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# Welfare considerations: Salivary cortisol concentrations on frequency of therapy dog visits in an outpatient hospital setting: A pilot study

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ABSTRACT

The animal-assisted therapy field is exponentially growing under the lack of science-based evidence of potential risks to the animals involved. Even though to become a therapy dog, the dog must pass an evaluation, most evaluations do not take into account disposition. Thus, a dog could become certified as a therapy dog but still become uncomfortable in stressful situations. Therefore, it is important to understand the magnitude of stress therapy dogs may experience during visits and if the amount of visits per month affects the level of stress. In this 4 × 4 Latin square-designed pilot study, four therapy dog teams were randomly assigned to an outpatient nursing unit at Mayo Clinic, Rochester, MN. The therapy dog teams were then randomly assigned to the order of the four treatments. The treatments include: treatment A, two visits a week over the course of four weeks; treatment B, one visit a week over the course of four weeks; treatment C, two visits over the course of four weeks; treatment D, one visit over the course of four weeks. Interestingly, this study noted a dog × time effect. Dog 3, the youngest in the study, had the highest postsalivary cortisol for treatment A, C, and D. When comparing pre and postsalivary cortisol concentrations, only treatment A was significantly different ($P = 0.04$). This novel study was the first to assess the frequency of therapy dog visits' effect on therapy dog salivary cortisol. In comparing baseline to postvisit salivary cortisol concentration, treatment A had a significant reduction in cortisol postvisit. These data suggest that the more frequently, two visits a week, the therapy dog visits, the lower the cortisol concentrations will be. To further evaluate the welfare and potential state of stress in therapy dogs, researchers need to collect additional biological, objective parameters and have visits uniformed and recorded for behavioral analysis.



## Introduction

As the human-animal bond grows stronger, the demand for therapy dog visits in a hospital setting is increasing. Beneficial relationships have been demonstrated for the effects of animals have on the elderly, children with autism, hospitalized patients, hospice care, and behavioral conditions (Nimer and Lundahl, 2007). Dog visits significantly reduces the level of anxiety experienced by psychiatric patients (Barker and Dawson, 1998; Lundqvist et al., 2017; Tsai et al., 2010). In addition, animal-assisted therapy visits can improve quality of life (Nordgren and Engstrom, 2014), coping ability, and self-efficacy (Berget et al., 2007; Berget et al., 2008). Animal-assisted therapy not only improves mental outlook, but also physiologically, 20 minutes of petting a dog can increase oxytocin concentrations, and positively affect other endocrine responses, decreasing cortisol, epinephrine, and norepinephrine (Beetz et al., 2012). Oxytocin is known to play a crucial role in behavioral functions and social bonding. Neurochemicals, such as cortisol, epinephrine, and norepinephrine, are involved with behavioral function and are associated with the fight or flight and stress response (Beetz et al., 2012). Interaction with a friendly animal can also decrease blood pressure (Barker and Dawson, 1998), heart rate, and improve heart rate variability (Kuhne et al., 2014). Based on these results, the implication is that human-animal interaction can alleviate a stress response (Beetz et al., 2012).

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Although there is a large amount of data to support the benefits of animals in humans' lives (Barker and Dawson, 1998; Berget et al., 2007; Berget et al., 2008; Beetz et al., 2012; Kuhne et al., 2014), research on therapy dog welfare is limited. The animal-assisted therapy field is growing exponentially but lacks science-based assessment of potential risks to the animal involved (Serpell et al., 2010). One study hypothesized that dogs that were approached, petted, and hugged by strangers in an unfamiliar environment became uncomfortable with these interactions. These interactions and behaviors are commonly observed in animal-assisted interventions (Serpell et al., 2010).

Although therapy dogs must pass an evaluation, most evaluations do not take into account disposition, so a dog could become certified as a therapy dog, but still become stressed in unfamiliar situations. There are two different qualifications for therapy dogs: 1. predictable, this means that the dog is predictable under normal circumstances; and 2. complex, meaning the dog behaves appropriately in complex environments (Pet Partners, 2014). Although dogs are assessed on how well they can behave in different complexities of environments, this does not guarantee that the dog will not become stressed. Assessing the stress of therapy dogs in complex environments, such as an outpatient hospital setting, is vital for understanding therapy dog welfare.

Stress is a state in which the body is reacting to endogenous and exogenous threats that help the body cope with danger. When the body is experiencing stress, cortisol release from the hypothalamus-pituitary adrenal axis increases, potentially causing some detrimental outcomes to the health and welfare (Fries et al., 2009; Glenk et al., 2013). Although stress in mammals is well studied, the long-term effects of stress in dogs are underrepresented (Glenk, 2017; McCullough et al., 2018; Palestrini et al., 2017). Therefore, it is important to understand the magnitude of stress therapy dogs may experience during visits and whether the number of visits per month affects the level of stress (Venable et al., 2016).

This pilot study investigated the salivary cortisol concentrations of therapy dogs that experienced different frequencies of visits with outpatient nurses. Effect of visits was assessed by comparing the at home, baseline salivary cortisol to the postvisit salivary cortisol concentrations for each dog. This study was part of a larger study that observed the effects of therapy dog visits on outpatient nurses' compassion fatigue, burnout, work satisfaction, and productivity (Clark et al., 2018)

## Methods

### *Subjects*

Four therapy dog teams from Mayo Clinic, Rochester's Caring Canine Program volunteered for this study. Each volunteer therapy dog team sees patients at the clinic regularly, is registered with a therapy dog organization, and was willing to stop additional therapy dog visits for the duration of this study. The demographics for the four dogs were two males, a 12-year-old Bichon (Dog 1) and a 10-year-old small mixed breed (Dog 2); and two females, a 7-year-old Standard Poodle (Dog 3) and a 10-year-old Shih-poo (Dog 4). Both male dogs had female handlers and were registered with Pet Partners. Both female dogs had male handlers. Dog 3 was registered with Therapy Dog International and Dog 4 was registered with Alliance of Therapy Dogs. Mayo Clinic Rochester's IACUC committee approved this study (protocol A00003246-17). Four outpatient nursing units in the General Internal Medicine Department at Mayo Clinic, Rochester, MN, were selected for participation in this study. The four nursing units were selected based on the nurse population that worked full time, did not work in other units, and were able to participate in all five treatments. This selection criterion for the nursing units was applied to ensure that nurses would not see other therapy dogs at different frequencies, but that the nurses would be available during the visits. Each unit had $6 \pm SD = 1$ nursing actively participating in the study's visits and was approved by Mayo Clinic Rochester's IRB (protocol 17-009373). Each of the participating nurses signed a HIPAA waiver, stated their willingness to participate, and disclosed that they had no fear of or allergies to dogs.

### *Study design*

This study was set up as a $4 \times 4$ Latin square. The four therapy dog teams were randomly assigned to a nursing unit, by being asked to pick an envelope that contained the nursing unit they would be visiting. The therapy dog teams were then randomly assigned to the order of the four treatments using PROC PLAN block randomization design on SAS version 9.4. The treatments included were treatment (TRT) A, two visits a week for four weeks; TRT B, one visit a week for four weeks; TRT C, two visits over four weeks; and TRT D, one visit over four weeks. Each visit lasted between $15 \pm SD = 5$ minutes in length and took place between 1130 and 1330. There was a one-week washout period in between each block. Therapy dog team visits were consistent on time and day of the week for each team, but because of volunteer basis, it varied between teams. Dog 1 and 2 visited on Mondays and Fridays, Dog 3 visited on Tuesdays and Thursdays, and Dog 4 visited on Mondays and Wednesdays. During this visit, the handler and dog met the nurses at a designated, quiet area. The session consisted of the nurses petting the therapy dog and conversing with the dog handler; visits were non-goal oriented. Throughout the duration of the study, the therapy dogs were not allowed to make any additional hospital visits, to control for the exact frequency of visits during the four-week period.

### *Salivary cortisol analysis*

Salivary cortisol was used as a noninvasive procedure to assess the stress response during the visit. The morning of each visit, 30 minutes after the therapy dog had woken up, the cortisol awakening response (Fries et al., 2009), a baseline saliva sample was collected using SalivaBio's Children's Swabs, Salimetrics LLC, Carlsbad, CA, (Salimetrics, 2018) by the dog's handler. After the visit, the therapy dog team met with a study staff member to collect the postvisit saliva using the same technique for saliva collection on baseline. Each salivary collection was under two minutes to ensure the sampling did not affect the cortisol concentration (Fries et al., 2009). The saliva swab was placed in a swab storage tube (SST) $17 \times 100$ mm (Salimetrics, 2018). All saliva samples in the storage tubes were stored in a $-80°F$, until shipped on dry ice overnight to Salimetrics LLC, Carlsbad, CA, to be analyzed for salivary cortisol concentrations.

### *Statistical analysis*

The salivary cortisol concentrations were analyzed as a $4 \times 4$ Latin square design using the MIXED procedure of SAS (SAS 9.4 Inst. Inc., Cary, NC). Postvisit salivary cortisol concentrations were analyzed using a *t*-test of SAS 9.4, with the baseline sample that was collected the morning of, at home, before any stimuli was introduced. Significance was set at ($P \leq 0.05$) and the tendency was set at ($P \leq 0.10$).

## Results

This pilot study was a Latin square design that consisted of four therapy dog teams; each therapy dog team participated in four

treatments for a total of 15 visits. Each treatment had a baseline and postvisit salivary cortisol concentration collected for a total of 114 observations, giving this study design a power of $r^2 = 0.808$, when analyzed using the PROC POWER function of SAS.

Four outpatient nursing units in the Department of General Internal Medicine at Mayo Clinic in Rochester, Minnesota, were selected based on the nurse population working full time and not crossing over into other units. The nursing units within the Department of General Internal Medicine included 1 - women's health and consulting medicine; 2 - home enteral nutrition and home paracentral nutrition; and 3/4 - two different departments of executive health. Each nursing unit had 6 ± SD = 1 nurses participating in the study. A total of 24 nurses participated, 23 women and 1 man, with an average age of 43.13 ± SD = 11.76 years with 20.29 ± SD = 11.78 years of experience.

Overall, the randomized block design was significantly different (ANOVA: $F_{13,97} = 2.49$; $P = 0.005$). There was a significant difference between treatments ($t_3 = 2.91$; $P = 0.03$) when analyzing the data with a type 2, 3, and 4 sum of squares. In addition, there was a significant ($t_6 = 3.51$; $P = 0.003$) dog × time effect. Dog 3, registered with Therapy Dog International, had the highest postvisit cortisol concentrations for TRT A, C, and D. Dog 1, registered with Pet Partners, had the lowest postvisit cortisol concentrations for TRT B, C, and D.

When comparing baseline and postsalivary cortisol concentrations, only TRT A was significantly different ($t_{28} = 1.70$; $P = 0.04$). There was a decrease in means from baseline to postvisit salivary cortisol concentrations, suggesting that the interaction with the nurses did not increase the cortisol response in the dogs in comparison to the concentration of cortisol collected at home in the morning. Interestingly, numerically, TRT C had a lower salivary cortisol concentration postvisit compared to its baseline samples. In contrast, TRT B's postvisit salivary cortisol concentrations increased in comparison to their baseline means. TRT D's baseline and postvisit salivary cortisol concentration means were the same; however, the baseline minimum and maximum values for cortisol were, overall, numerically, lower than the minimum and maximum values for the postvisit cortisol (Table).

## Discussion

Studies have recently begun to investigate the welfare of therapy dog during visits (Glenk, 2017; McCullough et al., 2018; Palestrini et al., 2017). This novel, pilot study was the first to assess salivary cortisol of therapy dogs with respect to differing frequencies of visits' with outpatient nurses, revealing a dog × time effect. Dog 3, the youngest dog, had the highest postsalivary cortisol concentration for TRT A, C, and D. Although Dog 3 had volunteered at other facilities, the team was the newest to join Mayo Clinic Rochester's Caring Canines Program and had been volunteering only for a few months before the start of the study. The higher postvisit salivary cortisol may be due to exposure to a new environment and not due to the perceived stress. Despite this, Dog 3 had the most positive feedback from the outpatient nurses and had the most requests on conclusion of the study (Clark et al., 2018). Dog 1, the oldest dog, had the lowest postvisit salivary cortisol concentrations for TRT B, C, and D. Dog 1 was also one of the longest volunteering teams (>5 years volunteering) in the Mayo Clinic Rochester's Caring Canines Program and attended Mayo Clinic's Therapy Dog Preparation Course before becoming a volunteer. Both dogs, Dog 1 and Dog 3, were registered with different organizations. Mayo Clinic accepts Alliance of Therapy Dog, Therapy Dog International, and Pet Partners, and on successful completion of the evaluation, all dogs are vetted through an interview process and shadowed visits around the hospital. A larger study would need to be conducted to evaluate if frequency of stress responses was associated with therapy dog organization.

In comparing baseline to postvisit salivary cortisol concentration, TRT A had a significant reduction in cortisol postvisit. These data suggest that the more frequently, two visits a week, the therapy dog visits, the lower the cortisol concentrations will be after the visit. However, only TRT B, one visit a week over the course of four weeks, had a higher salivary cortisol average postvisit in comparison to baseline. This could have been due to Dog 3 having a much larger postvisit salivary cortisol concentration. Although salivary cortisol is used as a biomarker for stress, there are a number of factors that play a role in the variability of cortisol concentrations, possibly including sex of the dog handler (Schöberl et al., 2017). Schöberl et al. (2017) noted that male dogs with female handlers are more likely to experience better coping strategies and have lower cortisol variability. The sex of the handler was also thought to play a strong role in how well therapy dogs adapt to different environments over how well the dog is able to cope with differences. Same gender/sex interactions were associated with lower stress responses (Schöberl et al., 2017). Dog 3 was a female dog with a male handler. Of the 24 participating nurses, 1 was male. This pattern could have contributed to Dog 3's high cortisol concentrations.

One major limitation to this study was that the nursing population was strictly outpatient nurses who were not always available, due to schedule or vacation time, to attend the therapy dog visits. Although the researchers prescreened nurses who stayed in the same specialty area, worked full time, and were willing to attend, scheduling visits was challenging. All nurses who participated in the study have to be able to attend at least 14 of the 15 sessions. A second limitation to this study was the availability of therapy dog teams. To participate in this study, therapy dog teams had to stop all routine hospital visits for the entire duration of the study, and all therapy dog teams had to be available during business hours.

**Table**
Baseline and postvisit salivary cortisol concentrations (μg/dL) for each frequency of visits

| Treatment | Baseline | | | | Postvisit | | | | *P*-value | Cohen's *d*[e] |
|---|---|---|---|---|---|---|---|---|---|---|
| | Means | Min | Max | St. Dev. | Means | Min | Max | St. Dev. | | |
| TRT A[a] | 0.20 | 0.04 | 0.93 | 0.22 | 0.15 | 0.03 | 0.43 | 0.07 | 0.04[f] | 0.30 |
| TRT B[b] | 0.27 | 0.04 | 0.81 | 0.26 | 0.57 | 0.02 | 4.07 | 1.13 | 0.14 | 0.36 |
| TRT C[c] | 0.27 | 0.02 | 0.94 | 0.39 | 0.19 | 0.04 | 0.64 | 0.21 | 0.32 | 0.25 |
| TRT D[d] | 0.12 | 0.03 | 0.24 | 0.08 | 0.12 | 0.22 | 0.46 | 0.07 | 0.08 | 0.07 |

[a] Treatment A—therapy dog visit twice a week for four weeks.
[b] Treatment B—therapy dog visit once a week for four weeks.
[c] Treatment C—therapy dog visit twice over four weeks.
[d] Treatment D—therapy dog visit once over four weeks.
[e] Cohen's d—effects size; = (M2-M1)/$SD_{pooled}$.
[f] Significantly different ($P < 0.05$).

## Conclusion

Overall, salivary cortisol decreases from postvisit in comparison to baseline when therapy dogs visited twice a week over the course of four weeks, suggesting that familiarity may play a role in the comfort level of therapy dogs during visits in an outpatient hospital setting. This finding suggests that therapy dog teams who visit the same area more frequently will experience a less stressful response.

Salivary cortisol is only one measure associated with a stress response and, alone, cannot determine if a dog is stressed or has good welfare (Hecht, 2016). To further evaluate the welfare and potential state of stress in therapy dogs, researchers need to collect additional objective, biological and behavioral data, using standardized visits that are recorded for behavioral analysis. Studies and those focusing on in-patient populations are also needed.

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## Ethical consideration

Institutional Animal Care and Use Committee (IACUC) approval was obtained before initiation of this study (protocol A00003246-17). In addition, Institutional Review Board (IRB) approval was obtained before the initiation of this study (protocol 17-009373).

## Conflict of interest

None of the authors of this original research have any declared financial interest. No conflict of interest of either a financial or personal nature reported.

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