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The Human-Animal-Relationship between individuals with Posttraumatic Stress Disorder and their assistance dogs - influence on the humans' Quality of Life as well as on the dogs' salivary cortisol levels

Master Thesis

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Declaration of Authorship

I declare that this Master Thesis has been written by myself. I have not used any other than the listed sources, nor have I received any unauthorized help. I hereby certify that I have not submitted this Master Thesis in any form (to a reviewer for assessment) either in Austria or abroad. Furthermore, I assure that the printed and electronic copies I have submitted are identical.

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Abstract

Assistance dogs for people with Posttraumatic Stress Disorder (PTSD) live with and support their handlers by performing tasks that are supposed to mitigate effects of the mental disability. Since studies on the effects of PTSD-assistance dogs' work on the handlers' symptoms have exclusively been conducted with war veterans in the US, the present study examines the Quality of Life (QoL) of PTSD-assistance dogs' handlers in Austria and Germany. This study is based on the Capability Approach by Nussbaum and Sen using a qualitative online questionnaire. To correspondingly explore whether the involved assistance dogs experience distress triggered by their daily schedules we measured their salivary cortisol values. These were compared to the cortisol levels of companion dogs without special tasks as well as signal dogs for diabetic people that have a similar workload.

The results showed that people suffering from PTSD-symptoms can improve their QoL with the aid of their assistance dog to better cope with their daily routine. However, being accompanied by an assistance dog creates new social barriers that may not have existed before. Moreover, we found significantly lower salivary cortisol levels in PTSD-assistance dogs compared to the control groups. This might be explained by their special training to soothe their handlers e.g., during flashbacks and the necessity to stay calm themselves. Additionally, the close relationship between the focal dog group and their handlers who might also function as their social buffers could explain the unexpected findings of this study. We conclude that a positive relationship between PTSD-assistance dogs and their handlers can reduce stress on both sides, and that training well tuned to the requirements of an assistance dog can prevent stress in the daily life of these dogs.

Kurzfassung

Assistenzhunde für Menschen mit Posttraumatischer Belastungsstörung (PTBS) leben mit diesen zusammen und unterstützen sie, indem sie Aufgaben übernehmen, welche die Auswirkungen der PTBS-Symptome mildern sollen. Da Studien zu den Auswirkungen der Arbeit von PTBS-Assistenzhunden auf die Symptomatik Betroffener ausschließlich mit Kriegsveteranen in den USA durchgeführt wurden, untersucht die vorliegende Studie die Lebensqualität von PTBS-Assistenzhundehalter:innen in Österreich und Deutschland. Diese Studie wurde auf Basis des Fähigkeiten-Ansatzes von Nussbaum und Sen mittels eines qualitativen Online-Fragebogens durchgeführt. Des Weiteren wurde erforscht, ob die beteiligten Assistenzhunde durch ihre täglichen Aufgaben Stress erfahren. Hierzu wurden ihre Speichelcortisolwerte gemessen, welche anschließend mit jenen von Familienhunden ohne spezielle Aufgaben, sowie Signalhunden für Diabetiker:innen, die eine ähnliche Arbeitsbelastung haben, verglichen wurden.

Die Ergebnisse zeigen, dass Menschen, die unter PTBS-Symptomen leiden, durch ihren Assistenzhund eine Verbesserung ihrer Lebensqualität erlangen, sodass sie ihren Alltag besser bewältigen können. Die Begleitung durch einen Assistenzhund schafft jedoch neue soziale Barrieren. Außerdem fanden wir bei den PTBS-Assistenzhunden im Vergleich zu den Kontrollgruppen signifikant niedrigere Speichelcortisolwerte. Dies könnte auf die spezielle Ausbildung der Hunde zurückzuführen sein, welche ihre Halter:innen beispielsweise während Flashbacks beruhigen und dabei selbst entspannt bleiben sollen. Auch die enge Beziehung zwischen den Assistenzhunden und ihren Halter:innen, die auch als soziale Puffer fungieren könnten, ist eine mögliche Erklärung der unerwarteten Ergebnisse dieser Studie. Wir kommen zu dem Schluss, dass eine positive Beziehung zwischen PTBS-Assistenzhunden und ihren Halter:innen Stress auf beiden Seiten reduzieren kann und auch ein gut an die Anforderungen eines Assistenzhundes angepasstes Training Stress im Alltag dieser Hunde vorbeugen kann.

List of Abbreviations

AAI	Animal Assisted Interventions
BBG	Bundesbehindertengesetz
BMASK	Bundesministerium für Arbeit, Soziales und Konsumentenschutz
DPT	Deep Pressure Therapy
EIA	Enzyme immunoassay
HAI	Human-Animal Interactions
Pos.	Position
PTSD	Posttraumatic Stress Disorder
QCA	Qualitative Content Analysis
QoL	Quality of Life

Content

1 Introduction

Posttraumatic Stress Disorder (PTSD) is an anxiety disorder that might appear after exposure to a critical life event or severe trauma perceived as life-threatening. The complex chronic stress phenomenon is linked to intrusive thoughts, avoidance or numbing of emotions, dissociation (Glenk & Kothgassner, 2017), re-experiencing traumatic events including flashbacks or nightmares, and hyperarousal, which can be manifested by difficulty in sleeping and concentrating (Institute of Medicine of the National Academies, 2006). PTSD symptoms persist for at least several weeks and can impair different areas of functioning e.g., personal, familial, social, educational and occupational (WHO, 2020).

PTSD-assistance dogs are trained to reduce the impact of specific symptoms for people living with this condition and might help to improve their overall Quality of Life (QoL). Examples of the dogs' tasks are to give PTSD-patients a sense of safety, helping to improve interpersonal connections, encouraging engagement in the community, and regain areas of functioning that may have been diminished by their trauma (Assistance Dogs Australia, 2020).

Especially nowadays, as people are affected by the Covid-19 pandemic but also by war and flight, dealing with trauma and related PTSD seems to be particularly necessary. The reality of life of directly affected people but also of those encountering them can be influenced by such drastic traumatizing events. The analysis of the QoL of those affected and in particular the well-being of the focal assistance dog group seems to be a timely research topic. Little is known about which impact PTSD-assistance dogs have on the QoL of their handlers except in the area of war veterans, who have been the center of QoL studies (Purdue University, 2018). Also, research on PTSD-assistance dogs' welfare is lacking. Although measurements of dogs' salivary cortisol levels have been carried out in previous studies (Wojtas et al., 2020; Cobb et al., 2016), such measurements have so far not been conducted with this assistance dog group.

This master thesis deals with the relationship between people with PTSD and their assistance dogs. It is meant as a pilot study, in which people with PTSD in Austria and Germany were asked about their QoL in connection with their assistance dogs. The anonymous survey took place via an online questionnaire, which was developed according to the Capability Approach by Martha Nussbaum and Amartya Sen (Nussbaum, 2006; Nussbaum & Sen, 1993). Based on the findings of previous studies which showed that PTSD-assistance dogs have a positive

impact on the QoL of war veterans, we hypothesized that PTSD-assistance dogs also affect the target groups' condition in a positive way.

Of equal importance is the welfare of the assistance dogs. In this thesis, we used saliva samples to measure their cortisol value in a non-invasive manner. The cortisol value is used as a physiological parameter for the analysis of the stress level of the dogs (Soo-Quee Koh & Choon-Huat Koh, 2007). The aim of the study is to shed light on whether PTSD-assistance dogs are exposed to increased stress levels in their daily lives due to their duties. We compared the cortisol values to the values of signal dogs for diabetic people[1], which have a similar workload as the group of PTSD-assistance dogs. Likewise, we made a comparison with the values of companion dogs[2]. For the comparison of cortisol values of the control groups we used existing data from a previous study by Bruckner (2019). The hypothesis of the second part of the study is that the cortisol levels of PTSD-assistance dogs are different from those of companion dogs due to working stress, like being on the alert and coping with patients' flashbacks. We chose signal dogs for diabetic people as the second control group; since they also work all day, they might have similar cortisol values. We therefore predicted that PTSD-assistance dogs' stress levels would be higher than those of companion dogs, but similar to those of the signal dog group. Since distress can impair psychological, physiological, immunological, and behavioral functions (Glenk & Kothgassner, 2017), these data could be the basis for outcome-dependent measures to improve or maintain assistance dogs' welfare.

1.1 State of research and research gap

PTSD-assistance dogs have been trained in America since the late 1990s - initially by those affected themselves (Österreichisches Assistenzhundezentrum, 2019). Scientific studies on the effects of cooperation between dogs and patients with PTSD can be found exclusively in the area of war veterans. For instance, researchers at Purdue University College of Veterinary

[1] Medical alert dogs reporting their handler with diabetes, or the handler's carer, of a potentially dangerous fluctuation in their blood glucose levels. The dogs are also trained to bring necessary supplies e.g., test kit (Howell, 2022).

[2] Pet animals without specialized training to improve the handlers' QoL (Howell, 2022).

Medicine conducted a preliminary study that showed that overall symptoms of PTSD were lower among war veterans with assistance dogs compared to those without (Purdue University, 2018). Studies on PTSD-assistance dogs' impact on the QoL of other human groups are lacking to date. In Europe, the training of PTSD-assistance dogs was first carried out in 2008 by the German Assistance Dog Center (Deutsches Assistenzhunde-Zentrum T.A.R.S.Q., 2022). Up until now, no studies have been carried out on PTSD-assistance dogs' work in European countries. Therefore, there is a research gap concerning the impact of PTSD-assistance dogs' work on the QoL of persons concerned.

Regarding cortisol levels of dogs as stress indicators, several studies have been carried out. An example is a study of the University of Life Sciences in Lublin, in which salivary cortisol interactions in different working dog[3] groups, namely search and rescue dogs and their handlers, were examined. A significant relationship between salivary cortisol levels in the dogs and their handlers was shown (Wojtas et al., 2020). Another pilot study concerning stress levels in dogs was conducted by Glenk et al. (2014), who focused on salivary cortisol in therapy dogs during animal-assisted interventions[4] (AAI). This study also took the dogs' behavior into account. The results showed that according to their cortisol levels, dogs were not more stressed during the AAI than in their free time. The prerequisite for this aspect is that the dogs are free and self-determined during their work (Glenk et al., 2014). Furthermore, Bruckner (2019) conducted a pilot study, in which salivary cortisol levels of signal dogs for diabetic people, therapy dogs and companion dogs were compared. No significant differences were found.

Aside from the investigation of stress levels in therapy dogs, in AAI and the other mentioned dog groups, the investigation of stress levels in assistance dogs - especially in the field of PTSD - is still a rather unexplored area. However, taking this topic into account is important to gather information about PTSD-assistance dogs' stress levels in their daily life to maintain or improve

[3] "Trained to accomplish specific, defined tasks" (Otto et al., 2021).

[4] "A goal oriented and structured intervention that intentionally includes or incorporates animals in health, education and human services (e.g., social work) for the purpose of therapeutic gains in Humans" (IAHAIO, 2018).

their welfare. One recent study looked at long-term stress levels in psychiatric service dogs for war veterans with PTSD. In this study, cortisol levels of the sample (n=11) were measured in the dogs' hair and compared to cortisol levels of companion dogs (n=19). Results showed no difference in the cortisol levels of both groups, indicating that the service dogs did not have a higher stress level than companion dogs (van Houtert et al., 2022).

1.2 Research questions and aim of the study

The aim of this study was to gain insight into the relationship between people with PTSD and their assistance dogs, particularly how assistance dogs affect the lives of the concerned people. According to the findings that assistance dogs have a positive impact on the QoL of war veterans with PTSD, we assumed that PTSD-assistance dogs have a similar impact on the target group. An alternative hypothesis is that people with a PTSD-assistance dog are facing challenges in the cooperation with their dogs. According to the described lack of research on the effects of being accompanied by an assistance dog on the QoL of people with PTSD, the first research question we examined is *"Which impact do assistance dogs have on the Quality of Life of their handlers with Posttraumatic Stress Disorder?"*

The second issue we addressed is whether PTSD-assistance dogs face more stressful situations during their daily work and thus have an increased salivary cortisol concentration compared to companion dogs and signal dogs for diabetic people. According to previous findings, dog groups with special tasks did not show elevated stress levels compared to dogs without any tasks. But since PTSD-assistance dogs permanently live and work with people with mental disorders and do not have defined working hours but must be in readiness all the time we assumed that their cortisol values would be higher than those of companion dogs. Signal dogs for diabetic people have a quite similar schedule and might therefore have similar stress levels to PTSD-assistance dogs. Due to the absent evaluation of PTSD-assistance dogs' welfare, the second research question is *"Are salivary cortisol levels of PTSD-assistance dogs higher than those of companion dogs and signal dogs for diabetic people due to their daily workload?"*

2 Theoretical framework

2.1 Posttraumatic Stress Disorder

In general, trauma is defined by the World Health Organization's (WHO) ICD-11 as a short- or long-lasting event or occurrence of extraordinary threat or catastrophic magnitude that would cause profound distress to almost anyone. The current Diagnostic and Statistical Manual of Mental Disorders (DSM-5) describes trauma as events that involve a confrontation with death, serious injury, or sexual violence. Four possible forms of traumata are considered: direct experience, personal witnessing, occurrence in close family or friends and repeated confrontation with aversive details e.g., in the context of one's job (Hecker & Maercker, 2015).

PTSD is an anxiety disorder appearing after exposure to a critical life event or severe trauma perceived as life-threatening. The complex chronic stress phenomenon is linked to intrusive thoughts, hyperarousal, avoidance, and dissociation. Stress is followed by prolonged continuation of biological responses leading to blunted cortisol secretion and elevated levels of catecholamines (Glenk & Kothgassner, 2017).

The essential characteristic of PTSD is a cluster of symptoms that include (APA, 2000; Hecker & Maercker, 2015):

• Re-experiencing intrusive recollections of a traumatic event, often through flashbacks or nightmares. Patients with PTSD might exhibit an involuntary attachment to the horrific experience. This manifests itself in images, sounds, or other vivid impressions of the traumatic event. These penetrate unintentionally into the awake state of consciousness as well as into sleep. Often there is a subjectively experienced state of flooding by these inner images.

• Avoidance or numbing efforts to avoid anything associated with the trauma and numbing of emotions. Those affected often try to “switch off” the thoughts flooding their minds, i.e., no longer thinking about what happened. The avoidance behavior also includes shying away from doing activities or going to places that remind them of the trauma. Despite intensive attempts, avoidance is unsuccessful in most cases. The numbing can be described as a flattening of general psychological responsiveness. Affected persons report that their feelings become more and more alike and that they feel alienated from other people. This is often accompanied by social withdrawal.

• Hyperarousal is often manifested by difficulty in sleeping and concentrating and by irritability. The excitation threshold of the autonomic nervous system is lowered, and stress has an earlier appearing and more sustained effect. During the day, affected persons are more alert to all stimuli (noises, unfamiliar faces, etc.), which may trigger startle reactions. At night, the constant arousal considerably prevents falling asleep or sleeping through.

If those symptoms last for a month or less, these might be indicative of acute stress disorder; however, if PTSD is diagnosed, symptoms are present for at least a month and cause clinically significant distress. Further, they impair for example social or occupational areas of functioning (US Department of Veterans Affairs, 2006). PTSD might occur alone, but most patients also have other psychiatric disorders, like major depressive disorder (Black et al., 2004; Kessler et al., 1995), which occur either with or after the development of PTSD. Its onset can be influenced by numerous traumatic events or stressors; but not everyone experiencing a traumatic event will develop PTSD. This depends on the intensity of the traumatic event and stressor, as well as on availability of protective factors before, during and after the traumatic event (Institute of Medicine of the national Academies, 2006).

After the depiction of PTSD and the symptoms that go along with it, the next section of this thesis explains how the QoL of affected people was inquired via an online questionnaire. This questionnaire was developed especially for the group of people with PTSD having an assistance dog. Definitions and an insight into the development of the questionnaire are provided in the following part of the thesis.

2.2 Quality of Life based on the Capability Approach

The following part of this master's thesis explains how the QoL of people with PTSD was assessed by applying Nussbaum's and Sen's Capability Approach (Nussbaum, 2006; Nussbaum & Sen, 1993). Therefore, it first provides possible definitions of the term QoL and will in a second step provide reasons why we found the concept of the Capability Approach an appropriated approach. This should help to understand how QoL was measured within the study and how a qualitative online questionnaire (3.2.1) was developed for this exact purpose. The basis is provided by Nussbaum's ten central human capabilities and different quantitative standardized instruments from the field of health to generate a dedicated questionnaire for the target group of PTSD-patients who have an assistance dog.

2.2.1 QoL definition

Defining the term QoL is not an easy task, since a broad variety of possible definitions is available, and it is inherently ambiguous and highly subjective. It can describe the experience individuals have of their own life as well as the living conditions in which individuals find themselves (Jenkinson, 2020).

According to the World Health Organization, QoL is defined as "an individuals' perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns" (WHO, 2012). The encyclopedia Britannica defines QoL as "the degree to which an individual is healthy, comfortable, and able to participate in or enjoy life events" (Jenkinson, 2020). Another possibility to look at QoL would be to conceive it as a personal expression of wants, desires, and interests, or a person could be asked about their satisfaction and happiness within a given situation (Barofsky & Rowan, 1998). Happiness, capabilities, and activities together make up a person's well-being, which is of importance for understanding the overall QoL. Nevertheless, Sen states that it cannot be used as a gold standard measure for QoL (Anand et al., 2020).

Within the Capability Approach, people's beings and doings[5] and how they are able to realize those are given priority, which is contrasted by other accounts of well-being. The Capability Approach does not focus on subjective categories to well-being, which are resources and material means, for example (Robeyns & Fibieger Byskov, 2020). How people can realize their beings and doings becomes especially meaningful for patients with PTSD living in an impeding environment. Different environmental factors like the organization of public places (e.g., going into a store with an assistance dog – see *4. Social challenges* in Appendix 10) complicate their possibility to realize their doings. Thus, it was assumed within this thesis that the QoL of people with PTSD is restricted in some way by environmental factors.

Based on the mentioned definitions it seems adequate to refer to QoL within this thesis as the beings and doings of an individual and their opportunities to realize those. Also their personal

[5] Beings and doings are defined as peoples' genuine opportunities e.g., to move around or have supportive social relationships (Robeyns & Fibieger Byskov, 2020).

perception of their position in life in relation to their goals, expectations, standards and concerns as well as their own psychological health, comfort and participation in life events should be taken into account. This concept was used, since the main interest of the study lies on the QoL of people with PTSD and how it is affected by an assistance dog, therefore these aspects which might be or have been impaired by PTSD-symptoms (see 2.1) are central to the definition.

2.2.2 QoL assessment

The question of whether any formal assessment can take individual uniqueness into account but still permit general statements is ubiquitous, since planning to assess QoL and measuring a subjective perception quantitatively can be a complex issue. There are different quantitative questionnaires available in the field of health research, but within this thesis, QoL was assessed by a qualitative questionnaire with open questions. This measure gives people with PTSD the opportunity to depict their own individual points of view and write about their personal experiences in a less limited frame.

Important for the QoL assessment is to distinguish between process and outcome: QoL assessment is an outcome measure. For instance, when a person feels pain or is depressed, and these feelings affect their ability to function; the change in functioning is a QoL measure (contrary to process measures, which encompass the coping activities to deal with the person's feelings). If this example is transferred to assistance dog ownership affecting QoL, this circumstance would require the demonstration that it leads to a change in function (Borofsky & Rowan, 1998), e.g., feeling more confident during social interactions.

This study applied Nussbaum and Sen's Capability Approach (Nussbaum, 2006; Nussbaum & Sen, 1993) to assess the QoL of people with PTSD, emphasizing its multidimensionality. In the following section, the Capability Approach will be presented, whereby some of the ten capabilities were picked to build the basis for the questionnaire to assess QoL. The Capability Approach is a theoretical framework developed by Martha Nussbaum and Amartya Sen, among others, to measure individual and societal welfare. It entails two normative claims: the freedom to achieve well-being is of primary moral importance. Additionally, well-being should be understood in terms of people's capabilities and functionings, which will now be further elaborated.

Capabilities are defined as doings and beings that people can achieve (for example being educated), whereas functionings are capabilities that have been realized. To convert a set of means (resources and public goods) into a functioning, a particular capability is needed, which depends on personal, sociopolitical, and environmental conditions (Robeyns & Fibieger Byskov, 2020). To achieve the doings and beings also real freedom is needed, which means that a person has all the means necessary to do so (Robeyns & Fibieger Byskov, 2020). The importance of the Capability Approach is that it changes the focus from means (resources and public goods) to ends (what people are actually able to do with those resources) in regard to measuring a person's well-being, since differences for example between an able-bodied and a disabled person cannot be captured by merely looking at resources. The approach provides a flexible multi-purpose framework and enables the recognition of the diversity of how people convert resources into real achievements (Robeyns & Fibieger Byskov, 2020).

Nussbaum lists ten capabilities as central requirements of a life with dignity, which can be further adapted and specified by any given society, but she claims that these capabilities necessarily have to be part of a just society. A society that does not guarantee the central requirements to all its citizens cannot be a fully just society. The ten capabilities are as follows (Nussbaum, 2006):

1. Life: the ability to live a full human life, not living in circumstances that we do not consider worth living.

2. Bodily Health: the ability to have good health, reproductive health, and shelter; being adequately nourished.

3. Bodily Integrity: mobility, protection from external violence (domestic violence and sexual assault), and sexual and reproductive self-determination.

4. Senses, Imagination, and Thought: the ability to use one's senses and intellectual faculties in a “truly human way”, i.e., under the condition of adequate education.

5. Emotions: being able to love, grieve, feel gratitude, anger, etc., and not having the emotional development blighted by fear and anxiety.

6. Practical Reason: the ability to develop an idea of the good life, to plan and critically reflect one's own life accordingly.

7. Affiliation: the abilities to, (a) live with others and in the confrontation with them and to identify with their situations, and (b) to have and use the social foundations of self-esteem (to be treated as an equally valuable person by others).

8. Other Species: living with concern for and in relation to animals, plants, and the world of nature

9. Pay: enjoying recovery, laughing, and playing

10. Control over one's Environment: (a: political) to be able to participate effectively in political processes and (b: material) to own and use property, equal property rights, the right to work, and to the realization of decent working conditions

We chose five of the ten capabilities as the basis of the online questionnaire, since those are affected by the changes of functioning through PTSD. Further, we used standardized instruments as an example to measure the QoL together with the identified capabilities to provide a specific questionnaire for people with PTSD having an assistance dog. The table which provides an insight into the creation of the questionnaire is explained in section 3.2.1.

After understanding the meaning of QoL and *how* it can be impaired by PTSD, it should also be understood *why* QoL might be restricted for affected people in the first place. To give an example, the capability "Emotions" can be applied. The central point here is that the emotional development should not be blighted by fear and anxiety. After a trauma, it might happen that affected persons are particularly alert and react to certain environmental stimuli. If, for example, a certain smell or sound was involved at the time of the traumatic experience, these can become triggers that evoke fear reactions leading to flashbacks, etc. (APA, 2000; Hecker & Maercker 2015). This means an impairment of the mentioned capability. As we live in a world full of triggers, it can be assumed that the QoL of people with PTSD is restricted due to environmental factors related to the trauma. It should be therefore considered that even though it is a general principle of the United Nations Convention on the Rights of Persons with Disabilities to enable

“full and effective participation and inclusion in society” (United Nations, 2006), this is not always enabled within our current environment and society.

2.3 PTSD-Assistance dogs

After the Capability Approach was introduced as a basis for assessing the QoL of PTSD-patients, the following point will explain what an assistance dog is in general. In addition, it will be shown which tasks a PTSD-assistance dog takes over in particular. This should illustrate the daily tasks and workload of PTSD-assistance dogs and how an improvement of their handlers’ QoL could be achieved through the support of the dogs.

An assistance dog is a dog that supports a person with a disability by performing tasks that mitigate effects of that specific disability (Howell et al., 2022). Becoming an assistance dog requires proof of the dog's health as well as its suitability in terms of character. Assistance dogs undergo special training - particularly with regard to social and environmental behavior, obedience and specific assistance. Assistance dogs are to be used for the purpose of extending the self-determination and participation of people with disabilities in all areas of life. In doing so, they live permanently with the person they support and are therefore more or less constantly on duty (Bundesministerium für Arbeit, Soziales und Konsumentenschutz (BMASK), 2015). Assistance dogs make a valuable contribution to communication and the reduction of attitudinal barriers. They include PTSD-assistance dogs as psychiatric assistance animals as well as signal dogs for diabetic people (Howell et al., 2022).

Legally, all assistance dogs in Austria are regulated since 01.01.2015 in § 39a of the Federal Disability Act (BMASK, 2015). The Messerli Research Institute of the University of Veterinary Medicine Vienna is in charge of conducting the assistance dog examinations. Common tasks performed by PTSD-assistance dogs include: Reducing anxiety through tactile stimulation (grounding), nudging or pawing to bring the person back to the present, interrupting an undesirable behavioral state, constant body contact, deep pressure stimulation, blocking contact from other people, “making” the handler leave their bed/house, “reminding” the handler to take their medication, keeping the handler “safe”, “sensing” the handler’s emotions and behaviors and thus preventing manifestation of an undesirable behavioral state, providing a “reality check” from anxiety or dissociation/hallucination, waking from nightmares (Lloyd et al., 2019).

2.4 Salivary cortisol as biomarker of stress

One goal of this study is to measure the cortisol levels of PTSD-assistance dogs to understand whether they experience more stress in their daily lives than the dogs of the two control groups. Therefore, in the following section, we will first discuss the definition of stress and then show how stress can be measured in dogs' saliva.

Among different possible definitions of stress, it is defined by Donald Broom as a state in which the adaptability of an individual is over-strained because of impulses acting on it. This leads to an endangered homeostasis (Broom & Johnson, 1993). Since the organism wants to keep homeostasis, it results in a stress reaction, which can be measured in physiological parameters as well as in behavior. Stress responses depend on type, magnitude, and duration of a stressor (Glenk & Kothgassner, 2017). A stressor can be either an actual or a perceived threat to health, survival, and/or individual fitness. Thereby, sympathetic and adrenal activation is induced (Glenk & Kothgassner, 2017). While short-term effects of elevated cortisol levels may have an adaptive function, prolonged high cortisol levels can lead to chronic stress and disease. For example, metabolic, cardiovascular, mental, and reproductive health of humans and animals might be impaired. It is therefore of great importance to understand the impact of PTSD-assistance dogs' schedules on their stress levels to be able to take any necessary measures to reduce stress.

The physiological response can be detected as changes in various biomarkers, which can be measured in saliva. In a simple manner, biomarkers can be described as molecules or cells, e.g., hormones whose presence or abnormal concentration in body fluids indicates disease (FDA-NIH Biomarker Working Group, 2016). An example is the hormone cortisol, which is among others found in the saliva. Salivary cortisol is used to measure chronic and acute stress, since it is associated with the activation of the hypothalamic–pituitary–adrenal (HPA) axis (Soo-Quee Koh & Choon-Huat Koh, 2007). Taking samples of salivary cortisol has the advantage over serum cortisol that it is non-invasive. This reduces stress while taking the sample which could bias the measurements. Taking samples of saliva from dogs is also easier than taking blood (Soo-Quee Koh & Choon-Huat Koh, 2007). Salivary cortisol secretion displays a marked circadian rhythm, at least in humans. Cortisol levels reach the peak right after awakening. Levels then decline rapidly and gradually decrease for the rest of the day. Studies on salivary

cortisol levels in dogs show controversial results regarding the circadian rhythm e.g., Koyama et al. (2003) could not confirm a circadian rhythm. To compensate for a possible variation, the samples within this study were taken three times per day at about the same time (Soo-Quee Koh & Choon-Huat Koh, 2007).

2.5 Study design

Within the scope of this master thesis, a mixed methods methodology has been applied, indicating a collection and analysis of qualitative as well as quantitative data to pursue the research questions of this study. Further characteristics of mixed methods research are the integration of both forms of data and their results, along with the logical organization of those procedures into a research design. The purpose of this methodology is to deepen the understanding and gain corroboration of the subject (Creswell, 2017).

Data concerning the QoL of people with PTSD in relation to their assistance dogs was gathered via a qualitative online questionnaire. The qualitative approach was used since relational aspects of Human-Animal Interactions (HAI) are inherently qualitative and difficult to obtain in quantitative methodologies. Furthermore, qualitative data can provide more detailed understanding of a problem and depict personal experiences of the focal groups' everyday life (Tedeschi & Jenkins, 2019).

In addition, samples of the participants' assistance dogs' saliva were collected to measure their stress levels in comparison to those of companion dogs and signal dogs for diabetic people. The use of a quantitative approach and applying a linear mixed effect model with cortisol level as the outcome variable helps to make results comparable.

Since qualitative data can provide insight into participants' perspectives in great depth, but quantitative data is needed to provide numbers regarding the dog samples' response to some variables, both offer different perspectives but provide a more complete understanding of the research subject when combined (Creswell, 2017). The relationship of people with PTSD and their assistance dogs has to be viewed as a whole within this study, because the peoples' QoL and the dogs' well-being are closely connected, as they need to function as a team. Therefore, investigating participants' QoL regarding an assistance dog is coupled with investigating the dogs' stress levels to understand the human-dog relationship.

The fact that the human-related part of this study precedes the animal-related part does not in any way mean that greater importance is attached to the former. Rather, they are two equally relevant parts of the study that complement each other. First, individuals with PTSD and the impact of their trauma on their daily lives have been addressed and the conditions under which assistance dogs live and work. In the next step, the potential stress to which the dogs are exposed and how this affects their well-being can be discussed.

3 Material and Methods

3.1 Ethical note

As regards the human-related part of this thesis, the procedures of the research proposal have been discussed and approved by the *Ethik-Kommission Medizinische Universität Wien* in accordance with GSP guidelines, EK No. 1942/2021.

Further, the procedures of the research proposal regarding the dog-related part have been discussed and approved by the institutional ethics and animal welfare committee in accordance with GSP guidelines and national legislation by the Ethics Committee of the University of Veterinary Medicine Vienna, Austria ETK-187/12/2021.

3.2 Data collection

3.2.1 Qualitative Online Questionnaire

Within this chapter, the development of the questionnaire for PTSD-patients with an assistance dog will be explained. Based on the ten capabilities and the presented pathology of PTSD in chapter 2.1 the focus can be directed to the possible changes in functions in patients' everyday life, which is shown in the following table:

Capability		Impairing factors of PTSD	Change in functioning
Life:	- Not dying prematurely - Having a life worth living	- Direct/indirect confrontation with death and serious injury - Trauma perceived as life-threatening	- Impaired vitality, e.g., not making any future plans - Suicidality, self-injury - Depressive disorder
Bodily Integrity:	- To be secure against violent (sexual) assault	- Direct/indirect confrontation with sexual violence - Shame - Guilt and self-blame - Disgust with one's own body - Self-hatred	- Lack of self-care - Lack of trust after human-induced trauma leading e.g., to hypervigilance and carrying of weapons
Senses, Imagination and Thought:	- Being able to have pleasurable experiences and to avoid non-beneficial pain	- Intrusive thoughts - Flashbacks and flooding by inner images - Dissociation - Impaired affect regulation and impulse control	- Prevention of falling asleep/sleeping through - Lack of drive - Impaired functioning in memory (partial amnesia of traumatic events) - Impaired concentration functioning - Change in functioning regarding higher irritability and frightfulness (being startled by subtle movements/noises)
Emotions:	- Being able to have an attachment, to love - Not having one's emotional development blighted by fear and anxiety	- Numbing - Trying to switch off thoughts - Hopelessness and despair	- Impaired functioning in everyday activities e.g., not visiting certain places, not leaving the house at the time the trauma happened - Impaired functioning of own emotions (emotions seem to be evened out) e.g., not being able to love, grieve, etc. - Poor social functioning, withdrawal
Affiliation:	- Showing concern for others - Engage in social interaction - Having the social bases of self-respect and nonhumiliation	- Feeling alienated - Not being able to trust	- Poor relationship functioning, e.g., social withdrawal and isolation

Table 1: *Impact of PTSD on capabilities* (Following the remarks of Nussbaum, 2006; Glenk & Kothgassner, 2017; Hecker & Maercker, 2015; APA, 2000; Maercker, 2013).

Together with the presented possible changes in function we used existing standardized instruments as models to generate the online questionnaire for the current study in order to incorporate relevant aspects to get an insight into the QoL of the target group. A standardized non-disease-specific instrument was developed by the EuroQol Group (EQ-5D, 2021). The EQ-5D is used to assess health-related QoL and is the most widely used generic instrument to assess QoL. In 2009, an improved version, the EQ-5D-5L, was introduced, whereby the questionnaire comprises the five dimensions mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. The patients indicate their health state by ticking a box next to the most appropriate statement in each dimension, which vary from no problems over slight problems, moderate problems, severe problems to extreme problems. Each decision results in a 1-digit number, the digits for the five dimensions can then be combined into a 5-digit number that describes the patient's health state (Devlin & Brooks, 2017; EQ-5D, 2021).

Another generic instrument that can be used independently from disease is the WHOQOL-BREF (WHO, 2012), which is the short form of the WHO Quality of Life questionnaire. It covers four health domains of which the domains psychological health, social relationships, and environment might be helpful within the present study (Heartbeat, 2017).

All things considered, the recent questionnaire used the discussed changes in function caused by PTSD in combination with the identified important aspects from the introduced instruments, applying qualitative questions based on the Capability Approach to make a more detailed analysis possible and give a deeper understanding of the participants' QoL as well as their worries, needs, and experiences. The goal was to assess the QoL of the participants with PTSD before they had an assistance dog and whether and how their QoL was influenced by getting such a dog. The questionnaire is provided in Appendix 1.

3.2.2 Collection of biological material (saliva)

Within the scope of the study, saliva samples of PTSD-assistance dogs (n=9, both sexes, aged between one and ten years), which are certified according to § 39a BBG and registered by the Prüf- und Koordinierungsstelle Assistenzhunde Austria (www.vetmeduni.ac.at/assistenzhunde/), were taken with a cotton roller (Cortisol-Salivette®, SARSTEDT AG & Co, Germany), as it has been established in several studies before (Glenk et al., 2013; Glenk et al., 2014; Haubenhofer et al., 2005; Kobelt et al., 2003; Bruckner, 2019). A daily profile was created over the course of a week (7 days).

Dog handlers received an instruction, including an explanation of the purpose of the project, the sampling process and labeling. They were provided with an introduction sheet, a checklist with all points they had to take care of and an introduction video (Appendix 2, Appendix 3, Appendix 4), which showed the different parts of the Salivette, sampling and labeling. They received some extra Salivettes to practice before collecting the samples. Further, they filled in a questionnaire about their dog, including date of birth and breed (Appendix 5).

The handlers had to sign a letter of agreement (Appendix 6), including a statement confirming that all dogs were clinically healthy, without medication and vaccinated regularly at the time of the study. The instructions and forms were adapted from Bruckner (2019).

Sampling has been executed by the study participants in their home environment to avoid stress for the dog by being handled from a foreign person in an unknown environment (Cobb et al., 2016; Jones et al., 2014). The dog handlers were asked not to feed the dog for a period of one hour before sampling, as this would contaminate the sample (SARSTEDT AG & Co.) with effects on the cortisol measures (Ligout et al., 2010). Participants were asked to wear disposable gloves to prevent contamination of the sample. The Salivette was placed gently into the cheek pouch where it remained for at least 60 seconds, but not longer than three minutes, since this could affect the cortisol value (Kobelt et al., 2003). Meanwhile the dogs got praised and petted, but no treats were given. Then the Salivette was removed and the dog got a treat. The saliva soaked Salivette was returned to the tube, was labelled and frozen in the handlers' freezers. Samples were transported in Styrofoam boxes with freezer packs. Participants were provided with a picture instruction (Appendix 7).

The handlers were asked to take samples three times a day (morning – noon – evening) on seven consecutive days. The time of sampling varied to some extent due to different daily routines of the dog handlers. Further, participants were asked to take the sample when the dogs were in a resting stage. This could also be during a working task, e.g., cuddling on the sofa with the handler to provide comfort. The reason was to avoid sampling immediately after stressful situations, since this would bias the results. Participants noted the times of sampling on the Salivette and on a protocol (Appendix 2). Extraordinary occurrences happening before sampling were as well registered in the protocol. Those states were categorized afterwards into company work (accompanying the handler to different places e.g., stores, public transport, social events), stress (possibly stressful events not connected to assistance work e.g., thunderstorms), walk (dog was walked before), working stress (possibly stressful events related to assistance dog work e.g., aiding when handler had a seizure) so we could test the effect of state on salivary cortisol levels afterwards (see 3.4.2).

3.3 Evaluation methods

3.3.1 Qualitative Content Analysis

Qualitative Content Analysis (QCA) is an evaluation method used in qualitative, empirical research and aims at analyzing material originating from any kind of communication (Mayring, 2015). We used it to systematically describe the meaning of rich data requiring interpretation (Schreier, 2012). As a method of qualitative research, the subject, as well as their individual experiences, are central, which is why QCA is particularly suitable for this thesis because the aim was to recreate the feelings of individuals and their QoL, not to present objective data. Further, Content Analysis is not a standard instrument that always looks the same and must be adapted to the concrete subject matter, the material, and is constructed for the specific research question (Mayring, 2015). Moreover, data receives a meaning through the recipient, who brings in their own perception of the material, own feelings, previous knowledge, and an individual background. The meaning of the data is therefore constructed in dependence of the researcher (Schreier, 2012).

Within this thesis we used the summary as method of the analysis, in which the material was reduced to obtain a manageable amount of the essential content. From this we inductively formed categories. This is especially helpful since qualitative research might produce lots of

data and the meaning cannot always be captured completely. We used QCA to focus on the most important aspects within the study (Schreier, 2012).

3.3.2 Saliva Sample Analysis

Analyses of the samples for cortisol content were performed by the Institute of Biochemistry of the University of Veterinary Medicine Vienna by using a highly sensitive cortisol enzyme immunoassay (EIA) (Palme & Möstl, 1997), which has been previously used in dogs' assessments (Glenk et al., 2013; Haubenhofer et al., 2005; Bruckner, 2019). For the comparison between salivary cortisol levels of PTSD-assistance dogs (n=9), companion dogs (n=8) and officially examined signal dogs for diabetic people (n=9), available data of the two control groups from Bruckner (2019) were used to minimize the number of dogs from which saliva samples had to be taken. The samples of companion dogs and signal dogs for diabetic people were taken in 2017 using the same kind of cotton roller (Cortisol-Salivette®, SARSTEDT AG&Co, Germany). Further, the instructions for participants were the same and like in the current study, participants took the saliva samples of their dogs at home following the same sampling schedule. As in our study, dogs should not have exercised shortly before sampling and the last feeding had to be at least one hour ago. Also, the storing and transport of the samples was done equally. Since the analyses of the samples for cortisol content were performed by the same institute using the EIA, the data of companion dogs and signal dogs for diabetic people collected by Bruckner should be comparable to the data of PTSD-assistance dogs we collected.

For the analysis the Salivettes were marked with the dogs' ID to make them recognizable before being re-sorted into plates of the format 36. After this step the samples were centrifuged for ten minutes at 3750 rpm to extract the saliva. Afterwards the saliva was transferred into new tubes. 50 µl saliva diluted 1:10 were used for the measurement of the cortisol value.

3.4 Data Analysis

In the following part the previously described QCA was applied to analyze the qualitative material gathered via the online questionnaire. Participants also answered one multiple choice question which was evaluated using descriptive statistics before statistically analyzing the quantitative data of PTSD-assistance dogs' salivary cortisol values. Afterwards we statistically analyzed the data gathered by collecting PTSD-assistance dogs' saliva samples (see 3.4.2).

3.4.1 Analysis of the qualitative online questionnaire

Determination of the material

Within this study 24 people with PTSD who currently have a PTSD-assistance dog tested according to § 39a BBG filled in a qualitative online questionnaire on the platform SoSci Survey. Open questions were asked about their daily lives with the dogs and how this affects their QoL but also about the dogs (e.g., character, stressful situations), and participants were asked to tick all statements which were applicable to them in a presented table. The answers to the questions which were evaluated with procedures of Qualitative Content Analysis amount to 16 pages.

The population targeted in this thesis includes only participants with PTSD who have assistance dogs, which are tested according to § 39a BBG and registered at the Prüf- und Koordinierungsstelle Assistenzhunde Österreich. The total population of people fulfilling these criteria in Austria is 25, who all received an invitation to participate in the study. The link to the survey was also distributed to two participants in Germany.

As regards the origin of the material, the participants were alone in their familiar environment to make them feel comfortable and avoid any stress or flashbacks. Participants were also offered the possibility to pause the process of filling in their answers and come back to it at another time whenever they needed a break. Since participants were asked about their feelings and personal experiences but also had to describe their dog, they may have been emotionally moved while answering the questions. Furthermore, it has to be taken into account that all the participants experienced some kind of trauma in their lives, which has been considered during the creation of the questionnaire. All data is available in written form therefore, it was not necessary to transcribe any other form of data.

The study is designed to understand previous experiences of participants in relation to their QoL with their assistance dogs. Subjects should be encouraged by the open question format to reflect on their personal emotions, experiences, and possible problems that may arise. They should think about how their lives have changed because of their dogs, what new opportunities this offers and how their assistance dog affects their QoL in everyday life. According to the

content-analytical communication model (Mayring, 2015), the direction of the analysis is to make statements about the emotional background of the participants.

Determination of the content analytical process model

In the next phase we determined the steps of analysis and a process model to make the QCA comprehensible for others and intersubjectively verifiable. In the context of this master thesis, the analysis of the questionnaires' answers was done by summarizing, because there was plenty of usable as well as structured data due to the precisely elaborated online questionnaire. After analyzing the answers of the participants in several steps, categories were inductively formed. For this purpose, the data were first paraphrased, unimportant paraphrases or paraphrases with the same content were deleted, and in a next reduction step, several paraphrases that refer to each other were combined. Subsequently, we checked whether the new statements compiled as a category system still represented the source material. This circular process was run through again and again until the result of the targeted reduction corresponded to the material (Mayring, 2015; Schreier, 2012). The goal of the analysis was to reduce the material in a way that the essential content was preserved, but to create a manageable corpus through abstraction that was still a reflection of the basic material (Mayring, 2015).

For the coding process, MAXQDA was used, which is a software for qualitative research that is suitable for QCA. With the help of the program, the answers of the study participants were coded, and the results of the analysis were visualized.

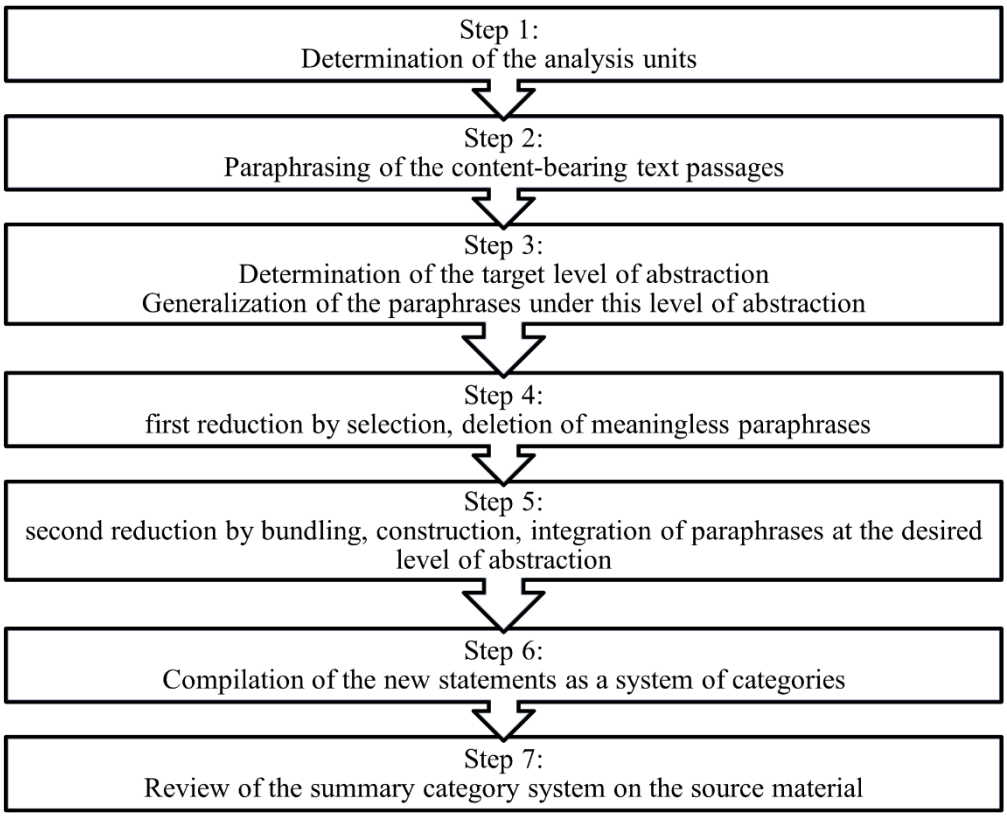

Figure 1 *Process model: Mayring provides a general content-analytical process model of the summary (Mayring 2014) which was used as a basis within the analysis of this thesis* (translation based on Mayring, 2015).

Presentation of the category system

After paraphrasing and reducing the material, categories were inductively formed, i.e., categories were derived directly from the material in a process of generalization without referring to previously formulated theories. In a first step, 79 categories were built, which could already be subclassified into five rough topics:

- Assessment of own PTBS-assistance dog
    - Desires
    - Insecurities
- Relationship
- Impact on life
- Social challenges
- Future prospects

Afterwards the interconnection between all 79 categories was reviewed and can be found illustrated in Appendix 8. Based on this first system of categories, 21 main categories were identified. These categories had incidence numbers of 7 or higher and were therefore highlighted in black as the most important ones with the most relevant interconnectivity. In addition to the six open questions of the questionnaire, one multiple choice question was posed. Participants could check all answers that applied to them. Those specific answers were analyzed by using descriptive statistics and assigned into the category system in a further step.

Figure 2 depicts a cutout of the 21 main categories as well as some relevant subcategories and their interconnections. The full depiction of the main categories can be found in Appendix 9.

In the next step of the analysis, the 21 main categories were reviewed based on the source material and supported by quotations from the questionnaire (translated from German) to check whether the material had been reduced in such a way that the essential content was preserved and to point out the interconnection between the developed categories. More quotations of participants to the particular main categories are listed in Appendix 12.

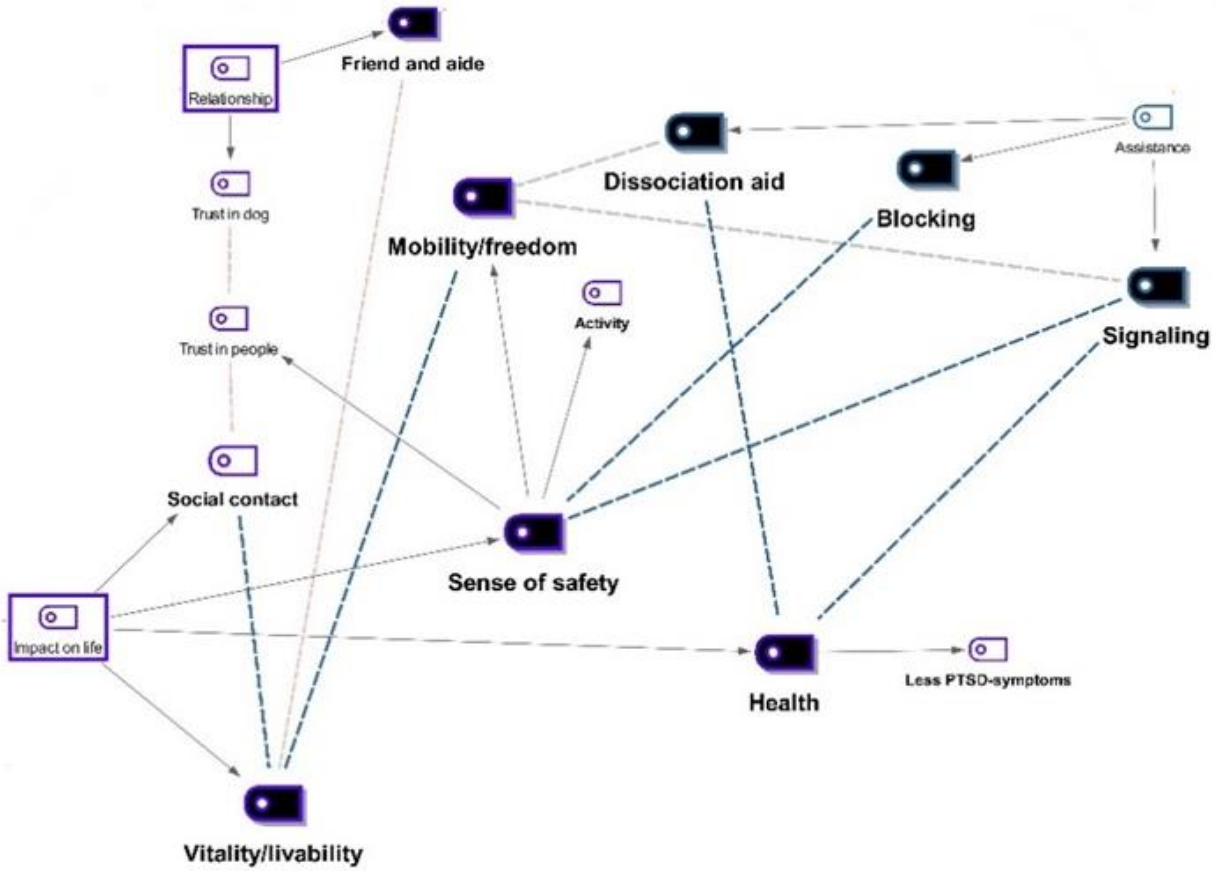

Figure 2 *Main categories: explaining the color codes and pictorial representation of the main and subcategories with their interconnections using the dogs' impact on participants' lives as an example.*

Figure 2 depicts a cutout of the main categories (marked with a black label) belonging to the topic *Impact on life* (all five topics are marked with a square). Arrows indicate which topics, subcategories, and main categories belong together. For instance, the main category *Friend and aide* as well as the subcategory *Trust in dog* belong to the topic *Relationship*.

Thin red dashed lines symbolize a connection between two categories, while thick blue dashed lines stand for the most important and strongest connections of categories. An example would be that being able to trust their dog helps participants to get in touch and trust people, therefore *Trust in dog* and *Trust in people* are interconnected. Being able to trust people helps to establish and/or maintain *Social contact*, therefore another connection line was drawn. Social contact is a very meaningful point since it prevents social withdrawal and loneliness, helping participants to regain their Vitality/viability. The social contact is thus strongly connected to this main category.

The topic *Impact on life* will now further be used as an example for the QCA we performed and to explain the relationships within the category system. To check whether the elaborated categories still reflect the content of the source material, they are supported by original quotes from the transcript. After this analysis step, the explanations of relationships were used to present the results in chapter 4.1. We proceeded in the same way with the remaining four topics, whose analysis is shown in Appendix 10.

Impact on life

This topic is closely interwoven with the human-dog relationship as well as with the assistance work of the dogs. On the one hand, the mentioned friendship and company of the dog increases the respondents' vitality and livability, which also has to do with the main category **"Mobility/freedom"**. Having an assistance dog by their side in otherwise frightening situations gives them a **"Sense of safety"** – this main category is connected to the dogs' duties **"Blocking"**, **"Signaling"** and **"Dissociation aid"**.
An example how blocking helps to increase the sense of safety is one participants' claim that "My dog gives me security above all; without him I wouldn't go out or into stores. He makes sure that people don't get too close to us" (transcript p.13, pos.172), which shows how the dog brings about more freedom since going out would not be possible otherwise. "Because of my dog I no longer always need an escort" (transcript p.13, pos.171) is another statement of a participant which was assigned to the category "Mobility/freedom".

Another aspect of gaining more vitality/livability and freedom by feeling safer is explained in the following quotation: "I can make it to university, I talk to strangers. I dare to go out to eat once in a while, I can go shopping, etc. I feel less alone, isolated or cut off from the environment" (transcript p.23, pos.227).

"Health" is one more main category associated with the dogs' tasks that has great impact on participants' lives: "Display of dissociative seizures resulting in greatly reduced risk of injury in everyday life and less exposure to violence from passersby or medical personnel […], interrupts self-injurious behavior, since then no serious injuries e.g., no more operations are necessary" (transcript p.15, pos.184).

The next category **“Routines/stability”** contains participants’ thoughts on having a more structured day and certain tasks to get done with their dog, e.g. “The dog allows me structure that I would not have managed to keep alone”, or “Structure! Days are not long and threatening anymore but divided into sections by manageable tasks. E.g., walking, eating, playing, training...” (transcript p.12, pos.164; p.23, pos.227).

This is further interwoven with the category **“Responsibility”**, since being responsible for the dog and the duties going along with it creates a regular daily schedule. Taking responsibility can have a positive effect on participants’ lives, as one of them explains: “Responsibility for the dog stabilizes me” (transcript p.24, pos.230). It can also give a purpose in life and make PTSD-patients feel “being loved, wanted, needed” (transcript p.22, pos.225). On the other hand, responsibility can also be a burden in certain situations, as it has been described in section 1 *Assessment of own PTBS-assistance dog* (Appendix 10 QCA of 4 main topics). Respondents seem to be aware of their responsibility and taking into account their relationship with the dogs as well as their description of what a great impact the dogs have on their well-being in everyday situations, they seem to be fond of reciprocating by giving something back to their dogs. Anticipating the future prospects of the participants, one of them mentioned that she wanted to “always be there for him and satisfy his needs for a happy dog life” (transcript p.26, pos.248) - this emphasizes the sense of responsibility as well as the caring relationship between human and dog.

Another impact on participants’ lives is that they are able to establish **“Social contact”**. They get in touch with strangers more easily by talking about their dogs, and sometimes even friendships develop, which contributes to Vitality/livability. An example is the following statement: “I get to know people, I allow closeness to a soul, I learn to trust” (transcript p.24, pos.233).

In the following analysis step, the results of the multiple-choice question from the questionnaire were merged with the categories just explained. Participants were presented with 27 statements about life with an assistance dog and could tick every applicable statement. The MC-question complements the open questions of the questionnaire. The results of this questions are represented in Appendix 11, *Table 2,* whereupon descriptive statistics has been used.

The majority of participants states that their motivation, satisfaction and activity level is higher than before they had their assistance dog, which can be put into the category **"Vitality/livability"**. Also, emotional strength belongs to this category. Further, most respondents indicate a higher mobility and use of public transport when accompanied by their dog as essential, described in **"Mobility/freedom"**. The category **"Sense of safety"** can be confirmed by participants saying that they are less frightened and always feel safe with their dog, even in public places. In accordance with the sense of safety is also the fact that participants have a better quality of sleep and can fall asleep more easily with their dog (despite only a minority sleeps through), while it also fits into the category **"Health"**.

Regarding the subcategory **"Social contact",** half of the sample states a positive change of social relationships due to their dogs. Nevertheless 18 of 24 people rarely trust others. All participants agreed that having an assistance dog changed their everyday life a lot, and based on their overall answers it can be assumed that it was a change for the positive. This assumption is further evaluated in chapter 4.

3.4.2 Statistical Analysis

We tested the effect of dog type by fitting a linear mixed model in R (version 4.1.2 R Core Team, 2021) using the function lmer from the lme4 package (version 1.1-27.1, Bates 2015). As key fixed effects of interest we used dog type (with levels: companion dog; PTSD dog; and signal dog) and time of day, as well as their interaction. As additional fixed effects that served as control variables, we included age and sex (levels: female and male). Before being included in the model we z-transformed age and time of day to ease model convergence and achieve easier interpretable model coefficients (Schielzeth, 2010). We inspected the response for whether its distribution was roughly symmetric, since this was not the case, we log-transformed (base e) cortisol level. We excluded one observation because its cortisol value was much lower than what is expected to be measured with good confidence (value = 0.08).

To avoid pseudoreplication we also included subject ID as well as a combination of subject and date (subj.date) to code for any day to day variation. To avoid overconfident models and to keep type I error rate at the nominal 5% level, we included all theoretical identifiable random slope components (Schielzeth & Forstmeier, 2009; Barr, 2013).

After fitting the model, we checked whether the assumptions of normally distributed and homogeneous residuals were fulfilled by visual inspection of a QQ-plot of residuals and residuals plotted against fitted values. These indicated no major deviations from these assumptions. We verified absence of collinearity by calculating the Variance Inflation Factor (VIF) using the R package “car” version 3.0-12 (Fox & Weisberg, 2019). This revealed that collinearity was not an issue (all VIFs <1.7). We visually inspected the best linear unbiased predictors (BLUPs) per level of the random effects were approximately normally distributed (Harrison et al., 2018).

We assessed model stability with regard to the model estimates, by comparing the estimates from the model including all data with estimates obtained from models in which the levels of random effects were excluded one at a time (Nieuwenhuis et al., 2012). This revealed the model to be of good stability with respect to both fixed effects and random effects.

We bootstrapped model estimates (to estimate confidence intervals) using the function bootMer of the package lme4. Then, we compared each full model with all terms included, to their respective null model lacking the key terms of interest but otherwise being identical in the

random effects part using a likelihood ratio test to avoid 'cryptic multiple testing' (Forstmeier & Schielzeth, 2011). If full-null model comparison revealed clear effects of the predictors of interest, we tested the individual fixed effects to achieve informative estimates of the fixed effects terms using the drop1 function in R. We did so by reducing model complexity and dropping non-significant interactions, from higher order to lower order terms, from the model one at a time and compare the simpler with the more complex model utilizing likelihood ratio tests.

We compared estimated marginal means and used Tukey HSD post hoc tests applied to the reduced model to compare cortisol values among dog types. This was done using the emmeans function from the emmeans package (v.1.6.3 Lenth, 2021). Because we expected that state (e.g., working stress during an assistance task like calming the handler during a flashback) could also influence cortisol level we also tested the effect of state separately from the other predictors using a similar linear mixed model. Only levels of state with at least 10 observations were included. Again, we compared estimated marginal means to compare cortisol values among different states.

4 Results

4.1 Results – qualitative online questionnaire

In the first results section of this master thesis, the study participants' views on their QoL that have been assessed via the qualitative online questionnaire are presented. Categories identified as particularly relevant in connection with the first research question are depicted in *Figure 3*. *Table 2* shows the individual capabilities and how they are affected by PTSD. Further, we assigned the categories (*Figure 3*) developed from participants' answers to the five capabilities in *Table 2* to visualize how the individual areas and capabilities are influenced by living with an assistance dog.

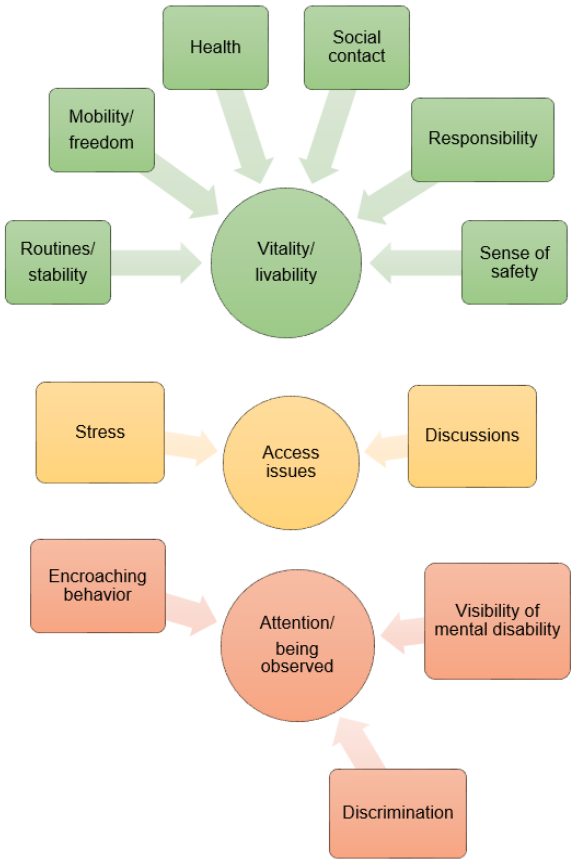

Figure 3 *Result categories: "Vitality/livability" describes the current state of the participants and how their assistance dogs help them to gain a kind of lust for life and to cope with daily challenges. "Access issues" and "Attention/being observed" take up the more challenging sides of having a PTSD-assistance dog and clarify that new obstacles can arise.*

Capability	Change in functioning by PTSD	Categories
1) Life	- Impaired vitality e.g., not making any future plans - Suicidality, self-injury - Depressive disorder	Vitality/livability Health Sense of safety Routines/stability Mobility/freedom
2) Bodily Integrity	- Lack of self-care - Lack of trust after human-induced trauma leading e.g., to hypervigilance and carrying of weapons	Vitality/livability Sense of safety Social contact Attention/being observed Encroaching behavior
3) Senses, Imagination and Thought	- Prevention of falling asleep/sleeping through - Lack of drive - Impaired functioning in memory (partial amnesia of traumatic events) - Impaired concentration functioning - Change in functioning regarding higher irritability and frightfulness (being startled by subtle movements/noises)	Vitality/livability Sense of safety Health Responsibility
4) Emotions	- Impaired functioning in everyday activities e.g., not visiting certain places, not leaving the house at the time the trauma happened - Impaired functioning of own emotions (emotions seem to be evened out) e.g., not being able to love, grieve, etc. - Poor social functioning, withdrawal	Vitality/livability Sense of safety Mobility/freedom Access Issues Discussions Stress Attention/being observed Visibility of mental disability Discrimination
5) Affiliation	- Poor relationship functioning e.g., social withdrawal and isolation	Vitality/livability

Table 2 *Categories related to capabilities: The five introduced capabilities and the changes in functioning caused by PTSD related to the categories and the participants' point of view.* (Following the remarks of Nussbaum, 2006; Glenk & Kothgassner, 2017; Hecker & Maercker, 2015; APA, 2000; Maercker, 2013).

In the following part, the results of the first part of our study are described. The categories developed from participants' answers in the questionnaire by applying QCA are used to show which impact PTSD-assistance dogs have on the five capabilities of interest, thus on the QoL of PTSD-patients.

1) Life: PTSD can cause an impaired vitality, since those affected often suffer from a number of different symptoms. One state often described by participants of this study is dissociation, which can be characterized by a reduced consciousness. Further, there can also be a focalization or blunting of affect, patients also have a feeling of being detached from the environment (Roy & Kraus, 2006). A majority of participants describes that their assistance dogs are a big aid for them because they signal dissociation early so it can be prevented, or they interrupt it by nudging and using Deep Pressure Therapy (DPT). All things considered, the assistance work of the dogs regarding dissociations (signaling and aid during attacks) gives them a much better QoL compared to times without their dogs. Participants describe that they have seizures during dissociations and also a higher risk of injuries e.g., by falling down or violence of passerby/health personnel. Besides, also self-injurious behavior was mentioned, and a participant stated that this behavior but also their eating disorder (transcript p.15, pos.184) was improved by the signaling and disrupting by the dog. Further, fewer injuries led to less need for surgery and hospitalizations. As shown, having a PTSD-assistance dog improves the overall health of the sample.

However, the described assistance work of the dogs as well as blocking strangers e.g., while waiting in line in a store, but also their mere company provides their handlers with a sense of safety. Before having a dog, the respondents had difficulties leaving their homes and follow daily schedules, which is another PTSD-symptom. Affected people might avoid stimuli associated with their trauma like certain places or activities (Roy & Kraus, 2006). An assistance dog enabling safety helps respondents to go e.g. to appointments on their own or use public transport. Furthermore, 21 of 24 participants state that their dog makes it easier for them to leave their home. In total study participants agreed that having an assistance dog gave them a higher mobility and freedom in their day to day lives.

Another point is that the interviewees claimed to have routines and stability in their lives because of their dogs. Daily tasks like walking and feeding the dog have to be done, and PTSD-

patients do not perceive days as threatening anymore, but separated into manageable segments (transcript p.23, pos.227). This is interwoven with the handlers' responsibility for their assistance dogs, which also gives them daily duties and draws their attachment to their dog, making them able to love. Since people with PTSD might suffer from numbing of emotions or a flattening of general psychological responsiveness or making them feel alienated from others, their assistance dogs as main attachment figures can help to overcome this emotional state. An increase of the vitality within this sample is visible through their future plans (see Appendix 10, 5. *Future prospects*).

2) Bodily Integrity: 18 of 24 participants rarely trust other people. One of several reasons shown in this study is the encroaching behavior of strange people when participants are out with their dogs. Patients with an assistance dog get more attention than without a dog and are more observed. They mentioned that people take videos of the working dog, want to pet them and ask unpleasant questions about the dogs or the patients' "invisible" disability, which those affected perceive as discriminating. This is one aspect that might have a negative impact on the QoL of people of the sample, since they and their disability become more eye-catching together with their assistance-dog while they prefer to be left alone and rather not interact with others.

On the other hand, participants said that it was easier for them to get in touch with new people and develop friendships since having an assistance dog. Social contacts lead to less loneliness and makes them feel less isolated from their environment than before (transcript p.23, pos. 227).

3) Senses, Imagination and Thought: Regarding the subjective experiences of more than half of the participants, having a PTSD-assistance dog can help to fall asleep and provide a better quality of sleep compared to the sleeping quality without a dog. In contrast, only eight people claimed to be able to sleep through because of their dog. Taking into account the overall sleep quality and the improvement of falling asleep, PTSD-assistance dogs add to their handlers' health and therefore to more vitality/livability.

Considering that PTSD can cause a lack of drive, it can be said that participants feel motivated by being responsible for their dogs, since it gives them a purpose and stability. Having that drive can be indicated as an improvement of QoL because it helps to embark on goals.

An example is the often-mentioned goal of being able to work or study and have professional success which can only be reached with the needed motivation.

An important point already mentioned in the analysis is that with responsibility comes burden insofar as respondents found themselves in challenging, frightening, or unpleasant situations. Examples given are the socialization process of puppies when they need to link things and situations positively that the handler herself is afraid of or having to go outside at night in the phase of housetraining. Putting themselves in those situations can be very challenging for people with PTSD, for instance when they experienced their trauma at night in the dark.

Regarding a higher irritability and frightfulness in the context of Senses, Imagination and Thought, a participant states that she feels more relaxed in her home with the dog since she would notice and signal when someone enters (transcript p.16, pos.184). Not being on the alert and being startled all the time respectively might lead to a sense of safety. Therefore, an increased vitality as well as QoL is indicated.

4) Emotions: As already discussed in the points above, people with PTSD often have trouble dealing with everyday activities and might avoid certain situations and places. It has further already been discussed that PTSD-assistance dogs can have a positive impact in this regard by helping to build social contacts, using public transport and participating in everyday activities. This contributes to the subcategories “Mobility/freedom” as well as “Sense of safety” and enables better vitality and viability for the target group.

The improvement of participants' vitality and livability in the field of their emotions and ability to follow everyday activities can be summed up by the following quotation of a respondent: “I go out every day accompanied by my dog. Before that, sometimes I didn't go out for days because of fear. I got back more quality of life through my dog” (transcript p.24, pos.231).

In contrast to this, another participant claims that also with the dog she does not feel comfortable in public places and most things are still difficult (transcript p.23, pos.227). One possible reason for this indisposition might for example be the already outlined additional attention of others and the curiosity going along with it. But another major issue described within the questionnaire is access issues. People with (mental) handicaps face refusal and have to fight for their right to enter with their assistance dog. The ones affected describe it as very stressful to discuss and

justify why they have to go into a store, to an appointment, etc. accompanied by a dog. It is also described that the stress of arguing with people who are unaware of the rights of assistance dogs are the biggest burden of having such a dog. In spite of the facilitation by a PTSD-assistance dog also new challenges and burdens emerge.

5) Affiliation: This last capability adds to point 2 since it also deals with the PTSD symptom social withdrawal and isolation. Human beings need social relationships. Not only is the dog an attachment figure patients form a close bond with, but also the assistance dog helps to establish and maintain contact and friendships. Moreover, half of the sample states that their relationship to family and friends changed for the better since having the dog. Besides, the vast majority of participants feels more self-confident with than without their dogs.

4.2 Results – PTSD-assistance dogs' salivary cortisol levels

In this section, the results of the statistical analysis regarding PTSD-assistance dogs' salivary cortisol levels in comparison to those of the control groups (companion dogs, signal dogs for diabetic people) are presented. Overall, the test predictors had a clear impact on cortisol levels (full-null model comparison: $\chi2 = 26.108$, df =5, $P < 0.0001$). However, we found no significant interaction between dog type and time of day (interaction effect: $\chi2 = 0.29$, df =1, P=0.866) so we removed this from the model (Appendix 15, *Table 6*).

The reduced model, only including main effects, revealed that cortisol levels differed between dog types ($\chi2 = 24.19$, df =2, $P < 0.0001$; Appendix 13, *Table 4*). More specifically PTSD-assistance dogs had significantly lower cortisol levels (*Figure 4*) compared to the other dog types. Time of day, sex and age did not appear to have any significant effect (Appendix 16, *Table 7*).

A model including the predictor variable state (stress, working stress, company work, walk) revealed no significant differences between different states ($\chi2=4.119$, df=4, P=0.39 (*Figure 5*; Appendix 17, *Table 8*,).

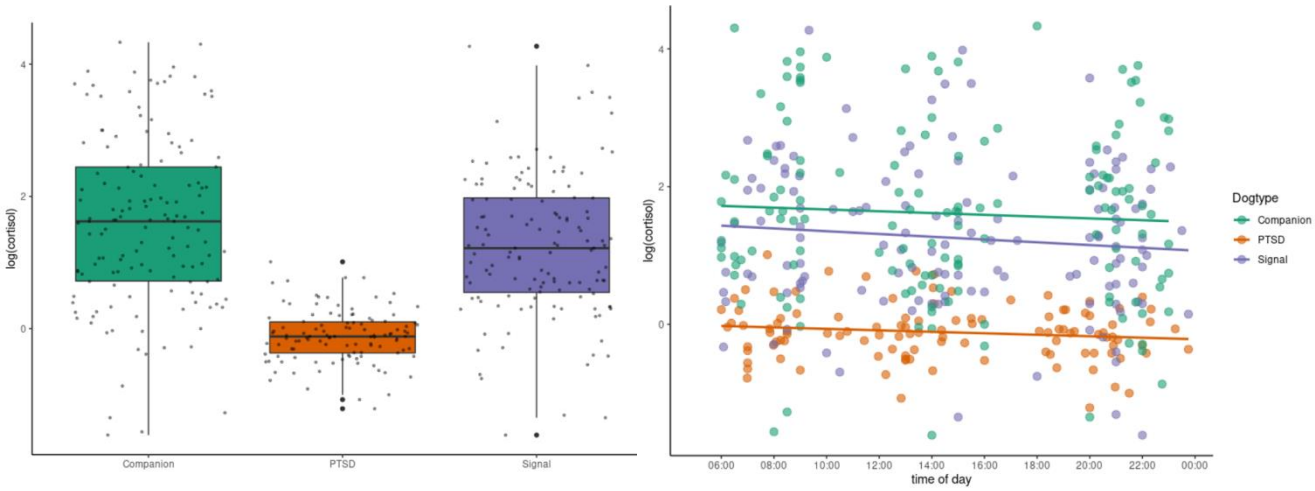

Figure 4 *Cortisol levels of dog types: Saliva cortisol of dog types (companion dogs, PTSD-assistance dogs, signal dogs for diabetic people) shown as box plots. The box represents the middle 50% of scores, upper and lower whiskers represent scores outside the middle 50%, circles represent outliners, the black line represents the median (left).*
Saliva cortisol of dog types (companion dogs, PTSD-assistance dogs, signal dogs for diabetic people) throughout the day shown as scatter plot. Dots represent values of data points, the three data clusters show the three sampling points of the day (morning, midday evening). Trend lines indicate the correlational relationship between variables (right).

Figure 5 *Dogs' states before sampling: Saliva cortisol of dog types in different states shown as box plots. The box represents the middle 50% of scores, upper and lower whiskers represent scores outside the middle 50%, circles represent outliners, the black line represents the median.*

5 Discussion

5.1 Influence of PTSD-assistance dogs on humans' QoL

Our research showed that PTSD-assistance dogs have a serious impact on the QoL of their handlers, which is represented in three main categories reflecting participants' experiences. The first is "Vitality/livability", which describes the current state of the participants and how their assistance dogs help them to gain a kind of lust for life and to cope with daily challenges. The tenor of all participants is that the dogs facilitate their everyday life compared to the time when they did not have an assistance dog yet. The second and third main categories are "Access issues" and "Attention/being observed". Those take up the more challenging sides of having a PTSD-assistance dog and show that the mere existence of an assistance dog does not eliminate all problems but can also lead to new obstacles.

The findings regarding the assistance work of interruption and signaling of dissociation by the focal dog group is in line with previous research on the effects of HAI during Animal Assisted Interventions (AAI), for example, for soldiers with PTSD (e.g., Beetz et al., 2019). HAI impact physiological parameters (e.g., cortisol levels) during stressful situations, whereas physical contact between humans and animals is especially effective. *Figure 2* depicts the connection of PTSD-assistance dogs' work (Signaling and Dissociation aid) with the category Health. DPT seems to be a very successful way to interrupt dissociations and reduce stress, presumably because physical contact and touch increase the levels of the attachment hormone oxytocin, leading to mental and physiological relaxation. The calming effect is even larger between humans and animals with a close relationship (Beetz et al., 2016), which applies to the study participants and their dogs. Moreover, focusing on the dog can have a distracting effect on PTSD-patients, retaining them in the here and now, helping to reduce flashbacks and intrusive thoughts (Beetz et al., 2016).

Besides, we found that people with PTSD leave their home more often together with their assistance dog, they make plans for their future and have an increased vitality/livability. The Blocking and Signaling of the dogs is strongly connected to the category Sense of safety, which is further interwoven with Mobility/freedom. This category again has a strong connection to Vitality/livability due to a possible increase of patients' motivation through the dog. It has been shown that HAI can also have psychological effects, such as reduction of depression, anxiety,

and put participants into a positive mood. Beyond that, humans' intrinsic motivation is activated via the involvement of animals, because due to biophilia (affinity to animals and nature, Wilson, 1984) people are emotionally involved during activities with animals (Wohlfahrth et al., 2013, 2014). Appendix 9 represents the connection of the category Vitality/livability with participants' motivation, which belongs to the topic Impact on life. Beetz and colleagues (2019) showed in a pilot study on AAI for soldiers with PTSD that already a short-term dog-assisted intervention of four 3-hours sessions once a week had positive effects on traumatized soldiers. One result was the improved mental wellness, especially regarding the participants' ability to experience joy. AAI lasted only for four weeks, whereas assistance dogs live permanently with their handlers. Studies on veterans with PTSD living with dogs (e.g., Stern et al., 2013, O'Haire & Rodruigez, 2018; Rodruigez et al., 2018) likewise show positive effects on the focal group's QoL, for instance an increase in calmness and decrease in depression, anxiety and worries. Those effects can also be found in the results of the current study, since participants state to have fewer PTSD-symptoms, which is a subcategory of Health. Furthermore, animals provide social support, which seems to be the most important variable in trauma recovery and is thought to improve healing processes (Tedeschi & Jenkins, 2019). According to the social support theory animals provide direct social support by being a source of nonjudgmental support and companionship, but also indirect support by facilitating HAI (Tedeschi & Jenkins, 2019). The participants' relationship to their dogs does not only enable trust in the dogs but also in some people (*Figure 2*) – participants indicated that they still do not trust others in general - leading to an improvement of social relationships.

The finding that most participants do not trust others despite having an assistance dog is in line with people with PTSD having a generally distrustful attitude and the feeling of not being able to trust anyone after their trauma (Hecker & Maercker, 2015). Regardless of this, participants find it easier to have social contact because of their dogs, giving them better Vitality/livability (*Figure 2*).

Almost all human beings have an inherent need to form and maintain at least a minimum quantity of interpersonal relationships, which is called the "need to belong" (Baumeister & Leary, 1995). While forming an attachment produces positive emotion in general, not doing so could lead to emotional distress (Baumeister & Leary, 1995). It is evident that psychological

health problems – which can for example cause eating disorders or suicide - are more common among people without social attachments (Baumeister & Leary, 1995). Arguably, it is helpful for the target group to gain social contacts for their mental health and subsequently this can partly improve their QoL. Additionally, an attachment bond - characterized by providing feelings of safety and security, often in a mutually beneficial way - can also be formed between human and dog (Tedeschi & Jenkins, 2019). This positive attachment bond is also indicated by the connection between friend and aid and vitality/livability in *Figure 2*.

An explanation why it is easier for people with PTSD to get in touch with others when they bring their assistance dog could be the sense of safety the dog provides by keeping company and by performing assistance tasks, which was often mentioned by the study participants. This is based on the biophilia effect, which means that a feeling of safety is provided by the presence of a calm and friendly animal leading to a reduction of psychological and physiological distress (Beetz et al., 2019). By providing a safe surrounding, the assistance dogs as well make their handlers more self-confident, which is another finding of the current study.

PTSD has a particularly negative impact on social functioning and relationships with affiliated people. However, social support and involvement as well as integration into a social network play a central role in coping with traumatic experiences (Ozer et al., 2003). By helping participants to a better self-confidence, assistance dogs enable them to be embedded into social relationships and gaining livability, hence leading to a possible improvement of QoL. Sense of safety is therefore interwoven with the subcategory Trust in people (*Figure 2*).

Additionally, previous studies on veterans with PTSD living with dogs (Stern et al., 2013, O'Haire & Rodruigez, 2018; Rodruigez et al., 2018) reported a higher cortisol awakening response, which could be interpreted as an indicator of better health and well-being. In the present study we also propose better overall health of the participants related to having an assistance dog, reinforcing the finding of a higher vitality and QoL of PTSD-patients with an assistance dog. Regarding the health of PTSD-patients related to their sleeping quality, participants reported an improvement since the time they obtained an assistance dog, while contrary to that the dog does not aid in sleeping through the night. The improved sleeping quality contributes to a better overall health of people with PTSD, since troubled sleep and

chronic stress can impair humans' health, as prolonged high cortisol levels can cause diseases (Glenk & Kothgassner, 2017).

Next to the elaborated positive effects of PTSD-assistance dogs on their handlers' QoL, some restrictions and burdens can also arise and must be considered. One point is the challenge of putting oneself into frightening situations resembling the traumatic event with regard to the dog, for example during the training process. This is depicted by the main category Responsibility, which is not only interwoven with Routines/stability, but also with Challenges with dog, showing a more problematic side. By getting oneself into such situations, symptoms of re-experiencing the event, such as intrusive thoughts or flashbacks, might be triggered. Stimuli reminiscent of the event could induce physiologic changes (Roy & Kraus, 2006). The risk of a decrease of QoL by putting oneself in such a situation must be traded off individually against the possible increase of QoL after overcoming tough phases like puppyhood, for instance.

The major issues concerning the target group brought up within this study are access issues for PTSD-assistance dogs as well as the problem of inclusion of people with invisible/mental disabilities. Inclusion is intended to compensate for disadvantageous initial positions and thus enable the persons concerned participation (Georgi, 2015). It can be described as an orientation framework that pursues the goal of a humane and democratic living, learning, and working together. In contrast to integration, the recognition and appreciation of difference in communities, institutions and organizations is considered fundamental in inclusion (Ziemen, 2016).

The fact that participants are excluded from participation in certain settings, e.g., entering a store or a doctor's practice with their labeled assistance dog and that their disability is sometimes not even recognized, shows that there is still a lot of work ahead of our society in relation to the inclusion of people with mental disabilities. In theory a legal framework is provided by the Austrian Bundesbehindertengesetz (BBG), which states that assistance dogs should be used for the purpose of expanding the self-determination and participation of people with disabilities in all areas of life (§ 39a (2)). Therefore, people with disabilities who are accompanied by their assistance dog need free access to public places, buildings, and services (BMASK, 2015). The handicapped ID with the additional entry of the assistance dog serves as proof for the claim of access rights (Bundesministerium für Soziales, Gesundheit, Pflege und

Konsumentenschutz, 2022). In practice society seems to be not entirely informed about the duties and rights of assistance dogs, which becomes clear by a participant's statement about having to constantly discuss with doctors and in stores about the dog's access, which leads to enormous stress (transcript p.20, pos.207).

Mental disability of people with PTSD is not apparent because they are not physically or cognitively restricted. Only through the dog the disability becomes visible, and the affected person receives the label "mentally disabled". However, since the affected person depends on the practical life support from their dog, the label is in some way necessary to receive assistance (Trescher, 2015).

Nevertheless, it is precisely this need for assistance from the dog that is the problem in society, because assistance dogs for people with an invisible disability are currently still a rarity. The International Classification of Functioning, Disability and Health (ICF) is not only based on physical dysfunctionality, but also expands the view to include the aspect of participation in general social life practices. Certain social factors, which individuals must deal with, and which hinder them, are in focus (Trescher, 2015). To provide education in this area, e.g., to show what tasks PTSD assistance dogs have, is of particular importance to reduce hindering social factors. The category Elucidation about assistance dogs' work is a main future prospect of the study participants, which is closely connected to the subcategories Sensitivity of society and Acceptance, shown in Appendix 9. Another important interconnection was made to the category Discrimination, which is associated with Social challenges. The discussed problem of access issues is likewise associated with the need of elucidation about the work of assistance dogs. In accordance with this very category is the subcategory Encroaching behavior, strongly related to Oppression and Disturbance at work, which not only leads to resentment in people with PTSD but in addition to insecurity in some dogs. It is therefore a constraint for affected people which could be reduced by a higher sensitivity through the education of society.

Another aspect that arises from being labeled is that mentally disabled people often have problems not only with discrimination in their everyday activities but also in the working environment. Even though there is only little data, it can be said that mentally ill people have twice the unemployment rate of the mentally healthy population (Kardorff, 2011). An important wish for participants' future is expressed by the main category Professional success (see

Appendix 9), interwoven with Elucidation about assistance dogs' work, but also strongly connected with the main category Togetherness, which again emphasizes the importance of relationship and the assistance dogs' work.

Based on these findings, the first research question *"Which impact do assistance dogs have on the Quality of Life of their handlers with Posttraumatic Stress Disorder?"* can be answered by providing evidence for the hypothesis that participants experience a change in their everyday lives since they got their assistance dogs. PTSD-assistance dogs increase their vitality and viability besides helping them to gain access to higher autonomy in their everyday lives. PTSD-patients with an assistance dog have an attachment figure which increases their social ability, improves (psychological) health and is a driving force. Aside from the mainly positive impacts PTSD-assistance dogs have on the QoL, (social) challenges put up by society and keeping a dog may arise.

5.2 Influence of PTSD-assistance work on dogs' salivary cortisol levels

In addition to the human aspect, this thesis provides valuable data for the second research question about the dogs: *"Are salivary cortisol levels of PTSD-assistance dogs higher than those of companion dogs and signal dogs for diabetic people due to their daily workload?"* The results of our study show a significant difference of salivary cortisol values in PTSD-assistance dogs compared to companion dogs as well as signal dogs for diabetic people. However, unexpectedly, cortisol levels of PTSD-assistance dogs were significantly lower than those of the two control groups. The results are contrary to the study of Bruckner (2019) and a meta-analysis done by Cobb et al. (2016) in which no significant effects of dog type (e.g., assistance, companion, therapy, hunting) on salivary cortisol concentrations were found.

We used the same sampling materials, schedule and instructions for handlers as Bruckner (2019), and the sample analysis was performed in the same institute (Institute of Biochemistry of the University of Veterinary Medicine Vienna) using the equivalent EIA to carry out the process of data collection and analysis as similarly as possible. A possible reason for the difference might be a seasonal variation in salivary cortisol concentrations, besides the mentioned possible circadian effect of cortisol (see 2.4), as it was detected in humans (Persson et al., 2008). Samples of our study were collected from April to June 2022, while samples of Bruckner were collected over different seasons from May 2017 to January 2018. In addition,

we could not completely control the participants' handling of the samples (how fast they stored them in the freezer and at which temperature, for example).

Another important aspect is that in our study as well as in the study conducted by Bruckner, saliva samples were collected by dog handlers who are not trained in this task. Dreschel and Granger (2008) showed that even veterinarians, veterinary technicians and veterinary assistants need training to collect adequate quantities of saliva to measure salivary biomarkers. They also might experience difficulties keeping the collecting swab in a dog's mouth for as long as two minutes if a dog is unwilling to cooperate (Wenger-Riggenbach et al., 2010). This explains why many samples taken by non-professionals within the current study had a low volume or were empty. This is problematic since samples with low volume lead to a disproportionately lower percentage of cortisol retrieved from absorbent materials, which can cause a considerable error variance in measurement (Dreschel & Granger, 2008).

Apart from reasons that cannot be completely ruled out due to variations in sampling, another reason for our unexpected results could be that dogs having a close personal relationship with their handlers show low salivary cortisol levels (Gunnar, 1998; Schöberl et al., 2012). The handler–dog attachment also has a significant effect on dogs' stress levels (Schöberl et al., 2012). PTSD-assistance dogs continuously accompany their handlers, provide tactile stimulation and body contact (Lloyd et al., 2019). Therefore, it is possible that a closer bond between dog and handler is formed than it is the case for companion dogs, which normally do not accompany their handlers to the same extent. Besides, it might be the case that companion dogs living in a family bond form a relationship to one or several family members but do not have such a strong attachment to a single person. As stated by the participants of the current study, they see their assistance dogs as social partners, which matches the findings of Schöberl et al. (2012), for example, who found that the quality and strength of the bond between human and dog affects dogs' salivary cortisol levels. As already mentioned in chapter 5.1, physical contact and touch increase the levels of the attachment hormone oxytocin (Nagasawa et al., 2015), leading to mental and physiological relaxation in humans with an even larger effect between humans and dogs with a close relationship (Beetz et al., 2016). The results of this study suggest that this effect may also be present vice versa, leading to lower cortisol concentrations in PTSD-assistance dogs as a result of social buffering. Oxytocin is secreted in response to

stress, whereby secretion is enhanced by the presence and physical contact of a social partner, reducing the activity of stress response systems (Buttner, 2016).

Signal dogs for diabetic people likewise accompany their handlers and are constantly on the alert. It seems plausible that they have a close attachment and strong relationship with their handlers as well. One possible explanation for the lower cortisol values of PTSD-assistance dogs in comparison to signal dogs for diabetic people could be that they are trained to perform quite different tasks. While PTSD-assistance dogs have to soothe their handlers when they are distressed and provide safety and calmness, signal dogs are trained to recognize and alert hypo- and hyperglycemic episodes of their handlers. They must show a certain alert behavior e.g., pawing, fetching a medical bag or nuzzling (Reeve et al., 2021). It is possible that PTSD-assistance dogs' salivary cortisol levels are lower due to their duty to appease their handlers and the joint need to stay calm whereas a certain level of arousal is required during alert dogs' work.

Following up on the results of Bruckner (2019) who found lower cortisol values after dog walks, but no differences between dogs' stress and working stress, we also included PTSD-assistance dogs' states before sampling, which were recorded by their handlers. The finding of no significant differences between the states might be due to low feedback of the handlers regarding different occurrences in the dogs' daily routines. They also noted very few dog walks, and the time between walks and sampling varied a lot. But other studies (Cobb et al., 2016) did not find any differences in salivary cortisol levels after physical activity within one hour before sampling.

Further, we did not find a significant effect of time of day on cortisol levels, which is in line with the findings of Bruckner (2019) and other previous studies (e.g., Koyama & Saito, 2003). In contrast, Beerda et al. (1996) showed significantly higher mean salivary cortisol concentrations in dogs in the morning than during the rest of the day.

Another factor that was controlled for within this study was age, since some studies (Rothuizen et al., 1993; Goy-Thollot et al., 2007) found an age-related increase in circulating cortisol in older dogs while others did not (Reimers et al., 1990; Hennessy et al., 1997; Mongillo et al., 2014). Therefore, the effect of age on cortisol remains controversial (Sandri et al., 2015). In the current study, the sample of PTSD-assistance dogs consisted of younger individuals on average

than that of companion and alert dogs. However, the results do not show a significance between age and cortisol values. We also controlled for an effect of sex on salivary cortisol levels. Like in a study of Haubenhofer et al. (2005), no significant effect of sex was found.

6 Limitations and Prospect

In the first part of this study a qualitative approach was used since many relational aspects of HAI are inherently qualitative and difficult to obtain in quantitative methodologies. Despite the seemingly weak evidence of the effectiveness of PTSD-assistance dog on human's QoL due to the very small sample size and simple experimental design, it should be kept in mind that qualitative data can provide rich, detailed accounts of authentic day-to-day applications and personal experiences of a directly affected sample (Tedeschi & Jenkins, 2019). To gain more study participants, sampling could be extended to other countries in future studies.

A clear limitation of the study design is that further inquiries regarding the participants' answers in the online questionnaire are not possible. Checking the answers with the respondents would have been helpful to interpret their subjective experiences and to acquire more details. Therefore, finding a possibility to conduct interviews with volunteers in future studies would be helpful. Also, a generalization of the results to other human groups accompanied by assistance dogs cannot be made. The findings of this study represent personal experiences and opinions of PTSD-patients in Austria and Germany. Other disabled people with assistance dogs also have to deal with obstacles and discrimination in their everyday lives, which sometimes might be comparable to the findings of this study, but different groups and even individuals might have different experiences.

Regarding the measurement of dogs' stress levels, it is necessary to improve the sampling strategy for future study participants to increase saliva volume. The usage of an enriched instead of a plain swab, as proposed by Meunier et al. (2021), for example, could be one possibility. In addition, another strategy to gain more samples to measure cortisol would be samples of feces (Schatz & Palme, 2001) or hair (Bryan et al., 2013; van Houtert et al., 2022), which should be easier to collect for non-professionals. Moreover, physiological parameters as well as dogs' behavior could be used to better understand whether dogs experience distress during or after being in different states like working situations or dog walks.

Further investigations on the circadian and seasonal effect of cortisol in dogs are needed as well, since this issue is still not solved. Future research could also take into account the stress levels of the assistance dogs' handlers in or after stressful situations e.g., by using a smart watch

or taking saliva samples of themselves at the same time as for their dogs. It would be interesting to measure the correlation between the cortisol levels of PTSD- assistance dogs and their handlers to find out if and to what extent they perceive the same situations as stressful, as it has been done in a previous study regarding search and rescue dogs and their handlers. A significant relationship between salivary cortisol levels in the dogs and humans was shown (Wojtas et al., 2020). Handlers could thus better assess in which situations not only they themselves but also their dogs are stressed, or in which situations their dogs are relaxed but which seem unpleasant to themselves. They could adapt their reaction to this, and if necessary, avoid such situations or act as an advocate for their assistance dogs.

7 Conclusion

In conclusion, this study has provided evidence for PTSD-assistance dogs improving their handlers' QoL by performing several assistance tasks and by being a social partner. However, having an assistance dog by one's side also brings new challenges in everyday life that need to be considered. One major problem are access issues for assistance dogs and how to behave when meeting a working assistance dog. Such issues must be treated in the future with special information campaigns. Further, this thesis has provided valuable data for addressing the welfare of assistance dogs. PTSD-assistance dogs' salivary cortisol levels are lower than those of the control groups, which could be explained by the dogs forming a very close attachment bond with their humans as well, who may represent a social buffer for them. On the other hand, PTSD-assistance dogs' work implies calmness, and they are trained to soothe their handlers, which might let their stress level stay lower.

8 References

Anand, P; Roope, LSJ; Culyer, AJ; Smith, R. (2020): Disability and multidimensional quality of life: A capability approach to health status assessment. Health Economics. 29:748–765. https://doi.org/10.1002/hec.4017.

APA (American Psychiatric Association) (2000): Diagnostic and Statistical Manual of Mental Disorders. Washington, DC: American Psychiatric Association.

Assistance Dogs Australia (2020): Assistance Dogs Australia's program for people living with PTSD (Access 14.01.2021).

Barr, D. J., Levy, R., Scheepers, C., Tily, H. J. (2013): Random effects structure for confirmatory hypothesis testing: Keep it maximal. Journal of Memory and Language, 68(3), 10.1016/j.jml.2012.11.001. https://doi.org/10.1016/j.jml.2012.11.001

Bates, D., Mächler, M., Bolker, B., Walker, S. (2015): Fitting Linear Mixed-Effects Models Using lme4. Journal of Statistical Software, 67(1 SE-Articles), 1–48. https://doi.org/10.18637/jss.v067.i01

Baumeister, & Leary, M. R. (1995). The Need to Belong. Psychological Bulletin, 117(3), 497–529. https://doi.org/10.1037/0033-2909.117.3.497.

Beetz A, Bales K. (2016): Affiliation and attachment in human-animal relationships. In: Freund L, McCune S, McCardle P, Esposito L, Gee N, editors.Neuroscience of Human-Animal Interaction. Washington, DC: American Psychological Association, 107–26.

Beetz, A. M., Schöfmann-Crawford, I. (2019): Clinical objectives for animal-assisted interventions: physiological and psychological targets in trauma-informed practice. Transforming Trauma: Resilience and Healing Through Our Connections with Animals, 91-123.

Beetz, A., Schöfmann, I., Girgensohn, R., Braas, R., Ernst, C. (2019): Positive effects of a short-term dog-assisted intervention for soldiers with post-traumatic stress disorder—A pilot study. Frontiers in veterinary science, 170.

Black, DW; Carney, CP; Peloso, PM; Woolson, RF; Schwartz, DA; Voelker, MD; Barrett, DH; Doebbeling, BN (2004): Gulf War veterans with anxiety: Prevalence, comorbidity, and risk factors. Epidemiology 15(2):135–142.

Borofsky, I., Rowan, A., (1998): Models for measuring quality of life: implications for human-animal interaction research. In Wilson, C.C., Turner, D.C., (Eds.), Companion animals in human health. Thousand Oaks, CA: SAGE Publications, pp. 91-102. Inc. doi: 10.4135/9781452232959.n5.

Broom, D. M., Johnson, K. G. (1993): Stress and Animal Welfare.

Bruckner, S. (2019): Comparative study of cortisol levels in diabetes alert dogs, therapy dogs and family dogs without special tasks. Unpublished diploma thesis, University of Veterinary Medicine, Vienna.

Bryan H.M., Adams A.G., Invik R.M., Wynne-Edwards K.E., Smits J.E. (2013): Hair as a meaningful measure of baseline cortisol levels over time in dogs. J Am Assoc Lab Anim Sci 2013;52:189–96.

Bundesministerium für Soziales, Gesundheit, Pflege und Konsumentenschutz (2022): Assistenzhund https://www.oesterreich.gv.at/themen/menschen_mit_behinderungen/Assistenzhund.html#:~:text=Der%20Behindertenpass%20mit%20der%20Zusatzeintragung,%C3%96ffentlichkeit%20leicht%20zu%20erkennen%20ist (Access 20.03.2022).

Buttner, A. P. (2016): Neurobiological underpinnings of dogs' human-like social competence: How interactions between stress response systems and oxytocin mediate dogs' social skills. *Neuroscience & Biobehavioral Reviews*, *71*, 198-214.

Creswell, J.W. (2017): Designing and conducting mixed methods research, SAGE Publications.

Deutsches Assistenzhundezentrum (2022): PTBS-Assistenzhund http://www.assistenzhunde-zentrum.de/index.php/assistenzhunde/ptbs-assistenzhund (Access 25.01.2022).

Devlin, N. J.; Brooks, R. (2017): EQ-5D and the EuroQol group: past, present and future. *Applied health economics and health policy*, *15*(2), 127-137.

Dreschel, N.A., Granger, D.A. (2008): Methods of collection for salivary cortisol measurement in dogs. Hormones and Behavior 55 (2009) pp. 163–168. https://doi.org/10.1016/j.yhbeh.2008.09.010

EQ-5D (2021): EQ-5D-5L | About https://euroqol.org/eq-5d-instruments/eq-5d-5l-about/ (Access 15.05.2021).

FDA-NIH Biomarker Working Group (2016): BEST (Biomarkers, EndpointS, and other Tools) Resource. Silver Spring (MD): Food and Drug Administration (US); Bethesda (MD): National Institutes of Health (US) www.ncbi.nlm.nih.gov/books/NBK326791/ (Access 12.01.2022).

Forstmeier, W., Schielzeth, H. (2011): Cryptic multiple hypotheses testing in linear models: overestimated effect sizes and the winner's curse. Behavioral Ecology and Sociobiology, 65(1), 47–55. https://doi.org/10.1007/s00265-010-1038-5

Fox, J., Weisberg, S. (2019): An {R} Companion to Applied Regression (Third). Sage. https://socialsciences.mcmaster.ca/jfox/Books/Companion/

Friedman MJ (2003): Post Traumatic Stress Disorder: The Latest Assessment and Treatment Strategies. Kansas City, MO: Compact Clinicals.

Georgi, V. (2015): Integration, Diversity, Inklusion. In: Magazin, II/2015, S. 25 – 27. https://www.die-bonn.de/zeitschrift/22015/einwanderung-01.pdf (Access 12.04.2022)

Glenk, Lisa Maria et al. (2014): Salivary cortisol and behavior in therapy dogs during animal-assisted interventions: A pilot study. In: Journal of Veterinary Behavior 2014, 9, 98-106; http://dx.doi.org/10.1016/j.jveb.2014.02.005.

Glenk, Lisa Maria; Kothgassner, Oswald David (2017): Life out of Balance: Stress-Related Disorders in Animals and Humans. In: Jensen-Jarolim, Erika (Ed.): Comparative medicine: Disorders linking humans with their animals. Cham, Switzerland: Springer 2017.

Glenk, LM; Kothgassner, OD (2017): Life Out of Balance: Stress-Related Disorders in Animals and Humans. In: Jensen-Jarolim (ed.), Comparative Medicine. Springer International Publishing AG, 97-108.

Goy-Thollot, I., Decosne-Junot, C., Bonnet, J.M. (2007): Influence of aging on adrenal responsiveness in a population of eleven healthy beagles. Res. Vet. Sci. 82, 195e201.

Gunnar, M. R. (1998): Quality of early care und buffering of neuroendocrine stress reactions: Potential effects on the developing human brain. Preventative Medicine 27: 208–211.

Harrison, X. A., Donaldson, L., Correa-Cano, M. E., Evans, J., Fisher, D. N., Goodwin, C. E. D., Robinson, B. S., Hodgson, D. J., Inger, R. (2018): A brief introduction to mixed effects modelling and multi-model inference in ecology. PeerJ, 6, e4794. https://doi.org/10.7717/peerj.4794

Haubenhofer D, Möstl E, Kirchengast S. (2005): Cortisol concentrations in saliva of humans and their dogs during intensive training courses in animal- assisted therapy. Wiener Tierärztliche Monatsschrift, (92): 66–73.

Heartbeat (2017): Generic Health Related Quality of Life Instruments. Berlin, HRTBT Medical Soutions GmbH.

Hecker, T; Maercker, A (2015): Komplexe posttraumatische Belastungsstörung nach ICD-11, Beschreibung des Diagnosevorschlags und Abgrenzung zur klassischen posttraumatischen Belastungsstörung. In: Psychotherapeut 60:547–561DOI 10.1007/s00278-015-0066-z.

Hennessy, M.B., Davis, H.N., Williams, M.T., Mellott, C., Douglas, C.W. (1997): Plasma cortisol levels of dogs at a county animal shelter. Physiol. Behav. 62, 485e490.

Howell, T.J.; Nieforth, L.; Thomas-Pino, C.; Samet, L.; Agbonika, S.; Cuevas-Pavincich, F.; Fry, N.E.; Hill, K.; Jegatheesan, B.; Kakinuma, M.; et al. (2022): Defining Terms Used for Animals Working in Support Roles for People with Support Needs. Animals 2022, 12, 1975. https://doi.org/10.3390/ani12151975.

Hussy, Walter; Schreier, Margrit; Echterhoff, Gerald (2010): Forschungsmethoden in Psychologie und Sozialwissenschaften für Bachelor. Berlin, Heidelberg: Springer Berlin Heidelberg.

IAHIAO (2018): AHAIO WHITE PAPER 2014, updated for 2018. THE IAHAIO DEFINITIONS FOR ANIMAL ASSISTED INTERVENTION AND GUIDELINES FOR WELLNESS OF ANIMALS INVOLVED IN AAI https://iahaio.org/wp/wp-content/uploads/2021/01/iahaio-white-paper-2018-english.pdf (Access 29.12.2021).

Institute of Medicine (2006): Posttraumatic Stress Disorder: Diagnosis and Assessment. Washington, DC: The National Academies Press. doi: 10.17226/11674.

Jenkinson, C. (2020): *Quality of life*. *Encyclopedia Britannica* https://www.britannica.com/topic/quality-of-life (Access 15.05.2021).

Kardorff, E. (2011): Systematische Diskriminierung. Sozial extra, 35(11/12), 39–42. https://doi.org/10.1007/s12054-011-0412-5

Kessler, RC; Sonnega, A; Bromet, E; Hughes, M et al. (1995): Posttraumatic stress disorder in the National Comorbidity Survey. Archives of General Psychiatry 52(12):1048–1060.

Koh, D.S.-Q., Koh, G.C.-H. (2007): The use of salivary biomarkers in occupational and environmental medicine. Occupational and Environmental Medicine, 64(3), 202-210 doi: 10.1136/oem.2006.026567.

Koyama, T., Omata, Y., Saito, A. (2003): Changes in salivary cortisol concentrations during a 24-hour period in dogs. Hormone and metabolic research, 35(06), 355-357.

Lenth, R. V. (2021): emmeans: Estimated Marginal Means, aka Least-Squares Means. https://cran.r-project.org/package=emmeans

Lloyd, J.; Johnston, L.; Lewis, J. (2019): Psychiatric assistance dog use for people living with mental health disorders. *Frontiers in veterinary science*, *6*, 166.

Maercker, A. (2013): Symptomatik, Klassifikation und Epidemiologie. In: Maercker, A- (ed.), Posttraumatische Belastungsstörungen. Springer-Verlag Berlin Heidelberg, 13-34.

Mayring, P. (2014): Qualitative Content Analysis. Theoretical Foundation, Basic Procedures and Software Solution https://qualitative-content-analysis.org/wp-content/uploads/Mayring2014QualitativeContentAnalysis.pdf (Access 11.04.2022).

Mayring, P. (2015): Qualitative Inhaltsanalyse: Grundlagen und Techniken. (12. Auflage) Weinheim : Basel : Beltz Verlag.

Meunier, S., Groessl, M., Reusch, C., Boretti, F., & Sieber-Ruckstuhl, N. (2021). Salivary cortisol in healthy dogs: a randomized cross-over study to evaluate different saliva stimulation methods and their effects on saliva volume and cortisol concentration. *BMC veterinary research*, *17*(1), 194. https://doi.org/10.1186/s12917-021-02890-1

Mongillo, P., Prana, E., Gabai, G., Bertotto, D., Marinelli, L. (2014): Effect of age and sex on plasma cortisol and dehydroepiandrosterone concentrations in the dog (Canis familiaris). Res. Vet. Sci. 96, 33e38.

Nagasawa, M., Mitsui, S., En, S., Ohtani, N., Ohta, M., Sakuma, Y., Onaka, T., Mogi, K., & Kikusui, T. (2015): Social evolution. Oxytocin-gaze positive loop and the coevolution of human-dog bonds. Science, 348(6232), 333-336. https://doi.org/10.1126/science.1261022

Newen, A., Vogeley, K. (2012): Menschliches selbstbewusstsein und die fähigkeit zur zuschreibung von einstellungen. In *Theory of mind* (pp. 161-180). Springer, Berlin, Heidelberg.

Nieuwenhuis, R., te Grotenhuis, M., Pelzer, B. (2012): Influence.ME: Tools for detecting influential data in mixed effects models. *R Journal*, *4*(2), 38–47. https://doi.org/10.32614/rj-2012-011

Nussbaum, M. C. (2006): Frontiers of Justice : Disability, Nationality, Species Membership. Harvard University Press.

Nussbaum, M., Sen, A. (1993): The Quality of Life. Oxford, online edn, Oxford Academic, 1 Nov. 2003), https://doi.org/10.1093/0198287976.001.0001 (accessed 02.09.2022).

O'Haire ME, Rodruigez KE. (2018): Preliminary efficacy of service dogs as a complementary treatment for posttraumatic stress disorder in military men and veterans. J Consult Clin Psychol. 86:179–88. doi: 10.1037/ccp0000267

Österreichisches Assistenzhundezentrum (2019): PTBS-Assistenzhund http://www.assistenzhunde-zentrum.at/index.php/assistenzhunde/ptbs-assistenzhund (Access 14.01.2021).

Otto, C. M., Darling, T., Murphy, L., Ng, Z., Pierce, B., Singletary, M., & Zoran, D. (2021): 2021 AAHA Working, Assistance, and Therapy Dog Guidelines. Journal of the American Animal Hospital Association, 57(6), 253-277.

Persson, R., Garde, A. H., Hansen, Å. M., Österberg, K., Larsson, B., Ørbæk, P., & Karlson, B. (2008): Seasonal variation in human salivary cortisol concentration. Chronobiology international, 25(6), 923-937.

Purdue University (2018): Study shows service dogs are associated with lower PTSD symptoms among war veterans https://www.purdue.edu/newsroom/releases/2018/Q1/study-shows-service-dogs-are-associated-with-lower-ptsd-symptoms-among-war-veterans-.html (Access 14.01.2021).

R Core Team. (2022): R: A Language and Environment for Statistical Computing. https://www.r-project.org/

Reeve C, Wilson C, Hanna D, Gadbois S (2021): Dog Owners' Survey reveals Medical Alert Dogs can alert to multiple conditions and multiple people. PLoS ONE 16(4): e0249191. https://doi. org/10.1371/journal.pone.0249191

Reimers, T.J., Lawler, D.F., Sutaria, P.M., Correa, M.T., Erb, H.N. (1990): Effects of age, sex, and body size on serum concentrations of thyroid and adrenocortical hormones in dogs. Am. J. Vet. Res. 51, 454e457.

Robeyns, I.; Fibieger Byskov, M. (2020): The Capability Approach. The Stanford Encyclopedia of Philosophy, Edward N. Zalta (ed.) https://plato.stanford.edu/entries/capability-approach/ (Access 19.07.2021).

Rodriguez, K. E., Bryce, C. I., Granger, D. A., & O'Haire, M. E. (2018): The effect of a service dog on salivary cortisol awakening response in a military population with posttraumatic stress disorder (PTSD). *Psychoneuroendocrinology*, *98*, 202-210.

Rothuizen, J., Reul, J.M., Van Sluijs, F.J., Mol, J.A., Rijnberk, A., De Kloet, E.R. (1993): Increased neuroendocrine reactivity and decreased brain mineralocorticoid receptor-binding capacity in aged dogs. Endocrinology 132, 161e168.

Roy, M.J., Kraus, P.L. (2006). Efforts to Improve the Diagnosis and Treatment of Posttraumatic Stress Disorder. In: Novel Approaches to the Diagnosis and Treatment of Posttraumatic Stress Disorder M.J. Roy (Ed.) IOS Press.

Schatz, S., Palme, R. (2001): Measurement of faecal cortisol metabolites in cats and dogs. A non-invasive method for evaluating adrenocortical function. Veterinary research communications, 25 (4): 271–287. DOI 10.1023/A:1010626608498.

Schielzeth, H. (2010): Simple means to improve the interpretability of regression coefficients. Methods in Ecology and Evolution, 1(2), 103–113. https://doi.org/https://doi.org/10.1111/j.2041-210X.2010.00012.x

Schielzeth, H., Forstmeier, W. (2009): Conclusions beyond support: overconfident estimates in mixed models. Behavioral Ecology : Official Journal of the International Society for Behavioral Ecology, 20(2), 416–420. https://doi.org/10.1093/beheco/arn145

Schöberl, I., Wedl, M., Bauer, B., Day, J., Möstl, E., Kotrschal, K. (2012): Effects of Owner–Dog Relationship and Owner Personality on Cortisol Modulation in Human–Dog Dyads, Anthrozoös, 25:2, 199-214, DOI: 10.2752/175303712X13316289505422

Schreier, M. (2012): Qualitative content analysis in practice. SAGE.

Soo-Quee Koh D, Choon-Huat Koh G. The use of salivary biomarkers in occupational and environmental medicine. Occup Environ Med. 2007 Mar;64(3):202-10. doi: 10.1136/oem.2006.026567. PMID: 17339296; PMCID: PMC2092532.

Bundesministerium für Arbeit, Soziales und Konsumentenschutz (2015): Richtlinien Assistenzhunde. https://www.vetmeduni.ac.at/fileadmin/v/assistenzhunde/Richtlinien_Assistenzhunde.pdf (Access 11.01.2022).

Stern, S. L. et al. (2013): Potential benefits of canine companionship for military veterans with posttraumatic stress disorder (PTSD). *Society & Animals*, *21*(6), 568-581.

Tedeschi, P. Jenkins, M.A. (2019): Transforming Trauma: Resilience and Healing Through Our Connections With Animals. Purdue University Press. (Knowledge Unlatched Open Access Edition.)

Trescher. (2015): Inklusion : Zur Dekonstruktion von Diskursteilhabebarrieren im Kontext von Freizeit und Behinderung. Springer Fachmedien Wiesbaden.

United Nations (2006): Convention on the Rights of Persons with Disabilities (CRPD) https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities.html#Fulltext (Access 10.04.2022).

United States. Department of Veterans Affairs (2006): Posttraumatic Stress Disorder: Diagnosis and Assessment. Washington, D.C.: National Academies Press.

van Houtert EAE, Endenburg N, Vermetten E and Rodenburg TB (2022): Hair Cortisol in Service Dogs for Veterans with Post-traumatic Stress Disorder Compared to Companion Dogs (CanisFamiliaris), Journal of Applied Animal Welfare Science, DOI: 10.1080/10888705.2022.2033119.

Wenger-Riggenbach B., Boretti F.S., Quante S., Schellenberg S., Reusch C.E., Sieber-Ruckstuhl N. (2010): Salivary cortisol concentrations in healthy dog and dogs with hypercortisolism. J Vet Intern Med. 2010; 24(3):551–556. doi: 10.1111/j.1939-1676.2010.0494.x.

Wilson, E. O. (1984). Biophilia. In *Biophilia*. Harvard University Press.

Wohlfarth, R., Mutschler, B., Beetz, A., & Schleider, K. (2014): An investigation into the efficacy of therapy dogs on reading performance in 6–7 year old children. *Hum Anim Int Bull*, *2*, 60-73.

Wohlfarth, R., Mutschler, B., Beetz, A., Kreuser, F., & Korsten-Reck, U. (2013): Dogs motivate obese children for physical activity: key elements of a motivational theory of animal-assisted interventions. *Frontiers in psychology*, *4*, 796.

Wojtas, Justyna; Karpinski, Mirosław; Czyzowski, Piotr (2020): Salivary Cortisol Interactions in Search and Rescue Dogs and Their Handlers. In: Animals 2020, 10, 595; doi:10.3390/ani10040595.

World Health Organization (2012): PROGRAMME ON MENTAL HEALTH, WHOQOL User Manual https://apps.who.int/iris/handle/10665/77932 (Access 15.05.2021).

World Health Organization (2020): ICD-11 for Mortality and Morbidity Statistics 6B40 Post traumatic stress disorder https://icd.who.int/browse11/l-m/en#/http://id.who.int/icd/entity/2070699808 (Access 14.01.2021).

Ziemen K. (2016): Inklusion. In: Ameln-Haffke, H. et al.: Lexikon Inklusion. Göttingen: Vandenhoeck & Ruprecht.

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11 Appendix

Appendix 1: Qualiltative online questionnaire

25% ausgefüllt

Lieber Teilnehmer, liebe Teilnehmerin,
herzlichen Dank, dass Sie sich die Zeit nehmen, um an der Studie „Die Mensch-Tier-Beziehung zwischen Personen mit Posttraumatischen Belastungsstörungen (PTBS) und ihren Assistenzhunden - Einfluss auf die Lebensqualität der Menschen sowie auf den Cortisolspiegel der Hunde“ teilzunehmen. Durch Ihr Mitwirken wird es möglich, neue wissenschaftliche Erkenntnisse im Bereich Lebensqualität von Menschen mit PTBS sowie Wohlergehen von Assistenzhunden zu gewinnen. Es handelt sich hierbei um eine vollständig anonyme Umfrage.
Die Beantwortung der Fragen wird ungefähr 10-20 Minuten in Anspruch nehmen. Während Sie die Fragen beantworten, können Sie jederzeit unterbrechen und zu einem späteren Zeitpunkt weiter machen. Sollte Sie die Beantwortung der Fragen belasten, wenden Sie sich bitte an Ihre psychologisch betreuende Einrichtung oder Betreuungsperson.
Sollten beim Ausfüllen des Online-Fragebogens Probleme auftreten, wenden Sie sich bitte jederzeit an die Prüf- und Koordinierungsstelle für Assistenzhunde der Veterinärmedizinischen Universität Wien

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Es wird darauf hingewiesen, dass im Falle einer Kontaktaufnahme Ihrerseits mit dem Studienleiter oder einem Mitglied des Studienteams die Anonymität nicht mehr gewährleistet werden kann.

Weiter

Befragung unterbrechen

M.A. Karoline Gerwisch, Veterinärmedizinische Universität Wien – 2021

1) Wie fühlen Sie sich heute?

Ich fühle mich:	

2) Bitte beschreiben Sie Ihren Hund.

Charaktereigenschaften:	
Was mag er*sie, was mag er*sie nicht?	
Wie ist Ihre Beziehung zu Ihrem Hund?	
Welche Rolle spielt Ihr Hund in Ihrem Leben?	
In welchen Situationen fühlt er*sie sich sehr wohl?	
In welchen Situationen fühlt er*sie sich unwohl?	

3) Bitte kreuzen Sie alle zutreffenden Aussagen an:

- [ ] Durch meinen Hund fühle ich mich aktuell motiviert
- [ ] Bevor mein Hund zu mir kam hatte ich weniger Lust neue Ziele zu verfolge
- [ ] Durch meinen Hund fühle ich mich emotional stark
- [ ] Ohne meinen Hund war ich weniger zufrieden als jetzt
- [ ] Mein Hund hat mir dabei geholfen anderen Menschen mehr zu vertrauen
- [ ] Ich vertraue anderen Menschen selten
- [ ] Mit meinem Hund an meiner Seite fühle ich mich immer sicher
- [ ] Durch die Anwesenheit meines Hundes kann ich gut einschlafen
- [ ] Durch die Anwesenheit meines Hundes kann ich durchschlafen
- [ ] Ohne meinen Hund hatte ich eine schlechtere Schlafqualität als jetzt
- [ ] Durch meinen Hund kann ich mich besser konzentrieren als zuvor (zum Beispiel beim Lesen eines Buches)
- [ ] Meine Konzentrationsfähigkeit hat sich durch die Anwesenheit meines Hundes wenig verändert
- [ ] Bevor mein Hund zu mir kam habe ich mich leicht erschreckt
- [ ] Durch meinen Hund bin ich weniger schreckhaft geworden
- [ ] Mein Hund erleichtert es mir das Haus zu verlassen
- [ ] Gemeinsam mit meinem Hund fühle ich mich wohl an öffentlichen Orten
- [ ] Wenn ich mit meinem Hund unterwegs bin benutze ich öffentliche Verkehrsmittel
- [ ] Auch wenn ich alleine unterwegs bin benutze ich öffentliche Verkehrsmittel
- [ ] Aufgrund der örtlichen Gegebenheiten fahre ich meist mit dem Auto/Fahrrad etc., oder gehe zu Fuß
- [ ] Ich fühle mich aktuell mobiler als in der Zeit, als mein Hund noch nicht bei mir war
- [ ] Durch meinen Hund kann ich wieder alltäglichen Tätigkeiten nachgehen, die vorher nicht möglich waren
- [ ] Mein Alltag hat sich durch die Anwesenheit meines Hundes wenig verändert
- [ ] Ich verlasse mein zuhause nur zusammen mit meinem Hund
- [ ] Ich treffe mich regelmäßig mit Freund*innen/Familie
- [ ] Die Beziehung zu Freund*innen/Familie hat sich positiv verändert, seit ich meinen Hund habe
- [ ] Bevor ich meinen Hund hatte, habe ich mich weniger mit Freund*innen/Familie getroffen als jetzt
- [ ] Ich fühle mich jetzt selbstbewusster als ohne meinen Hund

Bitte ergänzen Sie die Liste mit weiteren Punkten, die Sie persönlich als wichtig empfinden.

Antwort:

4) Bitte zählen Sie die Aufgaben Ihres Hundes auf, die für Sie besonders wichtig sind, und beschreiben Sie, warum er*sie Ihnen damit sehr hilft.

Antwort:

5) Kam es durch die Zusammenarbeit mit Ihrem Hund zu neuen Herausforderungen/Belastungen im Alltag für Sie? Wenn ja, bitte beschreiben Sie diese.

Antwort:

6) Bitte nennen Sie ein paar für Sie wichtige Veränderungen in Ihrem Leben seitdem Ihr Hund bei Ihnen ist.

Antwort:

7) Zum Schluss bitte ich Sie, Ihre Zukunftspläne und Wünsche zu beschreiben.

Antwort:

Zurück Weiter

Befragung unterbrechen

Geschlecht:

- ○ Männlich
- ○ Weiblich
- ○ Divers

Alter:

Wie sind Sie zu Ihrem Hund gekommen und wie lange ist er schon bei Ihnen?

Antwort:

Alter des Hundes

Alter des Hundes:

Zurück Weiter

Befragung unterbrechen

Appendix 2: Anleitung für Hundehalter:innen

Wichtige Informationen und Anleitung zur Messung von Cortisol im Speichel des Hundes im Kontext der Masterarbeit „Die Mensch-Tier-Beziehung zwischen Personen mit Posttraumatischen Belastungsstörungen (PTBS) und ihren Assistenzhunden - Einfluss auf die Lebensqualität der Menschen sowie auf den Cortisolspiegel der Hunde“

1. **Fragestellung**

Über die Stressbelastung von PTBS-Assistenzhunden durch ihre alltäglichen Aufgaben gibt es zum jetzigen Zeitpunkt keine Untersuchungen. Da chronischer Stress zu verschiedenen Krankheiten führen kann, ist es allerdings wichtig, über die Stressbelastung der Hunde Bescheid zu wissen. Sollte sich zeigen, dass PTBS-Assistenzhunde einen generell erhöhten Cortisolwert, also einen erhöhten Stresslevel, haben, könnten in weiterer Folge Möglichkeiten zur Stressreduktion entwickelt werden. Diese könnten in den Alltag geprüfter PTBS-Assistenzhunde integriert werden. Die Cortisolwerte der PTBS-Assistenzhunde werden außerdem mit jenen von Familienhunden sowie Diabetikerwarnhunden verglichen.

2. **Biomarker**

Donald Broom definiert Stress als einen Zustand, in dem die Anpassungsfähigkeit eines Individuums aufgrund der Reize, die auf dieses einwirken, überfordert ist. Dies gefährdet die Homöostase, also das innere Gleichgewicht wichtiger Körperfunktionen (Broom und Johnson 1993). Da der Körper jedoch stets bestrebt ist diese zu erhalten, kommt es zu einer Stressreaktion. Diese lässt sich sowohl im Verhalten als auch als physiologische Parameter messen. Die physiologische Reaktion kann als Veränderung verschiedener Biomarker festgestellt werden, die auch im Speichel gemessen werden können (Soo-Quee Koh und Choon-Huat Koh 2007). Die Analyse durch den Speichel des Hundes bietet den Vorteil, dass die Probenahme nicht invasiv ist und dem Hund somit keinerlei Schmerzen zugefügt werden (Dreschel und Granger 2009). Analog zu einer Vielzahl anderer Studien (vgl. u. a. Glenk et al. 2014, Svobodova et al. 2014, Beerda et al. 1998) soll auch im Rahmen dieser Studie das Cortisol im Speichel des Hundes gemessen werden. Der Cortisolwert wird als physiologischer Parameter für die Analyse der Stressbelastung des Hundes herangezogen. Erfährt der Hund Stress, so erhöht sich unter anderem der Level der Glukokortikoide in seinem Körper. Glukokortikoide sind eine bestimmte Gruppe von Hormonen, die in der Nebennierenrinde produziert werden und zu denen unter anderem das Cortisol gehört. Damit die

Nebennierenrinde dazu angeregt wird Cortisol zu produzieren, bedarf es einer Signalkaskade, die auch als Hypothalamus-Hypophysen-Nebennierenachse oder HPA-Achse bezeichnet wird. Als Reaktion auf einen Stressreiz wird also zunächst der Hypothalamus, der im Zwischenhirn des Hundes liegt, aktiviert. Dieser schüttet ein Hormon aus, das einen weiteren Bereich im Gehirn aktiviert - die Hypophyse. Diese schüttet erneut ein Hormon aus, welches durch den Körper wandert und die Nebennierenrinde zur Produktion von Cortisol anregt. Durch einen passiven Vorgang diffundiert das Cortisol auch in den Speichel. Hierdurch kann die Stressreaktion des Hundes und folglich die Aktivierung der HPA-Achse durch das im Speichel vorhandene Cortisol gemessen werden. Das im Speichel enthaltene Hormon Cortisol wurde bereits in einer Vielzahl von Studien herangezogen, um eine Stressreaktion des Hundes zu messen (vgl. u. a. Glenk et al. 2014, Svobodova et al. 2014, Beerda et al. 1998).

Referenzen

Beerda, B., Schilder, M.B.H., van Hooff, J.A.R.A.M., de Vries, H.W., Mol, J.A. (1998) Behavioural, saliva cortisol and heart rate responses to different types of stimuli in dogs. Applied Animal Behaviour Science, 58, 365–381.

Broom, D.M., Johnson, K.G. (2008) Stress and animal welfare. Kluwer Academic Publishers, Dordrecht. Dreschel, N.A., Granger, D.A. (2009) Methods of collection for slaivary cortisol measurement in dogs. Hormones and Behavior, 55, 163-168.

Glenk, L.M., Kothgassner, O.D., Stetina, B.U., Palme, R., Kepplinger, B., Baron, H. (2014) Salivary cortisol and behavior in therapy dogs during animal-assisted intervantions: A pilot study. Journal of Veterinary Behavior, 9, 98-106.

Koh, D.S.-Q., Koh, G.C.-H. (2007) The use of salivary biomarkers in occupational and environmental medicine. Occupational and Environmental Medicine, 64(3), 202-210 doi: 10.1136/oem.2006.026567.

Svobodova, I., Chaloupkova, H., Koncel, R., Bartos, L., Hradecka, L., Jebavy, L., (2014) Cortisol and secretory immunoglobulin A response to stress in german shepherd dogs. PlosONE, 9 (3), e90820.

Wichtige Hinweise zur Speichelprobenahme

Um aus den Speichelproben eindeutige Messungen zu erzielen und somit den Verlust dieser wertvollen Daten zu verhindern ist es entscheidend, dass für die Probenahme einige Punkte bedacht werden:

- Der Hund soll mindestens eine Stunde vor Entnahme der Speichelprobe nicht gefüttert worden sein, da Fleisch nachgewiesenermaßen die Werte beeinflussen würde. Die Gabe von Belohnungen bis etwa 15 Min vor der Probenahme ist möglich. Es sollten hierfür jedoch Leckerchen gewählt werden, die entweder feucht oder zumindest halbfeucht sind. Verunreinigungen der Mess-Salivette mittels Futterreste, Blut (Zahnfleischbluten) oder Ähnlichem machen die Probe unbrauchbar.

- Der Hund sollte sich kurz vor der Probenahme nicht sportlich betätigt haben.

- Entnehmen Sie Speichelproben bitte immer in entspannten Situationen.

- Die Salivette soll ruhig im Hundemaul liegen. Ein übermäßiges Reiben an den Lefzen und am Zahnfleisch sollte vermieden werden, damit es zu keinen Verunreinigungen kommt.

Kooperationspartner:

Die Speichelprobe

Zeitpunkte der Speichelprobenahme

Die Speichelproben werden drei Mal täglich an sieben aufeinanderfolgenden Tagen genommen. In diesen Zeitraum sollen keine Feiertage fallen. An welchem Wochentag begonnen wird ist unwichtig. Die Uhrzeiten der Probenahme variieren stark vom Tagesablauf der Hundehalter:innen, müssen aber unbedingt dokumentiert werden. Die erste Probenahme des Tages passiert wenn möglich gleich nach dem Aufstehen, die zweite zur Mittagszeit und die dritte am Abend.

Ablauf der Speichelprobenahme

Für die Speichelprobenahme wird das Folgende benötigt:

- Eine Salivette
- Ein Einmalhandschuh
- Werte Tabelle
- Stift
- Leckerchen

1. Über die Hand, mit der Sie die Salivette festhalten werden, ziehen Sie bitte zunächst den Einmalhandschuh.

2. Nun wird die Salivette in das Maul des Hundes geführt und dort für 1-2 Min. festgehalten, da eine ausreichende Menge an Speichel für die nachfolgenden Messungen benötigt wird.

3. Nach dieser Zeit wird die Salivette aus dem Maul des Hundes herausgenommen und der Hund wird mit dem Leckerchen belohnt.

Nach der Probenahme muss diese sofort mit Wochentag und Uhrzeit beschriftet und eingefroren werden, um eine korrekte Messung zu gewährleisten.

Bitte tragen Sie die Daten zur Probenahme anschließend in die ausgehändigte Tabelle ein. Außerdem können Sie zusätzlich zur Uhrzeit auch besondere Vorkommnisse im Zeitraum

zwischen der letzten Probenahme und der aktuellen in die Spalte der Tabelle eintragen (Siehe Beispieltabelle).

	Montag	Dienstag	Mittwoch	Donnerstag	Freitag	Samstag	Sonntag
Früh (6-9)	8:15	8:30 Zu spät aufgestanden	8:00	7:30 Unruhige Nacht	8:00	8:30	8:45
Mittags (12-15)	14:45 davor Langer Spaziergang	13:30	14:00 War davor lange alleine	12:30	13:45 Hat davor im Garten gespielt	14:15 Ausflug mit den Kindern	15:00
Abends (20-23)	22:30	22:00 Besuch war davor da	22:45	21:45	22:30 Babysitter war da	21:30	21:00 Davor war eine Geburtstagsfeier

Zeitraum der Probenahme: 10.01.2022 – 17.01.2022

Name des Hundes: Kimba

Appendix 3: Checkliste für Hundehalter:innen

Probenahme

Leckerli bereitstellen
Einweghandschuhe anziehen
Baumwollröllchen in die Backe legen
60 Sekunden warten
Baumwollröllchen herausnehmen und in das Röhrchen stecken
Zumachen
Dem Hund ein Leckerli geben
Salivette mit Wochentag und Uhrzeit beschriften (Wasserfester Stift)
Datum, Uhrzeit und besondere Vorkommnisse im Protokoll eintragen
Röhrchen einfrieren

Beschriftung

Beispiel:

Wochentag: Freitag

Uhrzeit: 8:15

Andere Angaben auf der Salivette bitte unbeachtet lassen

Verpacken

Behälter mit Vornamen, Familienname, Hundename beschriften
Beschriftete Röhrchen in den Behälter geben
Kühl Akku dazulegen
Behälter fest verschließen (Klebeband)

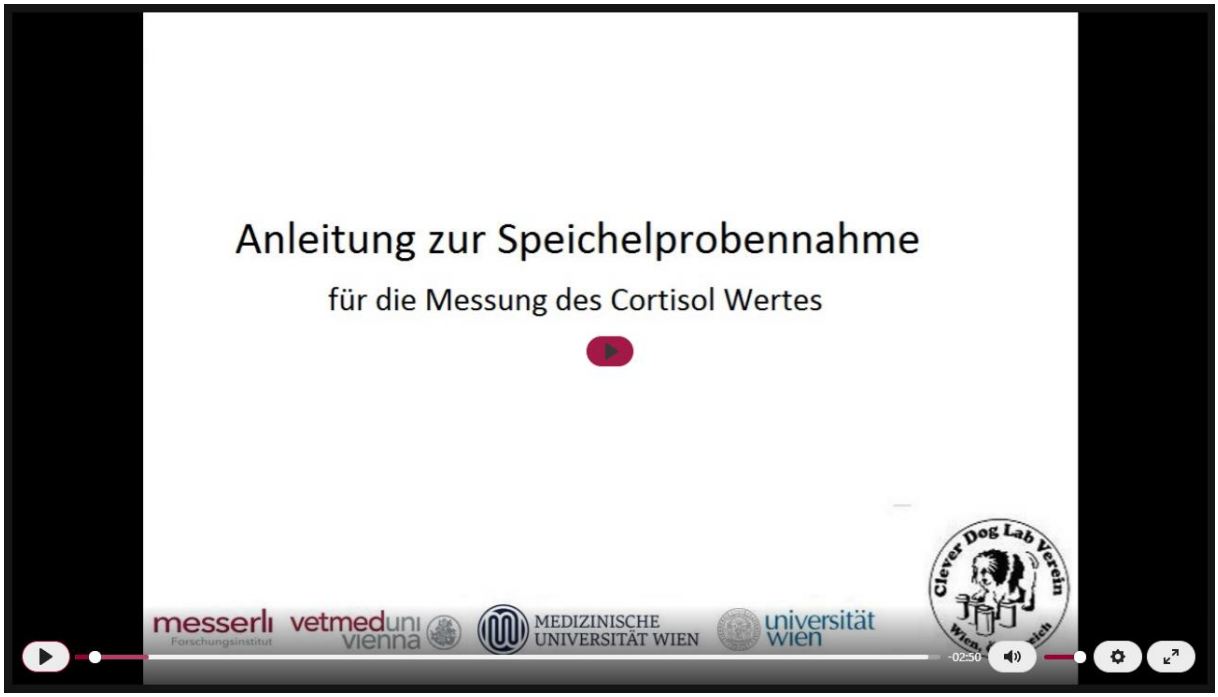
Für jegliche Art von Fragen bin ich unter **karoline.gerwisch@vetmeduni.ac.at** erreichbar!

Vielen Dank für Ihre Teilnahme!

Karoline Gerwisch

Appendix 4: Videoanleitung Speichelprobenahme

Foto aus dem Video, welches den Teilnehmer:innen mittels eines Links zur Verfügung gestellt wurde.



Appendix 5: Fragebogen Hundehalter:innen

Name Hund ……

Rasse oder Mischling …….

Geburtsdatum ……

Im Haushalt lebende Hunde (Anzahl) …….

Insgesamt im Haushalt lebende Personen (Alter) …….

Zeitraum der Probenahme ……

Datum des Versandes der Proben …….

Sonstige Anmerkungen (Persönlichkeit des Hundes, besondere Umstände)
……
……
……
……
……
……

Für jegliche Art von Fragen bin ich unter **karoline.gerwisch@vetmeduni.ac.at** erreichbar!

Vielen Dank für Ihre Teilnahme!

Karoline Gerwisch

Appendix 6: Einverständnis- und Verpflichtungserklärung der Hundehalter:innen

Ich,

Name des:der Hundehalter:in: …….

Wohnort:……

Tel.Nr.……..

E-Mailadresse:……

erkläre hiermit, dass ich damit einverstanden bin, dass mein Hund

Name:……..

Chipnummer:…….

Geschlecht:……..

Geburtsdatum:…….

Rasse: …….

im Zeitraum von …….. bis ……..

an folgendem Projekt

„Die Mensch-Tier-Beziehung zwischen Personen mit Posttraumatischen Belastungsstörungen (PTBS) und ihren Assistenzhunden - Einfluss auf die Lebensqualität der Menschen sowie auf den Cortisolspiegel der Hunde“

im Bereich der Vergleichenden Kognitionsforschung am Messerli Forschungsinstitut, Veterinärmedizinische Universität, Veterinärplatz 1, 1210 Wien, **teilnimmt**.

Im Rahmen des genannten Projekts werden Untersuchungen ohne invasive Methoden durchgeführt; diese beinhalten insbesondere die folgenden Maßnahmen:

Im Rahmen des Projektes werden Speichelproben von PTBS-Assistenzhunden genommen, um aus diesen deren aktuelle Cortisolwerte zu ermitteln. Cortisol ist ein physiologischer Parameter, der zur Ermittlung von Stress herangezogen wird. Ziel des Projektes ist es herauszufinden, ob PTBS-Assistenzhunde aufgrund der Angststörung ihrer Halter:innen und

ihrer damit verbundenen ständigen Einsatzbereitschaft einen höheren Cortisollevel haben als Familienhunde und Diabetikerwarnhunde. Die Speichelproben werden drei Mal täglich an sieben aufeinanderfolgenden Tagen von den Hundehalter:innen genommen. Diese bekommen eine Einführung in der Technik der Probennahme und der Probenbeschriftung.

Ich erkläre mich bereit, den Anleitungen des Testleiters zu folgen, wobei es mir jedoch freisteht, die Untersuchung jederzeit abzubrechen.

Ich bestätige, dass der oben bezeichnete Hund nach meinem Wissen frei von ansteckenden Krankheiten ist und über einen wirksamen, zumindest die CORE-Komponenten1 umfassenden Impfschutz verfügt. Sollten bei dem oben bezeichneten Hund im Projektzeitraum Anzeichen einer Erkrankung auftreten, so verpflichte ich mich dazu, ihn unverzüglich einem Tierarzt vorzustellen und den Testleiter über eine allfällige Erkrankung sowie über neue Medikamente, die dem Hund verabreicht werden, zu informieren, da eine Änderung des Gesundheitsstatus die Ergebnisse der Studie beeinflussen kann.

Für den oben bezeichneten Hund besteht im Projektzeitraum eine aufrechte Haftpflichtversicherung mit der gesetzlich vorgesehenen Deckungssumme.

Ich erkläre mich mit dieser Vereinbarung vollinhaltlich einverstanden:

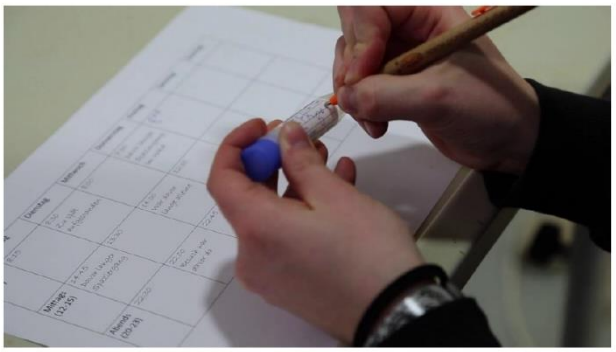
Unterschrift des Halters: ……..

Datum: Wien, am ……

Appendix 7: Bildanleitung für Hundehalter:innen

Teile der Salivette

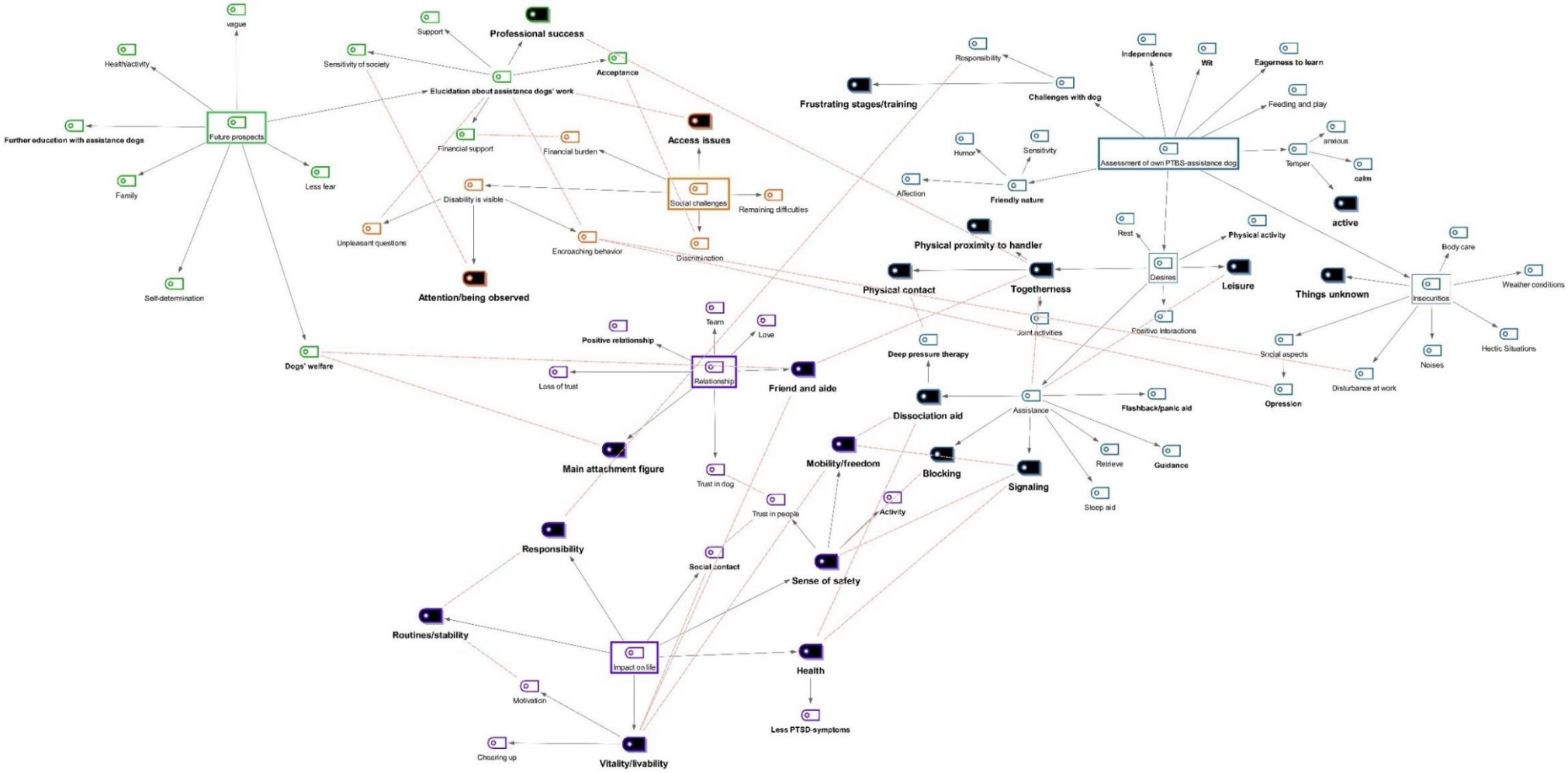
Beschriftung der Salivette



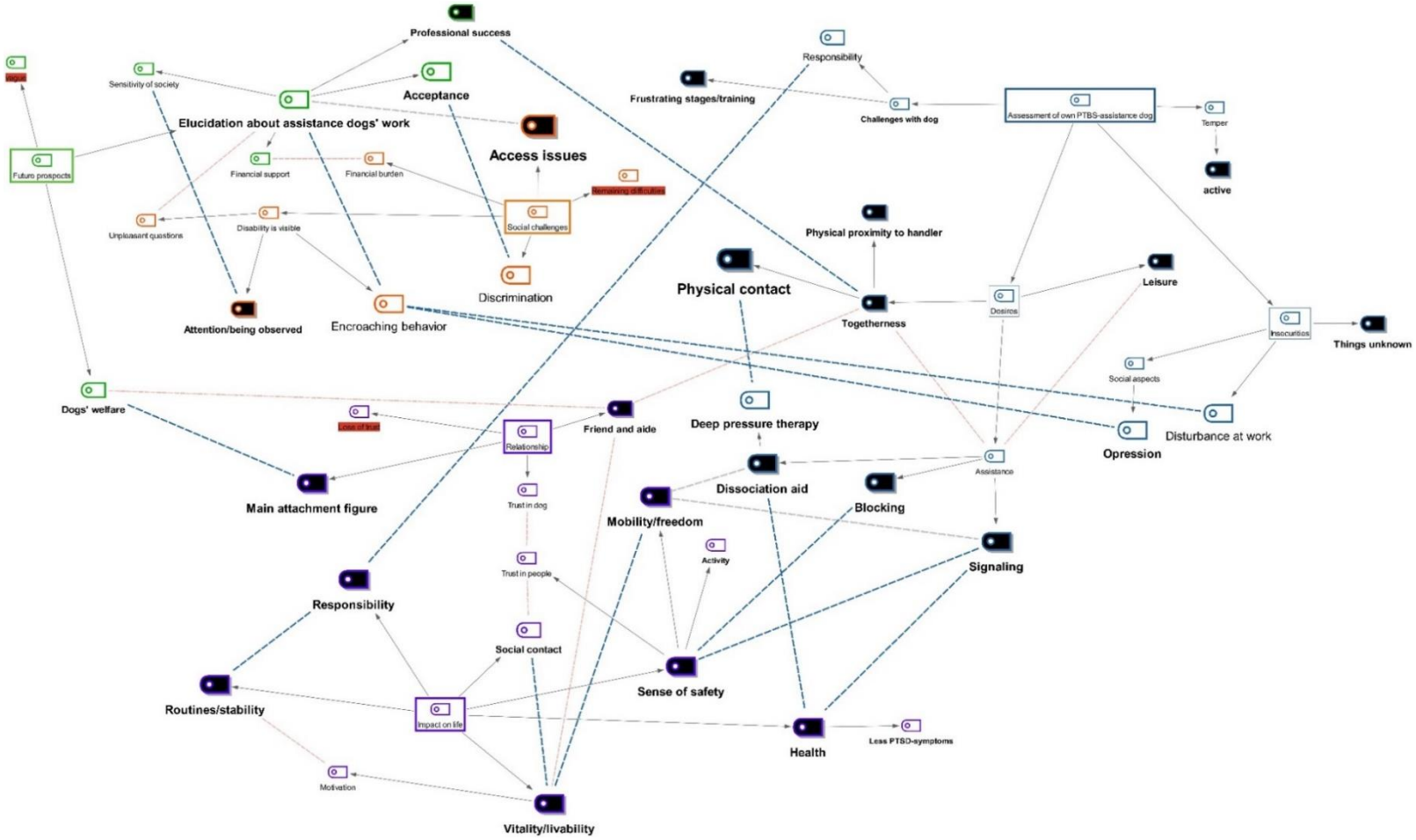
- Wochentag
- Uhrzeit

Packanleitung für Styroporboxen zum Transport der Speichelproben

Appendix 8: Category system



Appendix 9: Main categories



Appendix 10 QCA of 4 main topics

1. Assessment of own PTBS-assistance dog

The main category identified among other subcategories was the characteristic **"active"**. For example, participants described their dog in the following way: "likes to play and romp", "lively blatherskite", "energetic" (transcript p.2, pos.36, p.3, pos.39, 44).

In line with this description falls the subtopic "desires", which describes what participants have to say about the needs and preferences. Analog to the mentioned active temper of the assistance dogs, their handlers have also been aware that they need **"Leisure"** and rest as well. This was pointed out by the following statements: "He likes to relax under the desk", "being able to run properly in nature" (transcript p.9, pos.119, 122).

Further, the participants described the importance of close contact between themselves and their dogs, which was summed up in the main category **"Togetherness"** with the two subcategories **"Physical proximity to handler"** and **"Physical contact"**.

While togetherness was described as the mere fact of being together e.g. "My dog feels good when he is just allowed to chill near me", or "When we take our breaks together" (transcript p.10, pos.126, 132), physical proximity to handler was more about the physical closeness between dog and person, e.g. "He likes to lay on my feet", "She loves to be cuddled" (transcript p.4, pos.50, 56).

Physical contact is an important category, which is tightly connected to the **"Assistance"** work of the dogs, which is as well considered as a desire. **"Dissociation aid"** is a major task of assistance whereby **"Deep pressure therapy"** is described as fundamental support during dissociation. "For dissociations [...] lay on my lap – deep pressure therapy, his weight soothes", "By nudging hands she interrupts a dissociative seizure, by lying in contact she secures me" (transcript p.14, pos.181, p.18, pos.194).

Further main categories falling into the scope of assistance are **"Blocking"** as well as **"Signaling"**. Participants depicted those as relevant duties: "Indicating dissociation by recognizing and indicating certain behaviors, I can then sit down early. She blocks for me so that I feel safer" (transcript p.18, pos. 198), "Interrupt and display dissociations, block strangers

by standing in front of me" (transcript p.16, pos.185), "He signals tension and dissociation so that I can react early on" (transcript p.18, pos.197). The delineated categories of Assistance were tightly connected to the topic "Impact on life" and its categories and will therefore be further discussed under point 3.

Aside from the desires of the dogs, participants also talked about **"Insecurities"**, whereby **"Things unknown"** have the highest incidence number. "Strange situations, strange people", "Confined spaces she does not know" (transcript p.11, pos.151; p.12, pos.158) are environments in which the dogs feel insecure. Another important aspect seemed to be that dogs feel insecure when disturbed/oppressed during their work, which is connected to the topic social challenges (see point 4.).

When describing their assistance dogs, participants also mentioned challenges they faced with or because of the dogs, which seems to be linked to the category **"Responsibility"** (see point 3.). Especially problems summarized in the category **"Frustrating stages/training"** occurred at times. "Puppy time was partly very exhausting. The sudden great responsibility and challenges, the dog also needed security from his human and I could not provide it", "Going out in the dark, training in public places"," I got her as a puppy, so I had to show her life first and link things positively that I might have been more afraid of and avoided on my own. The time of housetraining (I could not take my sleep medication)" (transcript p.20, pos.208, 209, 210). The quotes show that participants initially had to overcome and put themselves in uncomfortable situations for their eventual assistance dog. This shows that the great responsibility for the animal can also harbor problems that not every person with PTSD may be able to cope with.

2. Relationship

Almost all participants described the relationship to their dog as positive – they see their dogs as friends, helpers, or their one and everything which led to the main categories **"Main attachment figure"** and **"Friend and aide"**. Examples underpinning this are: "She is everything for me. My best friend, helper and she will always be and remain something very special for me", "She has become my purpose in life" (transcript p.8, pos.100, 102). Furthermore "Friend and aide" is coherent with the main category **"Vitality/livability"** (see point 3.) since having an assistance dog is described as enabling respondents freedom in life

and a greater QoL for instance by facilitating social contact or accompanying in everyday life. Answers to the question which role the dog plays for participants were e.g. “A very big one, because otherwise many things would not be possible for me in everyday life”, “Support, friend, door opener, comforter”, “She is my salvation. I am proud of her, never thought that a dog can do so great to my life.”, or “She is incredibly important to me. Without her, I probably wouldn't be alive, or at least wouldn't have gotten as far as I am now. She gives me quality of life” (transcript p.8, pos.104, 107, 109; p.9, pos.113).

In contrast to this, a participant stated that she lost trust to the dog “She trusts me completely, I trust her not so much anymore after some unforeseen incidents” (transcript p.7, pos.82). In such a concrete case it would have to be asked again how the loss of trust came about in order to be able to work on the relationship between dog and handler. This is not possible within the framework of the chosen method of this thesis. However, it should be pointed out that the basis of trust is not self-evident, but necessary to enable a successful cooperation of the human-dog team, which could positively influence the QoL eventually.

3. Impact on life

See chapter 3.3.1

4. Social challenges

The main topic aside from the frustrating stages and training was social challenges. The main categories within it are **“Access issues”** and **“Attention/being observed”**.

Having access issues to e.g. supermarkets seems to be a widespread topic, with the source that people with a mental disability are not easily recognized, in contrast to e.g. someone with a guide dog for blind people. This leads to enormous stress for them since they often find themselves in situations where they have to explain and argue for entrance into a store. Participants state the following: “Access problems and constantly having to discuss especially with doctors and in stores leads to massive stress”, “Assistance dogs are not widely used and people are usually not informed that assistance dogs are allowed everywhere, which often leads to access problems and discussions”, “Unfortunately, I often have to fight to get my dog into stores with me. This often overwhelms me” (transcript p.20, pos.207; p.21, pos.212, 213).

Getting more attention than wanted is another frequently mentioned issue, since an assistance dog makes an actually invisible disability more visible. In addition to inadequate questions and disturbances of the dogs' work (summarized in the subcategory "Encroaching behavior"), participants as well mentioned discrimination of people with mental disability. The following quotations are examples of respondents' experiences with discrimination and inappropriate behavior of others:

"Many curious (but partly also penetrating) questions why I have the dog or what the dog can do. So much more attention, even if you want to be left alone" (transcript p.21, pos.215).

"Discrimination is very directly visible through assistance dogs, visibility of an invisible disability in everyday life and stupid questions (e.g., "why do you need an assistance dog, you look normal anyway")" (transcript p.20, pos.207).

"People talk to me in the store, want to pet my dog even with high visibility vest" (transcript p.19, pos.206).

The encroaching behavior of strange people is connected to the topic "insecurities of the dog", where participants mentioned that their dogs do not like oppression or being disturbed during work. Those social aspects must be considered since they might also have an impact on the dogs' stress levels and therefore their wellbeing. Challenges people with a PTSD-assistance dog have to face will be further discussed in the results section of this thesis, since it is a very important aspect, and respondents mentioned that some difficulties remain even with the dog by their side.

5. Future prospects

The category that was identified as mattering most to participants is **"Professional success"**, meaning that they want to have a job where they are accepted with their disability and can prove themselves together with their dogs. The junction of their wishes to be fulfilled seems to be "Education about assistance dogs' work" because it might lead to a higher sensitivity of people and subsequently to acceptance of people with (mental) disabilities. If people knew about assistance dogs' duties and rights, they might not interrupt their work, which would lead to reduced stress for the dogs as well as for their handlers since discussions and justifications about access to public institutions would be redundant.

"After graduation I would like to find a job where I am accepted and can work with my subject matter" (transcript p.28, pos.253) is an example of how a higher acceptance could bring about the desired professional success. Moreover, participants claim that they want to "get ahead professionally with my assistance dog by my side" (transcript p.30, pos.264), or "someday find a job together with my dog" (transcript p.28, pos.255). The fact that participants' long-term goal is to have a job where they can bring their dog shows again that for most of them, the dog is the main attachment figure. The conclusion can be drawn that this is related to their wish to enable the dogs' welfare like the following quotation depicts: "I wish that my assistance dog will be a healthy and happy dog for a long time to come" (transcript p.28, pos.254).

While the majority of participants has quite clear and promising plans and wishes for the future, it has to be kept in mind that some people with PTSD see the future as unclear and vague

Appendix 11 Results of the MC-question

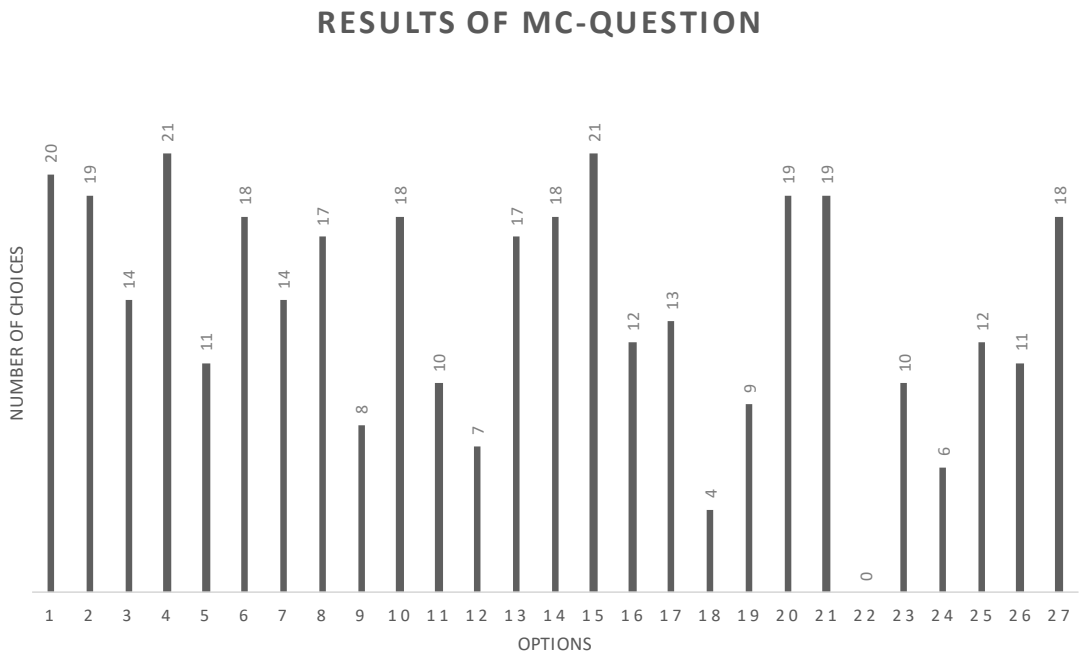


Table 3 *Results of MC-question: showing the results of the MC-question with the incidence number for each statement the participants chose.*

24 of 25 participants fulfilled the task of ticking all applicable statements. 20-24 participants checked the following statements (in decreasing order):

- Without my dog I was less satisfied than now.
- My dog makes it easier for me to leave my house.
- I currently feel motivated by my dog.

Statements chosen 12-19 participants are (in decreasing order):

- Before my dog came to me, I had less desire to pursue new goals.
- I currently feel more mobile than when my dog was not with me.
- Because of my dog I can do everyday activities again that were not possible before.
- I rarely trust other people.
- Without my dog I had a worse quality of sleep than now.
- Because of my dog I have become less jumpy.
- The presence of my dog makes me fall asleep well.
- Before my dog came to me, I was easily frightened.
- My dog makes me feel emotionally strong.
- With my dog by my side, I always feel safe.
- When I am out with my dog, I use public transport
- Together with my dog I feel comfortable in public places.
- The relationship with friends/family has changed positively since I got my dog.

The remainder of statements was chosen by less than half of the participants. None of them chose statement 22 “My everyday life has changed little due to the presence of my dog”.

Appendix 12: Quotation Examples

	Main categories	Quotations of participants (translated from German)
Transcript, Pos. 25	**active**	playful
Transcript, Pos. 26		Wants to work
Transcript, Pos. 30		Creative, open-minded
Transcript, Pos. 31		keen
Transcript, Pos. 32		Fun-loving
Transcript, Pos. 50	**Togetherness**	He likes to watch cooking
	Physical proximity to handler	He likes to be rubbed with the towel and cuddled on the belly or buttocks
Transcript, Pos. 51	**Physical proximity to handler**	Extremely fond of cuddeling
Transcript, Pos. 53	**Leisure**	Soft sleeping places
Transcript, Pos. 60	**Physical proximity to handler**	Lying in contact
Transcript, Pos. 99	**Main attachment figure**	My dog is the most important thing for me and has a central role
Transcript, Pos. 101	**Vitality/livability**	Irreplaceable, enables freedoms
Transcript, Pos. 102	**Responsibility** **Main attachment figure**	She has become my purpose in life. She puts me in a position where I can and am allowed to take on responsibility. She is my anchor.

Transcript, Pos. 105		Life partner
Transcript, Pos. 108		He is the most important thing in my life
Transcript, Pos. 115	**Vitality/livability**	A very big one, she accompanies me everywhere and spends a lot of time with me. She supports me.
Transcript, Pos. 125	**Leisure**	Being able to relax
Transcript, Pos. 156	**Things unknown**	Strangers at home
Transcript, Pos. 159		New things on the walk
Transcript, Pos. 166	**Health**	He helps me to get over high tension situations without hurting me, less depressive phases
Transcript, Pos. 167	**Responsibility** **Health**	Sense of life through responsibility for the dog, significantly fewer hospitalizations
Transcript, Pos. 168	**Mobility/freedom**	Through my dog I learn trust, through him I learn that not everything is bad, with my dog I conquer my freedom
Transcript, Pos. 169	**Responsibility**	Through my dog I learn to take responsibility for myself as well.
Transcript, Pos. 170	**Routines/stability**	My dog helped me find a daily structure
Transcript, Pos. 173	**Mobility/freedom** **Social contact**	I can go out again and meet people, I am freer
Transcript, Pos. 174	**Health**	My health condition is more stable since life with dog has settled down
Transcript, Pos. 176	**Vitality/livability**	I have gained zest for life through my dog.
Transcript, Pos. 177		It gives me pleasure to train with my dog

Transcript, Pos. 179	**Routines/stability** **Responsibility** **Vitality/livability**	Gives me a daily routine, a task, a responsibility, gives me beautiful moments, helps me to move, makes me laugh, challenges me.
Transcript, Pos. 187	**Dissociation aid**	Interrupting dissociations
Transcript, Pos. 188	**Signaling**	the early indication of anxiety
Transcript, Pos. 192	**Signaling** **Dissociation aid**	Nudging/indicating flashbacks and dissociations to interrupt them and bring me back to the current situation. Giving security, as the dog was not present in traumatic situations and thus, I become aware that I am not in that time
Transcript, Pos. 193	**Signaling** **Dissociation aid** **Blocking**	Warning of seizures: Avoiding falls and injuries, Being able to sit on the edge or semi-safe place/provide safety during seizures, Interrupting flashbacks and dissociations. I find it easier to get back to the here and now, blocking - people keep more distance.
Transcript, Pos. 195	**Signaling**	Timely seizure notification
Transcript, Pos. 196	**Signaling** **Blocking**	Indicate heartbeat, keep people away from me
Transcript, Pos. 198	**Deep pressure therapy**	DPT, she calms me down by laying over my legs
Transcript, Pos. 202	**Frustrating stages/training**	When practicing and training wanting to do everything right is very stressful
Transcript, Pos. 203	**Attention/being observed**	I am increasingly addressed on the street about what I have, that I do not look sick, and I am asked what my dog does.

Transcript, Pos. 204		The dog makes my condition visible. I am approached by people who would otherwise not notice it.
Transcript, Pos. 204		There are partly gawking and even filming people when the dog is working.
Transcript, Pos. 204	**Access issues**	I have to justify taking the dog with me at many places.
Transcript, Pos. 204		The most stress is caused by the ignorance of people about the work and the rights of assistance dogs and their owners.
Transcript, Pos. 204	**Responsibility**	More responsibility
Transcript, Pos. 205	**Attention/being observed**	More visibility in public because he is a very noticeable, beautiful dog
Transcript, Pos. 206	**Access issues**	I am approached that dogs are not allowed in here/ people talk to me in the store, want to pet my dog, even with a high-visibility vest/ you first have to debate with the authorities until you are allowed in with a dog.
Transcript, Pos. 223	**Frustrating stages/training**	Training was challenging at the beginning
Transcript, Pos. 223	**Attention/being observed**	Effect and the response of other people to the marked dog.
Transcript, Pos. 225	**Social contact**	Much less loneliness
Transcript, Pos. 225	**Health**	Exercise
Transcript, Pos. 226	**Sense of safety**	I dare to go by public transport with her and to be on the move in Vienna
Transcript, Pos. 227	**Vitality/livability**	Life is more fun
Transcript, Pos. 228	**Vitality/livability** **Social contact**	Gain in vitality and stability, a sense of belonging, a feeling of safety and security

	Sense of safety	
Transcript, Pos. 234	**Social contact**	He also helps a lot against the recurring loneliness.
Transcript, Pos. 239		I can visit friends living further away
Transcript, Pos. 243		I can better maintain social contacts
Transcript, Pos. 244	**Health**	I have less PTSD-symptoms
Transcript, Pos. 254	**Professional success**	Start a small job
Transcript, Pos. 269		find a job where she can be with me

Appendix 13 Results reduced model

Term	Estimate	SE	lower cl	upper cl	χ2	df	P	min	max
(Intercept)	1.64	0.20	1.24	2.01			(3)	1.31	1.88
DogtypePTSD (2)	-1.75	0.29	-2.36	-1.16	24.19	2	<0.001	-2.04	-1.39
DogtypeSignal (2)	-0.35	0.25	-0.82	0.12				-0.62	-0.14
z.time	-0.08	0.05	-0.18	0.03	2.05	1	0.152	-0.11	-0.04
z.age	-0.08	0.12	-0.33	0.17	0.48	1	0.490	-0.18	0.05
Sexm (2)	-0.06	0.21	-0.48	0.36	0.09	1	0.768	-0.22	0.11

Table 4 Results for the reduced model: *Cortisol levels differ between dog types. SE = standard deviation, χ2 = chi-square, df = degrees of freedom (1) time and age were z-transformed to a mean of zero and a standard deviation of one, mean (sd) of age was 5.159 (1.933), mean of time was 14:40 (2) Dog type and sex were dummy coded with companion' and 'female' being the respective reference categories (3) not indicated because of having a very limited interpretation*

Appendix 14 Post-hoc contrasts

	estimate	SE	df	t.ratio	p.value
Companion-PTSD	1.75	0.34	34	5.21	**<.0001**
Companion-Signal	0.35	0.29	29.70	1.19	0.469
PTSD-Signal	-1.40	0.31	36.40	-4.56	**0.0002**

Table 5 Post-hoc contrasts: *PTSD-assistance dogs' salivary cortisol levels are significantly lower (in bold) compared to those of signal dogs and companion dogs. SE = standard deviation, df = degrees of freedom*

Appendix 15 Results full model

Term	Estimate	SE	lower cl	upper cl	χ2	df	P	min	max
(Intercept)	1.63	0.20	1.24	2.03			(3)	1.30	1.76
DogtypePTSD (2)	-1.75	0.30	-2.32	-1.18			(3)	-1.94	-1.40
DogtypeSignal (2)	-0.32	0.26	-0.81	0.19			(3)	-0.49	-0.11
z.time	-0.07	0.09	-0.24	0.12			(3)	-0.14	0.05
z.age	-0.08	0.12	-0.30	0.16	0.45	1	0.500	-0.18	0.05
Sexm (2)	-0.06	0.21	-0.52	0.36	0.08	1	0.778	-0.22	0.11
DogtypePTSD:z.time	0.02	0.14	-0.28	0.28	0	0	0	-0.11	0.09
DogtypeSignal:z.time	-0.05	0.13	-0.34	0.20	0.29	2	0.866	-0.17	0.02

Table 6 Results for the full model: *No significant interaction between Dog type and time of day was found SE = standard deviation, χ2 = chi-square, df = degrees of freedom (1) time and age were z-transformed to a mean of zero and a standard deviation of one, mean (sd) of age was 5.159 (1.933), mean of time was 14:40 (2) Dog type and sex were dummy coded with companion' and 'female' being the respective reference categories (3) not indicated because of having a very limited interpretation*

Appendix 16 Log-cortisol values

Dogtype	emmean	SE	df	lower.CL	upper.CL
Companion	1.61	0.22	29.70	1.17	2.05
PTSD	-0.14	0.23	38.10	-0.60	0.32
Signal	1.26	0.19	32	0.87	1.66

Table 7 Log-cortisol values: *No significant effect of Time of day, sex and age was found. SE = standard deviation, df = degrees of freedom*

Appendix 17 Log-cortisol values for states

state_new	emmean	SE	df	lower.CL	upper.CL	Sample size
No information	0.90	0.18	28.80	0.54	1.26	289
Company work	0.63	0.32	201	-0.01	1.27	15
Walk	0.78	0.25	101	0.29	1.27	27
Working stres	1.05	0.30	183.50	0.46	1.65	15
Stress	1.15	0.23	83.10	0.69	1.61	34

Table 8 Log-cortisol values for different states: *No significant differences between different "states" (stress, working stress, company work, dog walk, no information) was found. SE = standard deviation, df = degrees of freedom*