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Effects of work duration, environment, and experience on stress-related dog behaviours in canine-assisted therapy

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Abstract

Canine-assisted therapy (CAT) work may impose stress on participating dogs. This study examined stress-related behaviours in Golden Retrievers in relation to session duration, working environment, and experience level. Twelve certified, experienced dogs were observed during one-hour CAT sessions. Stress-related behaviours increased with session duration ($r = 0.9317$, $P < 0.01$), reaching maximum levels within the first 20 min, after which no significant change occurred ($P > 0.05$). Lip licking, whale eye, gaze aversion, and owner-seeking were the most frequent behaviours. Environmental influences were assessed using a separate cohort of 12 experienced females working either in a nursing home or a vocational school. Dogs working at the school displayed fewer stress-related behaviours than those working in the nursing home (median 89 vs. 109; $P < 0.05$). Whale eye occurred less frequently in nursing-home dogs ($P = 0.048$), whereas yawning was markedly more common in this environment ($P < 0.001$). A third cohort of inexperienced dogs undergoing certification testing did not differ from experienced dogs in total behaviour frequency ($P = 0.8163$), though specific behaviours varied. Testing dogs showed more lip licking and whale eye, whereas experienced dogs displayed more gaze aversion, yawning, and shaking off. Behaviours increased during tasks involving intensive human–dog contact ($P < 0.0001$). Overall, the results underscore that therapy-dog welfare can be optimized by adapting session length, selecting suitable environments, and supporting dogs with appropriate handling strategies.

Ethology, calming signals, welfare, canine, animal-assisted interventions

The involvement of animals in human therapeutic processes has become common practice. Animals are widely used across various branches of animal-assisted interventions (AAI), and the global popularity of such interventions continues to rise (Palley et al. 2010; Fine et al. 2019). However, relatively few studies have focused on the impact of these interventions on the therapy animals themselves, despite their considerable stress potential (McCullough et al. 2018; Cortesi et al. 2025).

Researchers currently emphasize that AAI research should follow the One Health framework which outlines the conditions under which human benefit does not compromise animal health and welfare, and identifies scenarios in which animals may themselves benefit from such interactions (Hediger et al. 2019; Menna et al. 2019). To date, only a limited number of studies have examined the effects of these interventions on participating dogs (Glenk 2017). As the popularity of AAI continues to grow, the One Health approach underscores the need to more precisely identify both the benefits and the risks to all participants—human and animal alike (Fine et al. 2019; Hediger et al. 2019; Menna et al. 2019; Gallagher et al. 2021).

Dogs are widely incorporated into AAI not only due to their availability but also because of their trainability, favourable behavioural predispositions, and generally

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predictable behaviour (Glenk 2017). Their expanding use aligns with an increasing body of literature documenting positive effects on clients, including physical, emotional, social, and psychological benefits (Braun et al. 2009; Beggs and Townsend 2021). For the dogs, however, work in therapeutic settings may activate the stress potential inherent to these activities (Yong and Ruffman 2014; Glenk 2017; McCullough et al. 2018).

Changes in facial expression as well as body movement and posture serve as sensitive indicators of an individual's emotional state (Hall et al. 2018; Bremhorst et al. 2019; Flint et al. 2024). Various combinations and frequencies of behavioural elements have been described, depending on environmental conditions, frustration, or even 'burnout-like' responses in working dogs (Bremhorst et al. 2019; Cortesi et al. 2025). Numerous studies have identified common stress-related behaviours in dogs, such as increased locomotion, startle responses, panting, pupil dilation, whale eye, gaze aversion, trembling, whining, excessive licking, yawning, hiding, shaking off, limb lifting, and lowered body posture (Beerda et al. 1999; Beerda et al. 2000; Dreschel and Granger 2005; Palestrini et al. 2017; Kartashova et al. 2021; de Winkel et al. 2024). Many of these behaviours can occur in both positive and negative emotional contexts (Albuquerque et al. 2018; Csoltova and Mehinagic 2020). For instance, lip licking may indicate positive excitement during owner reunions (Rehn and Keeling 2011), negative emotional states during veterinary examinations (Csoltova et al. 2017), or frustration when expected rewards are withheld (Bremhorst et al. 2019).

Several studies have linked specific behaviours to specific contexts. Elevated tail wagging has been observed during owner greetings (Rehn and Keeling 2011), whereas shaking off occurs more frequently after agility competitions (Pastore et al. 2011). Dogs exposed to social or spatial restriction show increased locomotion, limb lifting, yawning, and shaking off (Beerda et al. 2000). Shaking off and yawning have also been identified as indicators of stress in working-dog training contexts, whereas limb lifting is often associated with conflict situations or fear of punishment (Schilder and van der Borg 2004; Bellaio et al. 2009). Still, behavioural responses depend on the dog's individual perception of the situation along with factors such as genetics, temperament, and previous experience. Therefore, individual differences must be considered when interpreting behavioural data (Hiby et al. 2006; Haubenhofer and Kirchengast 2007; Rooney et al. 2007; Passalacqua et al. 2013; McCullough et al. 2018).

Stress-related behaviours in therapy dogs may also be influenced by age, experience, training and habituation to specific contexts, predictability of the environment, novel socio-ecological circumstances, client age (and related behaviour), and microclimatic conditions of the workplace (Beerda et al. 1997; Haubenhofer et al. 2005; Marinelli et al. 2009; King et al. 2011; Kuhne et al. 2012; Ng et al. 2014). Thus, handlers must possess not only knowledge of their dog's individual characteristics but also the ability to interpret canine behaviour through interspecies communication cues, including movement, facial expression, and body posture (Kaminski and Nitzscher 2013; Walsh et al. 2024). Some handlers may misinterpret subtle stress signals and therefore fail to respond appropriately in early stages of stress. Questionnaire studies have shown that owners more accurately identify overt stress signals (e.g., whining, shaking) than subtle ones (e.g., gaze aversion, yawning, lip licking). Differences in interpretation have also been observed between male and female owners (Mariti et al. 2012).

Current literature provides inconsistent findings regarding the emotional states and welfare of therapy animals (Clark et al. 2020). Ongoing research seeks to determine the extent to which particular behaviours of working dogs reflect negative stress or positive arousal (Haubenhofer and Kirchengast 2006; Edgar et al. 2012). Some forms of canine-assisted therapy may even have a calming effect on the dog (Clark et al. 2020). De Winkel et al. (2024) highlight the advantages of combining physiological and

behavioural metrics when assessing welfare. The combination of multiple analysis methods has already been used to evaluate stress responses in various animal species (Kotianova et al. 2025; Sebankova et al. 2025). The influence of the environment, specific situations or activities on behavioural and physiological indicators of animal welfare has been confirmed by inter-species research (Kotianova et al. 2025; Paksoy et al. 2025; Sebankova et al. 2025). Given the growing global interest in AAI and the increasing number of dogs involved, ensuring the welfare of these animals and identifying conditions that may compromise their well-being remains a key scientific priority (Glenk and Foltin 2021; de Winkel et al. 2024).

The aim of this study was to evaluate the occurrence of stress-related behaviours over the duration of canine-assisted therapy sessions in order to determine an appropriate maximum session length with respect to canine welfare. Additionally, we assessed the effects of environmental context and handler experience on the occurrence of stress-related behaviours.

Materials and Methods

Assessment of stress-related behaviours over the course of therapy work

To evaluate the occurrence of stress-related behavioural manifestations during therapy work, 12 certified therapy dogs of the Golden Retriever breed – a breed commonly used in animal-assisted therapy in the Czech Republic – (8 females and 4 males), aged 5–10 years and with a minimum of three years of experience, were included. Based on professional articles and scientific literature (Beerda et al. 1999; Beerda et al. 2000; Dreschel and Granger 2005; Palestrini et al. 2017; Kartashova et al. 2021; de Winkel et al. 2024), stress-related canine behaviours (Table 1) were selected for observation in this study.

Table 1. Observed canine behavioural patterns.

Observed behaviour	Definition
Licking	The dog quickly moves the tongue upward to lick its nose.
Shaking off	Rapid lateral movements of the body from side to side.
Whale eye	The dog exposes the sclera by turning its head away while maintaining gaze in another direction.
Yawning	Wide opening of the mouth accompanied by deep inhalation, followed by a brief exhalation as the mouth closes.
Lifting a limb	Lifting of a front limb from the ground (regardless of the exact angle) without the intention to move, sometimes stretching it forward and retracting it back to the body.
Averting gaze	Turning the head away from the client, patient, or situation.
Seeking the handler	Looking toward the handler with an attempt to establish eye contact.
Attempt to escape the situation	The dog leaves or attempts to leave its position without the handler's cue, moving at least two limbs away from the client, patient, or situation, typically toward the handler or the exit.

Frequencies of selected behavioural elements were recorded continuously during a 60-min visit to a long-term care facility while the dogs worked at and on clients' beds. For analysis, the hour-long observation was divided into twelve 5-min intervals. Observations were conducted during regular visits with the same clients in rooms equipped to maintain a stable microclimate. For each interval, the total frequency of all observed behaviours was calculated across all 12 dogs. For each specific behavioural element, the median frequency across all dogs was used for evaluation.

Assessment of environmental effects on stress-related behaviours in therapy dogs

To assess differences in stress-related behaviours across working environments, a separate group of 12 female Golden Retrievers aged 5–10 years, each with at least three years of therapy experience, was evaluated. Six dogs worked in a long-term care facility, and six worked at a secondary vocational school. The frequencies

of behavioural elements listed in Table 1 were recorded during one hour of therapy work in each environment. For each group, median frequencies were calculated for each behavioural element.

Assessment of the effect of experience on stress-related behaviours in therapy dogs

To evaluate the impact of experience on the occurrence of stress-related behaviours, a 30-min observation during a single continuous period was conducted on 12 Golden Retrievers of both sexes (8 females, 4 males) under 3 years of age who were participating in therapy dog certification tests and had no prior therapy experience. Frequencies of the behavioural elements (Table 1) for each dog and overall were compared with those of 12 more experienced Golden Retrievers (8 females, 4 males), aged 5–10 years, certified and with at least three years of practice, who had been observed for 30 min during their therapy work. For this comparison, data from the first 30 min of the long-term care facility observations described above were used.

During the certification tests, behaviours were recorded during the following tasks: acclimation to medical equipment, sudden stimulus response test, entering a person's personal space, and being lifted by a stranger. These tasks simulate the types of interactions typical of therapy work. For additional analysis, tasks were categorized according to the degree of physical contact involved: contact tasks (entering personal space, being lifted by a stranger) and distance tasks (acclimation to medical equipment, sudden stimulus response). Total frequencies of observed behaviours for all 12 tested dogs were divided according to this classification and compared based on the differing levels of dog–examiner contact.

Behaviour recording

To obtain data for analysis, canine behaviour was recorded continuously during all observation intervals using two parallel portable cameras (Niceboy Vega X Pro; NICEBOY s.r.o., Prague, Czech Republic) for later evaluation. Video analyses were performed using the specialized behavioural analysis software The Observer XT (Noldus Information Technology, The Netherlands). Prior to the experiment and subsequent data evaluation, all evaluators underwent standardized training. A subsample of 20% of the recordings was independently analysed by a second evaluator, and inter-observer agreement was assessed using Cohen's kappa ($\kappa > 0.98$).

Statistical analysis

Statistical analyses were performed using UNISTAT 6.5 for Excel (Unistat Ltd., London, UK). Spearman's correlation coefficient was used to assess the relationship between therapy duration and frequency of behavioural elements. Differences in frequencies of behavioural manifestations were evaluated using chi-square test. A value of $P < 0.05$ was considered significant.

Results

Assessment of stress-related behaviours over the duration of therapy work

The total frequency of observed behavioural elements during the 1-h therapy session is shown in Fig. 1. As the duration of the therapy session increased, the frequency of behaviours associated with stress in dogs also increased ($r = 0.9317$, $P < 0.01$).

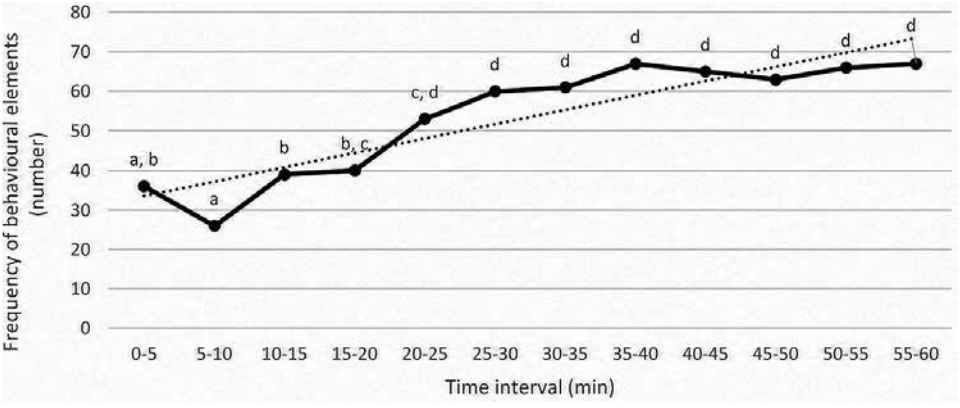

Fig. 1. Frequency of stress-related behaviours in dogs (n = 12) during 1 h of therapy work.

Different superscripts (a, b, c, d) indicate significant differences in frequency ($P < 0.05$).

Stress-related behaviours were observed within the first 20 min of the therapy session, during which their frequency reached its maximum and did not change significantly thereafter ($P > 0.05$).

Among the analysed behavioural elements, dogs working in clients' rooms and at their beds in the long-term care facility most frequently displayed licking, whale eye, gaze aversion, and seeking the handler. Compared to all other evaluated behavioural manifestations, these behaviours occurred significantly more often ($P < 0.05$), with licking being highly significantly more frequent ($P < 0.01$). Licking also occurred significantly more often than whale eye, gaze aversion, and seeking the handler ($P < 0.05$). No significant differences were found among whale eye, gaze aversion, and seeking the handler ($P > 0.05$).

Analysis of the temporal development of individual behavioural elements revealed a highly significant increase in licking (r = 0.8366, $P = 0.0007$), whale eye (r = 0.7368, $P = 0.0063$), gaze aversion (r = 0.8109, $P = 0.0014$), and seeking the handler (r = 0.8673, $P = 0.0003$). No significant increases or decreases were observed for the remaining behaviours.

Assessment of environmental effects on stress-related behaviours in therapy dogs

Fig. 2 presents the median frequencies of stress-related behavioural manifestations recorded in dogs working for one hour in two different environments. Therapy dogs working in a secondary vocational school during practical classes exhibited fewer stress-related behaviours ($P < 0.05$) than dogs working in clients' rooms and at their beds in the long-term care facility (median frequency 89 and 109, respectively).

Dogs working in the long-term care facility displayed whale eye significantly less often compared to dogs working in the school environment ($P = 0.048$). Conversely, yawning was observed significantly more often in the long-term care facility ($P < 0.001$). No significant differences were found between the two environments for the remaining behavioural elements ($P > 0.05$).

In school-working dogs, licking, gaze aversion, whale eye, and seeking the handler were recorded significantly more often ($P < 0.05$) compared to the other observed behaviours, with no significant differences among these four behaviours ($P > 0.05$).

In dogs working in the long-term care facility, licking and gaze aversion were the most frequently observed behaviours ($P < 0.05$); only in comparison with seeking the handler no significant difference was detected ($P > 0.05$).

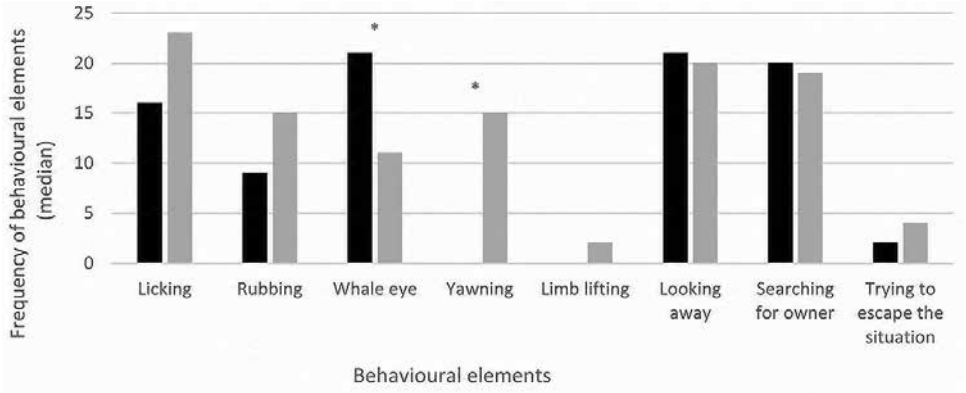

Fig. 2. Frequency of stress-related behaviours in dogs (n = 6 per group) performing therapy work in different environments during a 1-h session.

An asterisk (*) indicates a significant difference ($P < 0.05$) in frequency between environments.

Assessment of the effect of experience on stress-related behaviours in therapy dogs

No significant difference was found in the total frequency of stress-related behaviours between dogs undergoing therapy certification tests and dogs performing therapy work ($P = 0.8163$). However, the groups differed in specific behavioural elements.

Figure 3 shows that dogs undergoing certification tests exhibited significantly higher frequencies of licking ($P = 0.0080$) and whale eye ($P = 0.0013$) compared to experienced dogs. In contrast, experienced dogs showed significantly higher frequencies of gaze aversion ($P = 0.0265$), yawning ($P < 0.0001$), and shaking off ($P = 0.0025$). No significant differences were found between the groups for the remaining behaviours ($P > 0.05$).

Among dogs undergoing certification tests, licking and whale eye were the most frequent behavioural manifestations, with all other behaviours occurring significantly less frequently ($P < 0.01$) and without differences among them ($P > 0.05$).

Experienced dogs most frequently displayed licking, gaze aversion, and seeking the handler, with no significant differences among these behaviours ($P > 0.05$).

When comparing behaviour frequencies in certification-test dogs based on the degree of physical contact with the examiner, significantly more stress-related behaviours were observed during contact tasks (median 34) than during distance tasks (median 18) ($P = 0.0017$).

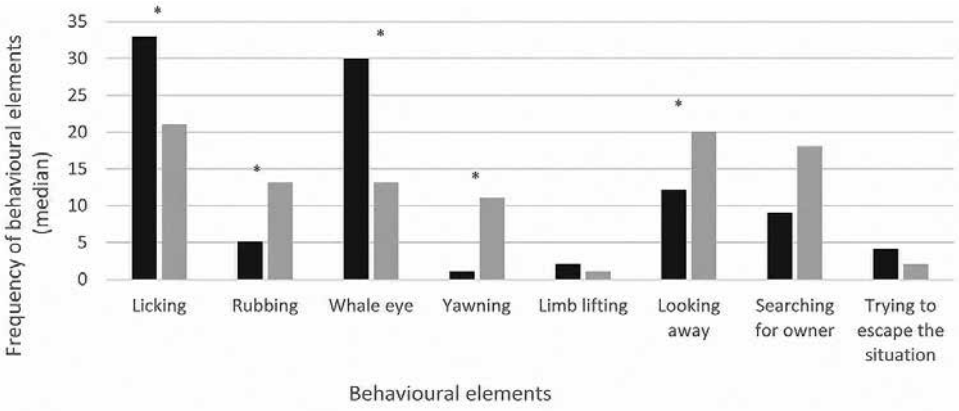

Fig. 3. Frequency of stress-related behaviours in dogs (n = 12 per group) during therapy certification tests and therapy practice over 30 min.

An asterisk (*) indicates a significant difference ($P < 0.05$) in frequency of behavioural elements between dogs during therapy certification tests and therapy practice.

Discussion

The activity of therapy dogs can be associated with stress, as demonstrated by the results of our study, in which all monitored groups of dogs exhibited behavioural elements indicative of stress. In our study, therapy dogs frequently displayed lip licking, whale eye, gaze aversion, and searching for the handler. These behaviours are commonly associated with stressful or frustrating situations in dogs (Beerda et al. 2000; King et al. 2011; Csoltova et al. 2017; Bremhorst et al. 2019). All monitored groups of therapy dogs showed a high occurrence of lip licking, which aligns with previous studies reporting that oral behaviours—particularly lip licking—are among the most frequently used stress-related signals in dogs (Beerda et al. 1999; McCullough et al. 2018).

An increase in stress-related behaviours was observed during the activity, confirming findings of earlier research that identified factors such as duration of work, time of day, and number of activities per unit of time as contributors to stress in dogs during practice (Haubenhofer and Kirchengast 2006; Haubenhofer and Kirchengast 2007). Our results revealed a significant rise in the monitored behaviours after 20–25 min of work. Based on these findings, it appears that the duration of animal-assisted interventions influences dogs' stress levels and thus affects their welfare during the activity. Palestrini et al. (2017) reported that a 20-min intervention did not elicit observable stress-related behaviours. Similarly, Corsetti et al. (2019) did not detect behavioural indicators of stress, though they suggested that this may have been due to the duration of their interventions, which did not exceed 30 min. According to our findings, dogs should not be required to continue working beyond this time threshold if their welfare is to be protected. However, given the multitude of factors influencing therapy dogs, exceeding or not exceeding this threshold may not necessarily lead to decreased or preserved welfare (Cortesi et al. 2024). Moreover, this time limit cannot be universally applied across all types of animal-assisted activities due to differences in environment, microclimate, client groups, and the age and experience of the dogs (Haubenhofer et al. 2005; Marinelli et al. 2009; King et al. 2011; Ng et al. 2014).

Another important factor preventing the establishment of a universal time limit is the individuality of each dog. Every dog may display a different repertoire of behavioural signals, even in identical situations (Rooney et al. 2007). Likewise, the same activity may elicit positive emotions in one dog and negative emotions in another. Dogs respond to new situations through various behaviours depending on their prior experiences and the specific circumstances (Haubenhofer et al. 2005; Ng et al. 2014), and their reactions are also influenced by the degree of contact with an unfamiliar person (Beerda et al. 1999; Kuhne et al. 2012; Glenk et al. 2014). Published studies may therefore differ considerably in their findings (Haubenhofer and Kirchengast 2007; Albuquerque et al. 2018; McCullough et al. 2018; Csoltova and Mehinagic 2020).

The differences in the frequency of stress-related behaviours observed across various working environments indicate that environment significantly affects animal welfare. The influence of environment on dogs' stress responses has also been described by Beerda et al. (1997). Environmental familiarity and habituation to the working setting can play an important role as well (Haubenhofer et al. 2005; Palestrini et al. 2017). Environmental predictability is another essential factor—less predictable environments have been linked to higher stress levels in dogs (Beerda et al. 1997).

The behavioural patterns most frequently displayed by dogs engaged in therapy work (lip licking, gaze aversion, whale eye, searching for the handler, yawning) have been widely reported as common during such activities (King et al. 2011; McCullough et al. 2018). These behaviours have also been associated with social or spatial restriction and have been observed in working dogs undergoing training (Beerda et al. 2000; Schilder and van der Borg 2004).

The relatively high occurrence of 'searching for the handler' underscores the importance of the dog–handler bond during practice and highlights the need for a well-coordinated therapy team. The significance of this bond is supported by research demonstrating differences in communication between dogs and their owners, dogs and unfamiliar individuals, and even between dogs themselves (Walsh et al. 2024). The handler should also be able to influence the dog's emotional experience in specific situations (Ng et al. 2014).

The lower frequencies of the monitored behaviours in dogs participating in actual practice compared with those undergoing evaluation during therapy certification tests may be linked to the previously discussed factors, including experience, the familiarity of the physical

environment, and the possibility of withdrawing from an uncomfortable situation—conditions in which the pressure on the dogs is generally lower than during testing (Hiby et al. 2006; Haubenhofer and Kirchengast 2007; Glenk et al. 2013; Passalacqua et al. 2013; Ng et al. 2014; Palestrini et al. 2017). Findings by Haubenhofer et al. (2005) suggest that training and habituation to therapeutic work improve dogs' ability to cope with stress. The effects of training and work experience on stress management have also been documented in service dogs (Haverbeke et al. 2008). Appropriately trained handlers may further reduce dogs' stress responses by shaping controlled and predictable interactions (Ng et al. 2014).

The differences observed between the individual exercises of the certification test suggest that the frequency of stress-related behaviours may depend on the level of physical contact and the type of interaction involved. The connection between human touch and stress responses in dogs has also been reported in studies on shelter dogs (Coppola et al. 2006). Individual reactions likely depend on the type of contact and the relationship between the dog and the person involved (Kuhne et al. 2012). Dogs' responses may also vary depending on whether the interaction occurs with the familiar handler, with an unfamiliar individual, or with multiple people during practice (King et al. 2011).

Differences may also arise from forced contact with the evaluator and the impossibility of escaping the situation. Even the mere possibility of escape can play an important role for dogs in such contexts (Glenk et al. 2013).

It is important to note that not only increased frequencies of the monitored behaviours, but also their various combinations—or even their absence—may indicate reduced welfare (Bremhorst et al. 2019).

The facts that each dog's temperament and personality shape individual variability in stress-related behaviours based on age, breed, and experience (Hiby et al. 2006; Passalacqua et al. 2013), along with the variability in coping strategies used in response to the same stimulus (Rooney et al. 2007), together with our relatively limited sample size, represent factors that may constrain the interpretation of our findings. These aspects should therefore be addressed in future research. Nonetheless, our study provides an important first step toward defining an upper time limit for therapy work and informing potential adjustments to the management of therapy dogs. Our results further highlight the significance of working environment and prior experience in shaping dogs' stress responses.

In conclusion, the results of this study suggest that the duration of animal-assisted interventions has a direct impact on dogs' welfare during their work. Despite the individuality of each dog and the multifactorial nature of welfare-related aspects, the study highlights the importance of selecting an appropriate time schedule for practice. According to our findings, therapy dogs should not exceed 25 min of continuous work if their welfare is to be maintained. Any extension beyond this threshold must be carefully considered and remains the responsibility of the handler, who should be able to assess the specific situation, environment, and type of activity being performed.

A limitation of the present study is that the observations were conducted exclusively on Golden Retrievers. Considering individual differences in temperament as well as breed-specific differences in stress-coping profiles, the recommended 25-min threshold for stress mitigation may vary among different dogs and breeds.

The variability in the frequency of individual stress-related behaviours across different environments underscores the importance of environmental factors influencing dogs' welfare during animal-assisted interventions. Differences in the behavioural frequencies between experienced therapy dogs and novice dogs undergoing certification examinations suggest that proper training and habituation to therapeutic activities improve dogs' adaptive abilities and reduce their stress during work. Even the perceived opportunity

to withdraw from an uncomfortable situation appears to affect the frequencies of stress-related behaviours during more or less contact-intensive components of the certification test. The relatively high occurrence of searching for the handler further emphasizes the importance of the dog–handler bond and highlights the need for a well-coordinated therapy team.

Based on our findings, the use of dogs in animal-assisted therapy can be considered an activity with stress potential, and excessive workload may substantially compromise their welfare. Future studies should therefore focus on refining the upper time limit in other branches of animal-assisted interventions and establishing evidence-based recommendations for time management in practice. To thoroughly evaluate the effects of therapeutic work on the welfare of these animals, further research is needed to investigate specific factors influencing the well-being of dogs involved in this field.

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