dog was so ill or unhappy that it would be preferably death. Many participants scored zero for the most negative levels in pain and mobility.

There is also an influence of the owner's behaviour (e.g. reaction to a painful situation), training, and dogs' previous experiences may influence the QoL expressed by a dog. The following text was received from a dog owner after she participated in the questionnaire. *"We own eight dogs from different breeds and backgrounds and we take care of two to six guest dogs daily. We keep them in groups of small and bigger dogs, depending on what fits the best to the dog. The ages of the dogs are between 1.5 and 14 years old. The smallest is a Jack Russel, the oldest a Teckel and the biggest a Golden Retriever. Since a week we have a Coton, tomorrow a Pincher arrives and the day after a Schnauzer as guests. As you see we have experience with many breeds. However it is still very hard to determine when life joy is overruled by pain. Training from Martin Gaus (a famous Dutch dog trainer) gave us many insights. But I wonder if even dogs without pain are also happy. We have experienced that guest dogs had problems when coming home again; they did not eat and were drained. The vet used to say that the guest dogs must have been missing the pack and attention they got during their stay here. After a couple of days the situation improved showing the adaptive capabilities of those dogs."* by A. de Vries (2012). This response illustrates how psychological health influences the dogs QoL in this case by physical symptoms as not eating and being drained. Other indications of stress due to changes are known such as when a pall or owner dies or when is moved to a different environment.

Schneider *et al.* (2010) studied the attachment relationships between owner and dog and how this influences QoL assessments. In this DHUI animal owner relationships are not included because answers relate closely to training method, of which the effects on the QoL are unknown. For example the QoL of a dog may be negatively influenced by leaching a dog when it really wants to run. However by young dogs this is necessary to prevent the growing joints from being overload. Or punishment and dominance can be viewed as necessary, corresponding to a life in a pack, however we are humans (not dogs) so inter species relationships may be of different in the Umwelt of dogs.

A positive aspect of the DHUI is that the use of QoL not only describes a life worth living but also the positive aspects of that life. It does not describe obligatory minimum requirements, but relates to a higher score when the dog feels better.

7. Conclusion

This research shows that the HUI can be changed into a DHUI for domesticated dogs. The main use of such tool would be to increase the objectivity in veterinary treatment decisions in dogs. It shows that even with a minimum of attributes an increasingly objective vision can be created. The QoL and ADB structure the decision in such a clear way that the most effective treatment can be chosen. The hypothetical case clearly shows the application possibilities from the DHUI in a MADM. The DHUI will increase the importance of animal welfare in decision, although the decisions will never be fully objective. Dog owners and vets will subjectively influence the decisions in multiple ways. Amongst others by the discrepancies between the proxies vision and the dogs experiences, the lack of knowledge, financial and emotional reasons. Ethology will be a valuable research field contributing to the development of a more objective QoL assessment tool (Christiansen and Forman 2007). For the time being, knowledge from other field such as cognitive neuroscience and evolutionary biology can and should be used to make reasoned assumptions about the cognitive and emotional lives of dogs and act accordingly (Bradshaw and Casey 2007). For use in real practise the DHUI should have more clear behavioural observational guidelines to indicate clearly how to score certain states. Also the study about the attributes and the effect of overlapping attributes should be deepened more to be able to correctly indicated errors. The development of a DHUI is regarded valuable, more even when all characteristics are taken into account.

The use of a DHUI is expected to help vets improving their ability to accurately define health problems and lower the variation amongst each other, and thus lower the risk of underestimation of problems. The DHUI is designed to improve, and increase awareness of dogs QoL. It will ease the decision making when dogs preferences are estimated in advance, **increasing the rationality of decision making in more difficult situation later in the dogs life. In this way the disability paradox will be more transparent and it will be easier to reflect to owners when it occurs.** The DHUI can be used as a communication tool between owners and vets to explain the QoL, and describe the symptoms by a clear levelling in attributes. It aims to provide dogs to life in better QoL and to improve QoL, and not necessary the life length. The DHUI is expected to be a useful tool in decreasing the subjectivity in difficult veterinary treatment decisions and increasing the importance of a good QoL for the dog.

References

- American Pet Products Manufactures Association (APPMA) 2007 Industry statistics and & trends. Retrieved from: <http://www.Appma.org> on 6-9-2007. Tesfom, G. and Birc, N.(2010) "Do they buy for their dogs the way they buy for themselves?" *Psychology & Marketing* 27(9) 898-912
- Anil, S.S., Anil, L., Deen, J. (2002) "Challenges of pain assessment in domestic animals" *Journal American Veterinary medical Association* 220(3)
- Anon (1993) "Report on Priorities for Animal Welfare" Research and Development, FAWC, London.
- Arnold, D., Girling, A., Stevens, Lilford, R. (2009) "Comparison of direct and indirect methods of estimating health state utilities for resource allocation: review and empirical analysis" *British Medical Journal* 339
- Barnard C.J. and Hurst, J.L. (1996) "Welfare by design; the natural selection of welfare criteria" *Animal Welfare* 5 405-433 IN Bradshaw J.W.S. and Casey R.A. (2007) "Anthropomorphism and anthropocentrism as influences in the quality of life of companion animals" *Animal Welfare* 16 149-154
- Bracke, M.B.N and Hopster, H. (2006) "Assessing the importance of natural behaviour for animal welfare." *Journal of Agricultural and Environmental Ethics* 19 77-89
- Bradshaw J.W.S. and Casey R.A. (2007) "Anthropomorphism and anthropocentrism as influences in the quality of life of companion animals" *Animal Welfare* 16 149-154
- Boissy, A., Arnould, C., Chaillou, E., Désiré, L., Duvaux-Ponter, C., Greiveldinger, L., Leterrier, C., Richard, S., Roussel, S., Saint-Dizier, H., Meunier-Salaün M.C., Valance, D., Veidier, I. (2007) "Emotions and cognition: a new approach to animal welfare." *Animal Welfare* 16(s) 37-43
- Brockman, B.K., Taylor, V.A., Brockman, C.M. (2008) "The price of unconditional love: Consumer decision making for high-dollar veterinary care" *Journal of Business research* 61 397-405
- Budke, C.M., Levine, J.M., Kerwin, S.C., Levine, G.J., Hettlich, B.F., Slater, M.R., (2008) "Evaluation of a questionnaire for obtaining owner- perceived, weighted quality of life assessments for dogs with spinal cord injuries" *Journal American Veterinary medical Association* 233(6)
- Clemen, R., and T. Reilly. "Structuring decisions. Making Hard Decisions with DecisionTools" . Pacific Grove, CA: Duxbury (2001): 43-110.
- Christiansen, S.B., Forkman, B. (2007) "Assessment of animal welfare in a veterinary context- A call for ethologists" *Applied Animal Behaviour Science* 106 203-220
- Churchill, G.A. (1995) "Marketing Research, methodological foundations" The Dryden Press, G edition USA
- Curtis S. (2007) "Commentary: performance indicates animal state of being: a Cinderella axiom?" *Professional animal Scientist* 23(6) 573-583
- Dantzer, R. and Mormède, P. (1983) "Stress in farm animals: a need for re-evaluation". *Journal of Animal Science* 57 6-18
- Denton, D.A., McKinley M.J., Farrel, M., Egan, G.F. (2009) "The role of primordial emotions in the evolutionary origin of consciousness." *Consciousness and Cognition* 18 500-514 IN Yeates, J.W. (2011) "Is a life worth living' a concept worth having?" *Animal Welfare* 20 397-406
- Dodgson, J., Spackman, M., Pearman, A., Philips, L., 2000. "Multi-Criteria Analysis: A Manual." Department of the Environment, Transport and Regions. London, 145pp. ISBN: 1 85112 454 3

FAWC 1979 "Farm Animal Welfare Council-Press Release" website consulted 1-2-2012
<<http://www.fawc.org.uk/freedoms.htm>>

Föllmi, J., Steiger, A., Walzer, C., Robert, N., Geissbühler, Doherr, MG., Wenker, C. (2007) "A scoring system to evaluate physical condition and quality of life in geriatric zoo mammals" *Animal welfare* 16-309-218

Fraser, D. (2003) "Assessing animal welfare at the farm and group level: the interplay of science and values." *Animal Welfare* 12: 433-443

Gregory, N.B. (2004) " *Physiology and behaviour of animal suffering*" Blackwell publishing: Oxford, UK IN
Föllmi, J., Steiger, A., Walzer, C., Robert, N., Geissbühler, Doherr, MG., Wenker, C. (2007) "A scoring system to evaluate physical condition and quality of life in geriatric zoo mammals" *Animal welfare* 16-309-218

Hardaker, J.B., Huirne, R.B.M., Anderson, J.R., Lien, G. (2004) " *Coping with risk in Agriculture*" second edition ISBN 0851998313 CABI publishing

Hare, B., Brown, M., Williamson, C., Tomasello, M. (2002) " *The Domestication of Social Cognition in Dogs*" *Science* 298

Health Qual Life Outcomes (2003); 1: 54. Published online 2003 October 16. doi: 10.1186/1477-7525-154

Hewson, C.J., Hiby, E.F., Bradshaw, J.W.S. (2007) "Assessing quality of life in companion and kennelled dogs: a critical review" *Animal Welfare* 16 89-95

Hielm-Björkman, A.K., Hannu, R., Tulamo, R-M. (2009) "Psychometric testing of the Helsinki chronic pain index by completion of a questionnaire in Finnish by owners of dogs with chronic signs of pain caused by osteoarthritis" *American Journal of Veterinary Research* 70(6) 727-734

Holton, L.L., Scott, E.M., Nolan, A.M., Reid, J., Welsh, E. (1998) "Relationship between physiological factors and clinical pain in dogs scored using a numerical rating scale." *Journal of small animal practice* 39(10) 469

Holbrook, M.B., Stephens, D.L., Day, E., Holbrook, S.M., Strazar, G. (2001) "A collective stereographic photo essay on key aspects of animal companionship: the truth about dogs and cats". Academic Market Scientific Review 1.

Horsman, J., Furlong, W., Feeny, W., Torrance, G., (2003) "The Health Utilities Index (HUI®): concepts, measurement properties and applications" *Health Qual Life Outcomes*. 1(54). Figure use.

Ireland, J.L., Clegg, P.D., McGowan, C.M., Duncan, J.S., McCall, S., Platt, L. Pinchbeck, G.L. (2011) "Owners' perceptions of quality of life in geriatric horses: a cross-sectional study" *Animal Welfare* 20 483-495

Kapatkin Q,S, Mayhewm P.D., Smith G.K. (2002) "Canine hip dysplasia: evidence-based treatment" *Compendium* 590-599

McMillan, F.D. (2003) "Maximizing quality of life in ill animals" *Journal American Animal Hospital Association* 39 227-235

Morris, P.H., Doe,C., Godsell, E. (2008) "Secondary emotions in non-primate species? Behavioural reports and subjective claims by animal owners" *Cognition and Emotion* 22(1) 3-20

Mourits, M.C.M., Asseldonk, M.A.P.M., Huirne, R.B.M. (2010) "Multi criteria decision making to evaluate control strategies of contagious animal diseases" *PREVET* doi:10.1016/j.prevetmed.2010.06.010

Morgan, C.A. (2007) "Autonomy and paternalism in quality of life determinations in veterinary practice" *Animal Welfare* 16 143-147

- Mitchell S.D. (2005) "*Anthropomorphism and cross-species modelling*". In Daston L and Mitmann G. (eds) "Thinking with animals: New perspectives on anthropomorphism 100-117 Columbia university Press: New York, USA
- Panksepp, J. (2005) "*Affective consciousness: core emotional feelings in animals and humans*" Consciousness and Cognition 14 30-80
- Parker, R.A., Yeates, J.W. (2011) "*Assessment of quality of life in equine patients*" Equine Veterinary Journal
- Quinn, M.M., Keuler, N.S., Lu, Y., Faria, M.L.E., Muir, P., Markel, M.D. (2007) "*Evaluation of agreement between numerical rating scales, visual analogue scoring scales, and force plate gait analysis in dogs.*" Veterinary surgery 36 360-367
- Remedios, A.M., Fries, C.L. (1995) "*Treatment of canine hip dysplasia: A review*" Canine veterinary Journal 36 503-509
- Russell J.A. and Carroll J.M. (1999) "*On the bipolarity of positive and negative affect*" Psychological Bulletin 125 3-30
- IN Yeates, J.W. (2011) "*Is a life worth living? a concept worth having?*" Animal Welfare 20 397-406
- Rutherford (2002) "*Assessing pain in animals*" Animal welfare 11 31-53
- In Ellingsen, K., Zanella, A.J., Bjekas, E., Indrebo, A., (2010) "*The relationship between Empathy, Perception of pain and attitudes toward pets among Norwegian dog owners*" Anthrozoös 23(3) 231-243
- Schneider, T.A., Lyons, J.B., Tetrack, M.A., Accort, E.E., (2010) "*Multidimensional quality of life and human-animal bond measures for companion dogs*" Journal of Veterinary Behaviour 5 287-301
- Taylor, K.D., Mills, D.S. (2007) "*Is quality of life a useful concept for companion animal*" Animal Welfare 16 55-56
- Torf, R. (2003) "*Kwantificering van gezondheidsrisico's aan de hand van DALY's en externe gezondheidskosten*" MIRA http://www.milieurapport.be/upload/main/miradata/MIRA-T/03_gevolgen/03_03/econ_O&O_05.pdf
- Torrance, G. W., Feeny, D.H., Furlong, W.J., Barr, R.D., Zhang, Y., Wang, Q., (1996) "*Multi-Attribute Preference Functions for A Comprehensive Health Status Classification System: Health Utilities Index Mark 2.*" Medical Care, 34(7) 702-722. derived from <http://www.healthutilities.com/> website consulted 17-11-2012
- TNS NIPO (2008) "*Aantal huishoudens met huisdieren ongewijzigd*" website consulted and personal contact 6-2-2012 <<http://www.tns-nipo.com/tns-nipo/nieuws/van/aantal-huishoudens-met-huisdieren-ongewijzigd/>>
- Wayne, R.K., Vilà, C. (2001) "*Phylogeny and origin of the domestic dog.* In: Ruvinsky, A. and Sampson, J. (eds) *The Genetics of the Dog*" CABI publishing: Wallingford, UK. Pp1-13.
- Wemelsfelder, F. (2007) "*How animals communicate quality of life: the qualitative assessment of behaviour*" Animal Welfare 16 25-31
- World Health Organization (WHO). "*Practical guidance for assessment of disease burden at national and local levels*". p. 36. Retrieved 04-10-2012
- Prüss-Üstün, A., Mathers, C.; Woodward, A. (2003). "*Assessing the environmental burden of disease at national and local levels: Introduction and methods.*" WHO Environmental Burden of Disease Series. 1. Geneva: World Health Organization. ISBN 9241546204.
- Williams, V.M., Lascelles, B.D.X., Robson, M.C. (2005) "*Current attitudes to, and use of, peri-operative analgesia in dogs and cats by veterinarians in New Zealand*" New Zealand veterinary Journal 53, 193-202
- Wojciechowska, J.I. and Hewson, C.J. (2005) "*Quality of life assessment in pet dogs*" Journal of the American Veterinary Medical Association 226:722-728

Yeates, J. and Main, D.C. (2008) *"Assessment of positive welfare: a review."* *Veterinary Journal* 175, 293-300.

Yeates, J.W. (2011) *"Is a life worth living' a concept worth having?"* *Animal Welfare* 20 397-406

Attachment I: The questionnaire

Het invullen duurt minder dan 20 minuten.

Alle vragenlijsten worden anoniem verwerkt. Mocht u nog vragen hebben, dan kunt u aan het einde van de vragenlijst commentaar geven/vragen stellen.

Door het invullen van deze vragenlijst levert u een belangrijke bijdrage aan dit onderzoek.

Doel van het onderzoek:

Het doel van deze vragenlijst is het definiëren van een gezondheidsindex voor honden. Een dergelijke index kan een hulpmiddel zijn om objectief te beoordelen hoeveel last een hond van een bepaalde ziekte of behandeling heeft. Zo kan de index gebruikt worden bij het maken van medische beslissingen, door bijvoorbeeld verschillende behandelingen op een objectieve manier te rangschikken.

De levenskwaliteit van honden is *net als* bij mensen te beoordelen op verschillende onderdelen. Bijvoorbeeld hoe gelukkig je je voelt, hoe gezond je bent en hoe goed je kan doen wat je graag wilt doen. In dit onderzoek ligt de nadruk op de onderdelen bewegen, pijn en normaal functioneren (kunnen doen wat je graag wilt doen) bij honden.

Het is de bedoeling dat u de vragen invult naar uw eigen gevoel of mening, er is geen goed of fout antwoord. Het gaat er om wat u vindt.

Ga er vanuit dat de vragen over een volwassen hond gaan.

Na een aantal basisvragen volgen er vragen die een deel van de gezondheidsindex voor honden zullen vormen. De laatste vragen zijn er om te peilen hoe u over diergeneeskundige beslissingen denkt. Succes!



1. In welk jaar bent u geboren?

2. Wat is uw geslacht?

☐ Vrouw ☐ Man

3. Wat is uw opleidingsniveau?

- ☐ Basisonderwijs
☐ MBO
☐ HBO
☐ Universitair

4.

Geef aan hoe u deze vragenlijst heeft gekregen, hieronder staan de benaderde doelgroepen:

- ☐ Ik ben student dierwetenschappen
- ☐ Ik ben dierenarts
- ☐ Ik krijg de nieuwsbrief van Dier & Recht
- ☐ Ik heb de vragenlijst via via toegestuurd gekregen

Anders, namelijk:

5. Heeft u affiniteit met honden?

Op een schaal van 1 tot 5:

1- U heeft helemaal niks met honden

5- U houdt heel erg veel van honden

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

6. Komt u met uw werk in aanraking met honden, zo ja, wat is uw beroep ?

(Zo nee ga naar de volgende vraag)

7. Heeft u op het moment zelf een hond?

☐ Ja ☐ Nee

8. Heeft u in het verleden een hond gehad of het gelopen jaar langer dan 3 dagen op een hond gepast?

☐ Ja ☐ Nee

9. Heeft u andere dieren dan honden?

- | | | |
|---|--|--|
| <input type="radio"/> Ja, gezelschapsdieren en/of paard | <input type="radio"/> Ja, boerderijdieren | <input type="radio"/> Ja, gezelschaps- en boerderijdieren |
| <input type="radio"/> Nee, ik heb geen dieren, maar ik zou het wel willen/leuk vinden | <input type="radio"/> Nee, ik heb geen dieren en ik heb daar ook geen behoefte aan | <input type="radio"/> Nee, ik vind het ethisch onverantwoord om dieren te houden |

Bij de volgende vragen gaat het er om dat u aangeeft hoe belangrijk u de onderdelen vindt voor een hond. Er wordt een onderscheid gemaakt tussen lichamelijke gezondheid en geestelijke gezondheid. De lichamelijke gezondheid staat voor het fysiek functioneren van het lichaam, dus bijvoorbeeld of de hond verwondingen heeft en of de spieren, het gebit, de vacht en de vertering goed zijn. De geestelijke gezondheid staat voor het mentaal functioneren, hierbij horen bijvoorbeeld het concentratievermogen, het geheugen en emoties.



10. Hoe belangrijk vindt u de geestelijke en de lichamelijke gezondheid van een hond?

Het is de bedoeling dat u in de volgende vragen steeds 100 punten verdeeld over de genoemde onderdelen. Geef de meeste punten voor wat u het belangrijkste vindt voor de levenskwaliteit van honden. U kunt ook een gelijk aantal punten geven. U kunt bijvoorbeeld 100 en 0 punten geven, 50 en 50 of 40 en 60, net hoe belangrijk u iets vindt.

Bij de volgende vraag moet het totaal dus op 100 punten uitkomen.

*Lichamelijke gezondheid	<input type="text"/>
*Geestelijke gezondheid	<input type="text"/>
<input type="text" value="842650"/>	

11. Hoe belangrijk vindt u de aan- of afwezigheid van de volgende 4 onderdelen voor de levenskwaliteit van een hond?

Let op dat u totaal weer op 100 punten uitkomt!

*Beweging (zoals lopen, draaien, zwemmen, rennen, opstaan etc.)	<input type="text"/>
*Pijn (als beleving op zich, dan wel chronisch of tijdelijk)	<input type="text"/>
*Geheugen (de kennis van de hond, de route weten, herinneringen, trainbaarheid etc.)	<input type="text"/>
*Emoties (het uiten van geluk, blijdschap, ongelukkigheid, agressie etc.)	<input type="text"/>

De gezondheidsindex voor honden

De volgende vragen gaan specifiek over de onderwerpen pijn, beweging en zelfredzaamheid.

Het is de bedoeling dat u de vragen invult naar uw eigen gevoel of mening, er is geen goed of fout antwoord. Het gaat er om wat u vindt.

12. Hoe belangrijk is het voor een hond om te kunnen blijven doen wat hij/zij altijd al gedaan heeft?

Door een ziekte zou het kunnen dat een hond niet *alles* meer zelfstandig kan doen wat hij/zij vroeger deed. Als bijvoorbeeld een poot geamputeerd moet worden, of dat de hond doof wordt. De volgende vragen gaan erover hoe het functioneren van de hond zijn of haar levenskwaliteit beïnvloedt.

Geef a.u.b. VOOR IEDER PUNT een score van 0 tot 10, deze score staat voor uw mening over de invloed van pijn op de levenskwaliteit van de hond:

0 is extreem negatief, de hond is liever dood dan zo ziek of ongelukkig.

10 is zeer positief, de hond is zeer gezond en zeer gelukkig.

*De hond kan alles, zonder problemen

*De hond heeft moeite met activiteiten of situaties, maar kan alles nog wel

*De hond vermijdt sommige situaties of activiteiten

*De hond heeft moeite met activiteiten of situaties, die niet te vermijden zijn

*De hond heeft moeite met *alledaagse* activiteiten en situaties

*De hond kan niet *alle* alledaagse activiteiten meer doen

*De hond kan het merendeel van de alledaagse activiteiten niet meer

Een gezondheidsindex voor honden - pijn, beweging en functionaliteit

De volgende vragen gaan specifiek over de onderwerpen pijn, beweging en zelfredzaamheid.

Het is de bedoeling dat u de vragen invult naar uw eigen gevoel of mening, er is geen goed of fout antwoord. Het gaat er om wat u vindt.

Honden kunnen niet zeggen wanneer ze pijn hebben. Om toch te weten wanneer een hond pijn heeft letten we op gedragsveranderingen. Gedragsveranderingen kunnen zijn dat de hond piept als u hem ergens aanraakt of dat hij/zij vreemd beweegt. Ook kan de hond banger, chagrijniger of minder actief zijn dan voorheen.

Om aan te geven hoe erg u pijn vindt voor de levenskwaliteit van een hond gaat de volgende vraag over pijnintensiteit en de tijdsduur ervan.

Ga er vanuit dat de vragen over een volwassen hond gaan.

13. Wat vindt u van de volgende situaties t.a.v. pijn voor een hond?

Geef a.u.b. VOOR IEDER PUNT een score van 0 tot 10, deze score staat voor Uw mening over de invloed van pijn op de levenskwaliteit van de hond:

Hoe LAGER uw cijfer hoe erger dus de pijn is voor de hond.

0 is extreem negatief, de hond is liever dood dan zo ziek of ongelukkig

10 is zeer positief, de hond is zeer gezond en zeer gelukkig

*Geen pijn of ongemak

*Af en toe pijn (1x per maand)

*Vaak pijn (1x per week of meer)

*Continu pijn

*Af en toe erge, intense pijn (1x per maand)

*Vaak erge, intense pijn (1x per week of meer)

*Continu erge, intense pijn



14. Wat vindt u van de volgende situaties t.a.v. bewegen voor een hond?

Over het algemeen kunnen we stellen dat honden graag bewegen, spelen of iets voor hun baas doen. Natuurlijk zijn er verschillen in bewegingsactiviteit van verschillende rassen; hier mag u er van uitgaan wat over het algemeen belangrijk is voor honden. Bij beweging kunt u denken aan lopen, rennen, opstaan, gaan liggen, de kop draaien, traplopen, zwemmen etc.

Geeft a.u.b. een score van 0 tot 10 voor ieder punt hieronder, deze score staat voor uw mening over de invloed van beweging op de levenskwaliteit van de hond:

0 is extreem negatief, de hond is liever dood dan zo ziek of ongelukkig.

10 is zeer positief, de hond is zeer gezond en zeer gelukkig.



*De hond beweegt soepel en normaal

*De hond beweegt soms iets stijf of vreemd

*De hond beweegt vaak stijf of vreemd

*De hond beweegt altijd stijf of vreemd

*De hond kan niet *alle* bewegingen meer maken

*De hond kan niet *alle* bewegingen meer maken en heeft bijv. een karretje of prothese nodig

*De hond kan de poten niet meer bewegen (kop en lichaam wel)

*De hond kan alleen nog maar liggen

15. Gaat u er vanuit dat honden de volgende emoties kunnen hebben?

	Weet ik niet	Ja	Nee
Angst	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Boosheid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Eenzaamheid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jaloezie	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trots	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Schuldgevoel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

16. Wie vindt u verantwoordelijk voor het levenseinde van de hond?

- ☐ De natuur (of God; het lot)
- ☐ De dierenarts
- ☐ De eigenaar
- ☐ Ik weet het niet

Anders, namelijk:

17. Hoe denkt u dat honden pijn ervaren in vergelijking met mensen?

- ☐ Erger
- ☐ Hetzelfde
- ☐ Minder erg
- ☐ Anders, namelijk:

18. Wie kan volgens u het beste de levenskwaliteit van een hond inschatten?

- ☐ De eigenaar
- ☐ De dierenarts
- ☐ Een hondengedragdeskundige (etholoog)
- ☐ Ik weet het niet
- ☐ Anders, namelijk:



19. Hoe beïnvloeden de onderstaande punten de levenskwaliteit van honden?

Geef hieronder achter ieder punt aan hoe dit de levenskwaliteit van een hond beïnvloedt.

U mag er hier vanuit gaan dat de klachten in ieder geval 1 tot 2 dagen duren.

U kunt kiezen uit **Zeer schadelijk** tot een **Positief** effect.

Als u het niet weet kiest u de laatste kolom: **Weet ik niet**

	Heel schadelijk (levenskwaliteit gaat erg omlaag)	Schadelijk	Een beetje schadelijk	Neutraal	Positief (levenskwaliteit gaat omhoog)	Weet ik niet
De hond eet minder	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

De hond eet meer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond drinkt minder	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond drinkt meer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond piept of huilt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond ziet, ruikt of hoort slechter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond is ziek (o.a. koorts)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond beweegt vreemd/moeilijk	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond staat moeilijk op	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond is minder alert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond is minder actief	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond is juist actiever (onrustig)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond heeft pijn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond ligt meer dan voorheen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond heeft diarree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond is duizelig	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond slaapt veel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

De hond slaapt weinig	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond is sneller bang	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond is sneller boos	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond is te dik	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond is te dun	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond lijkt ontevreden/ongelukkig	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond lijkt dommer (vergeetachtig) te worden	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond wordt onzindelijk	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De hond reageert anders op aanrakingen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

20. Zou u om hulp vragen bij de volgende voorvallen?

Hieronder staan dezelfde punten als in de vorige kolom, nu is het de bedoeling dat u aangeeft of en zo ja, wanneer u om hulp zou vragen.

U kunt kiezen om naar een dierenarts te gaan **'meteen tot binnen 2 dagen'**, of **'als de klachten langer dan 2 dagen aanhouden'**.

Als u vindt dat er niks gedaan hoeft te worden, bijvoorbeeld omdat de hond zelf wel weer beter wordt, of u zelf een oplossing weet, klikt u de kolom aan: **'Geen hulp nodig'**

Als u het niet weet klikt u de kolom : **'Ik weet het niet'** aan.

Vink de laatste kolom **'Anders...'** aan als u niet naar een dierenarts zou gaan maar wel op een andere manier advies zou vragen. Dit is het geval als u bijvoorbeeld naar een trainer gaat of in de dierenwinkel advies vraagt.

Ga er vanuit dat de vragen over een volwassen hond gaan.

	Ja, ik zou hiervoor binnen 2 dagen naar een dierenarts gaan	Ja, ik zou als de klachten langer dan 2 dagen duren naar een dierenarts gaan	Geen hulp nodig	Ik weet het niet	Anders, geen dierenarts bezoek maar wel ander advies namelijk:
De hond eet minder	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond eet meer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond drinkt minder	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond drinkt meer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond piept of huilt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond ziet, ruikt of hoort slechter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond is ziek (o.a. koorts)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond beweegt vreemd/moeilijk	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond staat moeilijk op	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond is minder alert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond is minder actief	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond is juist actiever (onrustig)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond heeft pijn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond ligt meer dan voorheen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>

De hond heeft diarree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond is duizelig	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond slaapt veel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond slaapt weinig	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond is sneller bang	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond is sneller boos	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond is te dik	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond is te dun	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond lijkt ontevreden/ongelukkig	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond lijkt dommer(vergeetachtig) te worden	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond wordt onzindelijk	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
De hond reageert anders op aanrakingen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>

21. EINDE

Hartelijk dank voor uw medewerking!

Als u nog opmerkingen heeft kunt u dat hieronder aangeven.

Let op de vragenlijst wordt anoniem ingevuld, dus wilt u antwoord neem dan contact op met sarah.pesie@wur.nl

Attachment II: Kruskal-wallis tests –All group medians compared.

Grey = A difference in group medians

Test Statistics ^{a,b}						
	Physical_score	Psychological_score	Mobility_score	Pain_score	Emotions_score	Memory_score
Chi-Square	14.419	15.725	.467	7.297	2.611	.957
df	3	3	3	3	3	3
Asymp. Sig.	.002	.001	.926	.063	.456	.812

a. Kruskal Wallis Test

b. Grouping Variable: 1=readers, 2=students, 3=vets, 4=others

Test Statistics ^{a,b}						
	funct1	funct2	funct3	funct4	funct5	funct6
Chi-Square	.550	.648	1.267	1.455	1.527	1.934
df	3	3	3	3	3	3
Asymp. Sig.	.908	.885	.737	.693	.676	.586

a. Kruskal Wallis Test

b. Grouping Variable: 1=readers, 2=students, 3=vets, 4=others

Test Statistics ^{a,b}						
	pain1	pain2	pain3	pain4	pain5	pain6
Chi-Square	.192	3.080	7.180	9.415	10.828	7.748
df	3	3	3	3	3	3
Asymp. Sig.	.979	.379	.066	.024	.013	.052

a. Kruskal Wallis Test

b. Grouping Variable: 1=readers, 2=students, 3=vets, 4=others

Test Statistics ^{a,b}						
	mob1	mob2	mob3	mob4	mob5	mob6
Chi-Square	2.037	7.715	4.155	3.043	2.506	4.621
df	3	3	3	3	3	3
Asymp. Sig.	.565	.052	.245	.385	.474	.202

a. Kruskal Wallis Test

b. Grouping Variable: 1=readers, 2=students, 3=vets, 4=others

Attachment III: Kruskal-Wallis tests –Vets and Animal Sciences students medians compared.

Test Statistics ^{a,b}						
	Physical_score	Psychological_score	Mobility_score	Pain_score	Emotions_score	Memory_score
Chi-Square	.596	1.023	.018	.213	.487	.233
df	1	1	1	1	1	1
Asymp. Sig.	.440	.312	.894	.644	.485	.630

a. Kruskal Wallis Test

b. Grouping Variable: 1=readers, 2=students, 3=vets, 4=others

Test Statistics ^{a,b}						
	funct1	funct2	funct3	funct4	funct5	funct6
Chi-Square	.048	.667	.349	1.138	.450	1.637
df	1	1	1	1	1	1
Asymp. Sig.	.827	.414	.555	.286	.502	.201

a. Kruskal Wallis Test

b. Grouping Variable: 1=readers, 2=students, 3=vets, 4=others

Test Statistics ^{a,b}							
	pain1	pain2	pain3	pain4	pain5	pain6	pain7
Chi-Square	.138	.016	2.949	2.704	2.024	.974	.011
df	1	1	1	1	1	1	1
Asymp. Sig.	.710	.899	.086	.100	.155	.324	.917

a. Kruskal Wallis Test

b. Grouping Variable: 1=readers, 2=students, 3=vets, 4=others

Test Statistics ^{a,b}								
	mob1	mob2	mob3	mob4	mob5	mob6	mob7	mob8
Chi-Square	.676	.362	2.647	3.235	1.390	.363	.064	.267
df	1	1	1	1	1	1	1	1
Asymp. Sig.	.411	.547	.104	.072	.238	.547	.801	.605

a. Kruskal Wallis Test

b. Grouping Variable: 1=readers, 2=students, 3=vets, 4=others

Attachment IV: Influence of demographics on mean weighted scores

Dog owners vs. people without dog

Group Statistics					
	1=owner_yes 2=owner_no	N	Mean	Std. Deviation	Std. Error Mean
Physical_score	1	330	50.44	7.896	.435
	2	138	53.01	9.524	.811
Mental_score	1	330	49.14	7.861	.433
	2	138	48.15	9.515	.810
Mobility_score	1	326	32.26	12.158	.673
	2	137	32.57	10.772	.920
Pain_score	1	325	27.42	12.847	.713
	2	137	29.01	11.218	.958
Emotions_score	1	325	17.76	8.169	.453
	2	137	16.36	7.222	.617
Memory_score	1	324	23.00	8.257	.459
	2	137	22.41	7.581	.648

Woman vs men

Group Statistics					
	1= vrouw, 2=man	N	Mean	Std. Deviation	Std. Error Mean
Physical_score	1	356	50.87	8.063	.427
	2	112	52.23	9.653	.912
Mental_score	1	356	48.90	7.894	.418
	2	112	48.66	9.818	.928
Mobility_score	1	352	32.04	10.660	.568
	2	111	33.33	14.710	1.396
Pain_score	1	351	28.12	12.250	.654
	2	111	27.19	12.876	1.222
Emotions_score	1	351	17.30	8.022	.428
	2	111	17.50	7.614	.723
Memory_score	1	350	22.98	7.868	.421
	2	111	22.33	8.650	.821

Young vs Old

Group Statistics					
	Age	N	Mean	Std. Deviation	Std. Error Mean
Physical_score	>= 30	251	50.24	8.470	.535
	< 30	217	52.30	8.374	.568
Mental_score	>= 30	251	49.20	8.436	.532
	< 30	217	48.43	8.324	.565
Mobility_score	>= 30	249	33.73	13.957	.884
	< 30	214	30.75	8.250	.564
Pain_score	>= 30	248	27.01	13.499	.857
	< 30	214	28.92	10.921	.747
Emotions_score	>= 30	248	17.08	8.430	.535
	< 30	214	17.65	7.288	.498
Memory_score	>= 30	247	23.07	9.070	.577
	< 30	214	22.54	6.715	.459

High Affection >=3 vs Low Affection <3

Group Statistics					
	Affection_level	N	Mean	Std. Deviation	Std. Error Mean
Physical_score	>= 3	452	51.00	8.224	.387
	< 3	16	56.88	13.022	3.256
Mental_score	>= 3	452	49.14	8.131	.382
	< 3	16	40.63	11.236	2.809
Mobility_score	>= 3	448	32.41	11.866	.561
	< 3	15	30.67	7.761	2.004
Pain_score	>= 3	447	27.70	12.482	.590
	< 3	15	33.67	7.669	1.980
Emotions_score	>= 3	447	17.38	7.952	.376
	< 3	15	16.40	7.029	1.815
Memory_score	>= 3	446	22.94	8.098	.383
	< 3	15	19.27	5.934	1.532