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Research

# Therapeutic for all? Observational assessments of therapy canine stress in an on-campus stress-reduction program

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ABSTRACT

Therapy animals are an important and growing support for students on university campuses; however, the stress experienced by dogs working in such programs has rarely been assessed. We assessed stress for 754 students, 40 handlers, and 40 dog participants in a canine therapy stress-reduction program hosted on a university campus. There was an overall significant decrease in handler and student stress and an increase in canine stress when observations of stress measured at home were compared to end-of-session stress. No change in canine stress was found when start-of-session stress was compared with end-of-session stress. For handlers whose initial self-reported stress was elevated, a correspondingly higher level of canine stress was identified at the end of the session. This finding suggests an emotional contagion or spillover model of stress whereby handlers—not student clients—negatively contribute to the affective experience of working therapy dogs.



In addition to providing companionship to humans, dogs (*Canis familiaris*) offer support through a variety of working roles that include hunting (Lupo, 2017), search and rescue (Greatbatch et al., 2015), security (Camp, 2001), military (Haverbeke et al., 2008), recovery (Diverio et al., 2016), and epilepsy detection (Browne et al., 2006). Relatively recently, dogs have been used in animal-assisted therapy (AAT), a therapeutic approach with origins in helping people overcome emotional or psychological challenges (Levinson, 1962). Traditionally, AAT has focused on interactions between dogs and people with physical or emotional disabilities (Carmack, 1984).

One emerging field within AAT is canine-assisted interventions (CAIs). As part of animal visitation programming, CAIs are especially popular on university campuses where students are provided opportunities to spend time with therapy dogs (Crossman and Kazdin, 2015). Such programs are frequently introduced during examination periods when university students are known to experience high levels of stress and exhibit low mental health functioning (Durand-Bush et al., 2015). On-campus CAI programs have been found to reduce homesickness, increase life satisfaction, increase campus connectedness (Binfet and Passmore, 2016), and reduce stress in university students (Barker et al., 2016; Crossman et al., 2015; Ward-Griffin et al., 2018).

As the fields of AAT and CAI advance, concerns for well-being have broadened to include all contributors to the therapeutic process and there have been recent calls to ensure that animal welfare is safeguarded (Ng et al., 2015; Serpell et al., 2010). Hatch (2007) argues that CAI programs raise potential concerns for the animals involved including animal cruelty, mistreatment, and mishandling. Not all human visitors to CAI sessions respond appropriately during interactions [e.g., they may have little or no experience with dogs or bring varied cultural perspectives on how to interact with dogs (Binfet and Struik, 2018)], and this potentially places therapy canines at risk (Hatch, 2007). Frequency and duration of CAI sessions, age, and the controllability and familiarity of visitors can all modulate canine welfare during a therapy session (Glenk, 2017). Researchers have identified that dogs are physiologically aroused by their work in CAI, however, there is debate as to whether the arousal is negative in nature (i.e., stress) or positive [i.e., excitement; Haubenhofer and Kirchengast, 2007, 2010]). Rooney et al. (2007) identified that a dog's previous experience in a setting or situation can impact the dog's response to stress. To safeguard therapy dogs experiencing heightened stress, Evans and Gray (2012) argue that handlers have a responsibility to provide therapy dogs with adequate rest and recovery between CAI sessions.

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These authors further argue that working canines should be considered "coworkers" to acknowledge their therapeutic skills and contributions. Despite the above calls to safeguard animal welfare, a review of the extant anthrozoological and veterinary peer-reviewed literature revealed a paucity of research assessing the well-being of working therapy canines in AAT or CAI programs. As Ng et al. (2015, p. 357) argue, "… there is a void in the literature regarding the impact of these interventions on the therapy animals themselves…."

We propose to help fill this knowledge gap by assessing the perceived stress of therapy dogs participating in an on-campus CAI. Assessing stress in working therapy dogs in CAIs not only responds to a key knowledge gap in the field of AAT generally but also serves to advance the field by developing observational stress protocols that support and protect the well-being of therapy dogs. To do so, we applied observational indicators of stress in therapy dogs participating in a CAI stress-reduction program for university students in an effort to answer the overarching question: Does the very intervention designed to reduce stress in human participants increase stress in canines? The use of observational assessments of stress allow for the study to be noninvasive to the participating dogs. Salivary cortisol sampling, although recognized as a commonly used indicator of stress, is more invasive and expensive, and there is discussion within the field as to its suitability as a biomarker of stress, especially when dogs show insecurity (Glenk, 2017; Pirrone et al., 2017). As Glenk (2017, p. 9) argues, "Interpretation of cortisol responses is further complicated by its differential function in acute and chronic stress conditions."

We sought answers to the following three questions driving this research: (1) Over the course of their time in the session, did stress change for canine, handler, and student participants?; (2) Was there inter-rater agreement regarding ratings of canine stress among observers (i.e., handler, student clients, and researcher)?; and (3) If changes in canine stress occurred, could we identify the factors potentially accounting for this change?

To answer these questions, we tackled two objectives. First, we sought to determine if dogs experience stress when participating in CAI sessions, and second, we sought to identify potential patterns describing stress in working therapy canines (i.e., factors affecting change in dog stress, factors affecting final dog stress, and inter-observer correlation of perceived dog stress) with the goal of informing better well-being outcomes for humans and dogs alike. Assessing stress during CAI sessions not only provides insights into the ability of therapy dogs to withstand stressors but additionally provides reassurance or validation that the canines were properly assessed for therapeutic work. If the dogs in our program have been suitably selected, we predict that (1) levels of baseline (home assessed) stress and working (in session) stress will be comparable and (2) no increase in stress would be observed in dogs over the course of a CAI session.

We anticipate that therapy dogs do not experience significantly elevated levels of stress during CAI sessions as they are selected for their even temperament, willingness to interact with strangers, basic obedience skills, controlled vocalization, disregard for food or toys on cue, and generally being able to cope with novel situations (Binfet and Struik, 2018; Mongillo et al., 2015). However, dogs participating in CAI sessions may have limited access to normative features of a caring environment—access to water, low stimulus, and ability to remove themselves from the environment—all factors that could create stress (Iannuzzi and Rowan, 1991). CAI sessions, especially those held on busy university campuses, provide a number of novel stimuli (e.g., many clients, rotating clients, clients with varied prior dog experience, a new setting) that could increase stress in therapy canines (Binfet and Struik, 2018; McCullough et al., 2017). In addition, the lack of the dog's familiarity with the setting, noise, the kind of handling they receive, or the presence of strangers can all be sources of stress (Mariti et al., 2017). Moreover, even well-trained and experienced CAI dogs may display signals of elevated stress on occasion, yet there are no protocols in place to identify these signals in many AAT programs (MacNamara et al., 2015).

## Methods

### *Participants*

#### *Dog participants*

We selected 40 therapy canines, which were predominately female (60%, *M*age = 4.75 years, *SD* = 2.89) with 1.83 years (*SD* = 1.88) of previous CAI experience. Participating dogs were 55% purebred and 45% mixed breed with the most common breeds being Labradors (N = 6) and Golden Retrievers (N = 6). All dogs were spayed or neutered.

#### *Handlers*

The 40 volunteer handlers participating in this study were predominantly female (85% *M*age = 39 years, range = 17-60 years, *SD* = 13.2), with 2.19 years (*SD* = 2.29) of previous CAI handler experience. As part of their admittance into the Building Academic Retention through K9s (B.A.R.K., 2017) program, handlers attended both an orientation and training session and their dogs were thoroughly screened and assessed for work in an on-campus stress-reduction program (see Binfet and Struik, 2018 for a full description of our screening and assessment protocols).

#### *Students*

Student participation was completely voluntary (N = 754), students were predominately female (65% female, 35% male, and <1% nonbinary) and in their first year of study (53% first year, 16% second year, 16% third year, and 15% fourth year). Students were mostly from British Columbia (49%), although other Canadian provinces or territories (27%) were represented as were countries outside Canada (24%).

### *Procedure*

Before commencing the study, university Behavioral Research Ethics approval for both human (H14-00474) and animal (A17-0164) participants was sought.

#### *Station assistants*

Twenty volunteer undergraduate station assistants were recruited to assist with data collection and, as a condition of their participation, were required to complete a short course on research ethics required of university students participating in research. Before the six CAI sessions, station assistants attended a training session to ensure the same data collection procedures were followed at each of the different dog-handler stations within the laboratory. During their training, station assistants practiced collecting data in a mock session. During each of the six CAI sessions, two station assistants were seated with each handler-canine team to assist the handler and participating students' documentation of their observational ratings of canine stress using the provided visual analog scale. This included keeping track of time, keeping track of data collection sheets, and helping answer questions from both handler and student raters. The station assistant's role was purely supportive in nature.

#### *Handlers*

The 40 volunteer handlers were recruited from a larger pool of 60 certified handler-canine teams working in an on-campus stress-

reduction program at a mid-size western Canadian Research Intensive University (see Binfet and Struik, 2018 for a full review of the procedures used to assess both dogs and handlers). Each handler provided informed written consent acknowledging his or her participation in the study, and completed a brief demographic survey. Handlers were asked to provide a baseline rating of their dog's stress level at home using the following prompt: "Please rate your dog's overall, general level of stress in your home setting out of 5 (1 = not very stressed and 5 = very stressed). Keep in mind that common signs of stress in dogs include trembling, yawning, nose licking, paw lifting, and looking away." As part of their orientation to the program, handlers received training on the identification of canine stress indicators, and a canine stress education poster (see Appendix A) was posted in the laboratory for their reference. The poster in the room was meant to elaborate on the example stress indicators listed on the data collection sheets and serve as a visual reminder for raters of what to look for when assessing canine stress. Handlers and their canines were scheduled to be assessed at one of the six sessions held weekly in the same room at 4:30 on Friday afternoons over the 2017 first academic semester (six CAI sessions total were conducted and a rotation of different dog-handler teams were scheduled at each one so that 15-17 teams were scheduled for each session).

When in a session, handler-dog teams were stationed 1-2 m apart in a room measuring 86 square meters. Within each session, handlers were asked to rate their canine's stress at three time points (station assistants prompted handlers to rate canine stress at predetermined times): (1) ten minutes after arrival (enough time to allow the dog to "settle"); (2) half-way through the session; and (3) at the end of the session based on frequency, duration, and intensity of observational indicators of canine stress. The data collection sheet contained the same five indicators of canine stress as was used in the baseline ratings completed by handlers in their home environment: trembling, yawning, nose licking, paw lifting, and looking away. Indicators of canine stress were also found on educational posters posted throughout the room (see Appendix B). If handlers required clarification, they were able to ask the station assistants or the researcher. In addition to providing ratings of the dog's stress, handlers were asked to provide self-ratings of stress on arrival and on leaving the session using a visual analog scale (see Appendix A) as increased handler stress levels have been found to correspond with increased canine stress levels (Buttner et al., 2015).

*Students*

Student participants completed a brief demographic survey, documented their arrival time, departure time, and provided self-ratings of their arrival and departure stress levels using a visual analog scale. In addition, students were asked to evaluate the stress of each participating canine that they visited during the session based on the same five indicators of canine stress used by the handlers; trembling, yawning, nose licking, paw lifting, and looking away. A large canine stress education poster, describing a more comprehensive list of canine stress indicators, was posted in the laboratory for students to reference (see Appendix B). If the students had questions regarding any of the behaviors, they could ask the station assistants for clarification. The assessment sheets used (see Appendix D) were placed in an envelope once completed so that students' ratings were not biased by peer ratings. Because the students moved freely among dogs, we only asked that they rate the stress levels of the dog once per session. Students reported the duration of their visit with the maximum visit duration being 90 minutes (see Appendix C).

*Researcher*

From a central location within the CAI facility, a researcher, trained in the recognition of canine behavioral stress indicators, rated each canine for signs of stress at three time points: (1) ten minutes after arrival; (2) half-way through the session; and (3) at the end of the session (note: these data collection time points corresponded to the time points used by handlers to rate canine stress but not necessarily with the students).

*Measure*

A single-item Visual Analog Scale (Lesage et al., 2012), requiring raters to identify on a 5-point, Likert-type scale (i.e., 1 = low stress, 5 = high stress) was used to assess both human and canine stress (see Appendices A, C, and D). A single-item Visual Analog Scale has been successfully used to assess changes in participants' perceptions of stress within the context of AAT research (e.g., Barker et al., 2012, 2016; Binfet et al., 2018; Wanous and Reichers, 1996; Zimmerman et al., 2006).

*Analysis*

We report the means and standard deviations for the number of students at sessions, time student spent at sessions, time spent with individual therapy dogs, student initial stress, student final stress, handler initial stress, handler final stress, dog initial stress, dog midpoint stress, and dog final stress. To test for differences in self-rated student stress, self-rated handler stress, handler-rated canine stress, and researcher-rated canine stress, we used paired Wilcoxon signed rank tests, as our data did not meet the assumptions of the paired *t*-test. For researcher-rated canine stress, we compared initial to final stress. For handler-rated canine stress, we compared (1) baseline (i.e., at home) stress to final stress and (2) initial stress to final stress. We summarize the percentage of dogs whose stress scores increased, decreased, or remained the same as rated by their handlers. We performed a nonparametric correlation test (Kendall's tau) to analyze agreement in stress ratings between the handler and the researcher. We then used a Wilcoxon ranked sum test to evaluate if the handler and researcher rate stress similarly. We evaluated initial stress, final stress, and change in stress separately. Change in stress was the difference between final stress and initial stress scores. Next, we used a generalized linear model to examine factors predicting changes in stress. We focused on the handler-rated dog stress rating, which we converted to a binomial variable. If there was a positive (the dog became less stressed) or neutral value, a 1 was assigned, and if the dog showed greater signs of stress, a 0 was assigned. A model selection framework was used to evaluate likely predictors of change in dog stress, including number of minutes exposed to students, number of minutes exposed to students self-rated as stressed, number of students, number of students self-rated as stressed, age of dog, handler experience, handler stress at the start of the trial. The "dredge" function was used in the R Package MuMIn to evaluate candidate models and present the top-ranking model. We then performed another generalized liner model to examine factors explaining final student stress rating. Again, we used a model selection framework to evaluate the candidate models, including handler stress (self-evaluation) at the start, handler stress (self-evaluation) at the end, initial student stress, change in dog stress, number of minutes each student interacted with the dog. Because more than one student interacted with the same dog, a mixed effects generalized linear model with a random effect for dog identity and a Poisson distribution was used. We then analyzed changes in student stress (initial stress to final stress) using a Poisson shifted (all positive values) to represent the response variable (change in student stress) with stress increasing as the value of the response variable decreased. The "dredge" function in the R Package MuMIn was used to evaluate candidate models and present the top-ranking model.

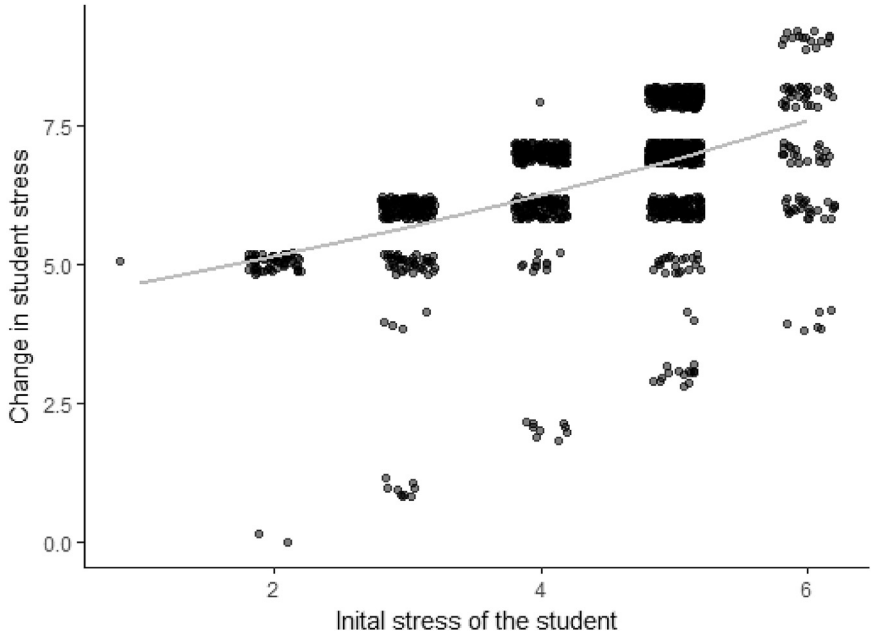


**Figure 1.** Effect of student stress on change in student stress. As the y-axis increases, the level of student stress decreases from initial to end of the trial. Students who had elevated stress at the start of the session experienced the greatest benefit from the stress-reduction program.

## Results

The average student attendance per session was 126 ($SD = 20$), and, on average, students remained in the session for 29 minutes ($SD = 18$, *range* = 2 to 90). Within any given session, there were 15-17 therapy dogs providing support to student visitors and, on average, students visited 6 dog-handler teams for 5 minutes ($SD = 5$) each within a session.

### *Pre-to-post changes in stress*

#### *Students*

Students' stress levels were significantly ($V = 202{,}460$, $P < 0.001$) lower after the canine therapy intervention (1.92 ± 0.89 [mean ± SD]) compared to before (3.38 ± 0.01). The top-ranked model explaining changes in student stress contained a single predictor, initial student stress, which had a positive effect on final student stress ($B = 0.141$, $SE$ 0.017, $P < 0.001$). Students who were more likely to express feelings of increased stress at the start of the session were less likely to express feelings of stress at the end of the trial. Initial student stress also increased the amount of change in student stress ($B = 0.098$, $SE$ 0.011, $P < 0.001$, Figure 1). This means that students experiencing higher levels of stress experienced greater benefits (greater magnitude of lowered stress) from spending time with therapy dogs. We did not find an effect of dog stress responses on change in student stress.

#### *Handlers*

Handler stress levels were also significantly lower ($V = 163$, $P = 0.02771$) after the canine therapy intervention (1.74 ± 1.04) compared with their arrival level (2.13 ± 1.13).

#### *Canines*

Compared with baseline stress ratings (1.26 ± 0.50), there was a significant increase ($V = 15$, $P = 0.06494$) in end-of-session stress ratings (1.51 ± 0.75). Within sessions, the start (1.53 ± 0.75) to finish (1.50 ± 0.82) stress ratings of dogs was stable ($V = 88$, $P = 0.8132$). We found that 25% of therapy dogs had increased stress as rated by their handler, 22.5% had decreased stress, and 52.5% had no change in stress over the course of their time working in a session as rated by their handler.

### *Inter-rater agreement of stress ratings*

A summary of canine stress ratings is found in Table. Ratings by handlers, researcher, and student visitors reveals that, across different raters, therapy canines working in a busy on-campus stress-reduction session are perceived to experience overall low stress. Because students visiting the canine therapy program were free to stay for a self-determined period, they did not provide three distinct ratings as did both handlers and the researcher. Thus, the comparison in the following examines correlations between handler and researcher ratings of canine stress.

The initial stress rating of the dog was not correlated between the handler and the researcher (tau = −0.015; $P = 0.567$) with a significantly lower ($W = 923{,}180$, $P < 0.001$) rating by the researcher (1.67 ± 0.75) than the handler (1.56 ± 0.80). The final stress ratings of the dog was not correlated between handlers and researchers (tau = 0.192; $P < 0.001$), with significantly higher ($W = 1{,}198{,}200$, $P < 0.001$) ratings of stress by handlers (1.50 ± 0.79) than the researcher (1.21 ± 0.40). The change in dog stress was correlated to handlers' ratings (tau = 0.1542; $P < 0.001$), with

**Table**
Canine stress mean ratings (mean ± standard deviation) as rated by the handlers, researchers, and students

| Observer | N | Baseline | First rating | Second rating | Third rating |
|---|---|---|---|---|---|
| Handlers | 40 | 1.26 ± 0.50 | 1.50 ± 0.82 | 1.48 ± 0.68 | 1.53 ± 0.75 |
| Researchers | 1 | [a] | 1.70 ± 0.69 | 1.20 ± 0.41 | 1.25 ± 0.44 |
| Students | 754 | [a] | 1.41 ± 0.70 | [b] | [b] |

[a] Researchers and students did not observe dogs in their home setting and therefore do not have baseline ratings.
[b] Student observers rated the dog's stress level throughout the session and did not align with the same three observation times as the researcher and handler.

significantly greater differences ($W = 792{,}750$, $P < 0.001$) assessed by the handler ($0.07 \pm 1.09$) than the researcher ($0.45 \pm 0.60$). The handler's ratings of his/her dog's stress level were used for the remainder of the results because handler ratings were more sensitive to change in dog stress level.

*Factors explaining changes in canine stress*

The top-ranked model predicting change in dog stress included a single term, handler stress at the start of the trial, which had a significant negative effect on dog stress ($B = -0.904$, SE: 0.415; $Z = -2.178$; $P = 0.030$). In other words, dogs were more likely to show signs of increased stress during a session if the handler was stressed at the start of the trial (see Figure 2). No other factors were found to contribute to elevated stress in dogs, including dog age, handler experience, handler stress, number of students in a session, and stress level of students.

## Discussion

Although previous research in canine therapy has been predominantly focused on the benefits to human participants (e.g., Crossman, 2017; Grajfoner et al., 2016; Ward-Griffin et al., 2018;), here we show how all participants are affected by this therapeutic modality. Several key findings emerged from our study have important implications for our understanding of human-dog interactions, for the design and management of CAI programs, and for stress theory.

Our findings support previous research (e.g., Binfet et al., 2018; Crump and Derting, 2015; Fiocco and Hunse, 2017; Ward-Griffin et al., 2018;), indicating that an on-campus canine therapy program in which university students spent time with therapy dogs to reduce their stress was shown to have demonstrable benefits to human well-being. Both students visiting our CAI sessions and handlers volunteering their time in a community CAI program experienced significant reductions in stress. The large effect size found in our study reflecting students' reduction in stress is in alignment with findings within the context of college students' stress reduction (Barker et al., 2016; Crossman and Kazdin, 2015; Crossman et al., 2015).

In addition to students experiencing a reduction in their stress from spending time with therapy dogs, so too were stress-reduction benefits experienced by the volunteer dog handlers who participated in our study. This is a novel contribution to the field—handlers who were not explicitly seeking to reduce their stress and rather volunteered their time in a community program, experienced significant reductions in stress. This finding is in accord with research on the benefits of volunteering that see well-being increase from benevolently donating one's time to helping others (Post, 2005, 2017; Poulin, 2014). Alternatively, this finding could be explained by the collective presence of the therapy dogs and the CAI session itself. Although not in direct contact with the many other therapy dogs in the session, the handlers' stress may have been reduced by the therapeutic milieu created in the laboratory—the calm and supportive atmosphere within which handlers volunteered (Peplau, 1989; Thomas et al., 2002).

In concert with biomarker research that identified no increase in the stress of working therapy dogs (e.g., Glenk et al., 2013, 2014; Ng et al., 2014; Palestrini et al. 2017), our research also identified a neutral effect of CAI on dog stress levels based on observations from student clients, their handler, and a trained researcher. Dogs display cues indicative of stress that enables visual, noninvasive monitoring of their well-being in real time. These clues include low body posture, vocalization, turning away, yawning, autogrooming, pacing, vocalization, panting, and excessive licking (Beerda et al., 1998; Rooney et al., 2007; Schilder and van der Borg, 2004). Evaluation of stress via biomarkers (e.g., cortisol) reveals that therapy dogs are generally not stressed by participation in AAT (Glenk et al., 2013, 2014; Ng et al., 2014). However, assessing canine stress via biomarker methods is more invasive or intrusive than observational assessments (e.g., requires saliva samples) because handling of the animal is required (Dreschel and Granger, 2009). Sample collection can be time consuming, costly to have samples analyzed, and collection may not yield a large enough sample volume for the assay (Granger et al., 2007), limiting the utility of this approach for the development of best management practices during CAI

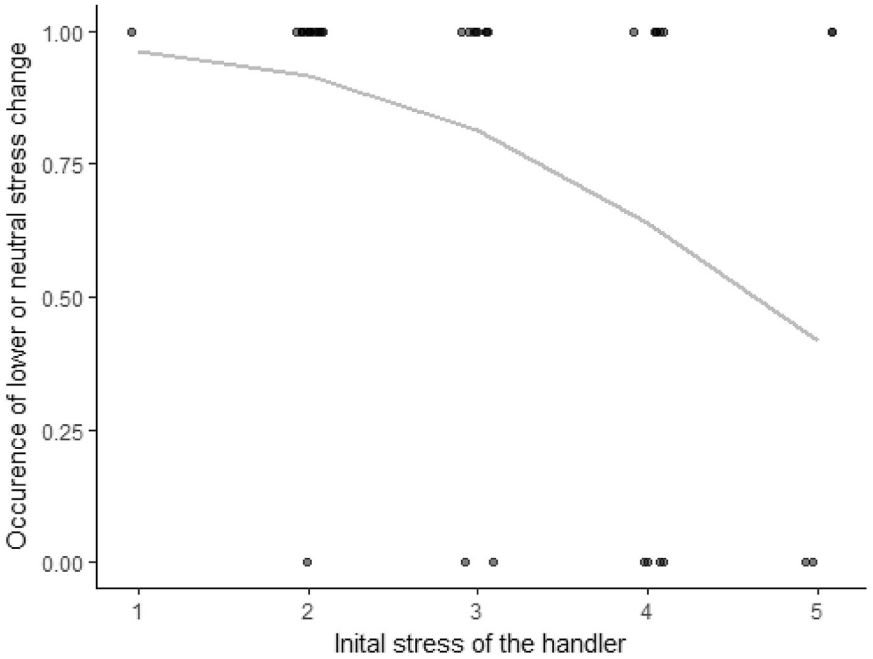


**Figure 2.** Effect of handler stress on change in dog stress. Dogs were rated as neutral or less stress (1) or as increased stress (0). As the initial stress of the handler increased, the occurrence of lower or neutral stress change decreased.

sessions. A recent study by Pirrone et al. (2017) suggests that salivary cortisol may not be a suitable marker to investigate stress in shelter dogs. Our use of observational assessments of canine stress compliments research using biomarker methodologies.

A salient finding arising from our study was that most canine participants were perceived by their handlers to experience very little change in stress and overall were rated as low in stress. A curious finding arising from our researcher is that 25% of our therapy dogs experienced increased stress during sessions and that the source of this elevated stress may be linked to the handler's start-of-session stress level. This associative stress may be explained by emotional contagion (Hatfield et al., 2014). Emotional contagion is defined as "emotional state–matching between individuals" (Huber et al., 2017). Researchers have found that dogs behave differently and show increased cortisol levels after hearing negative emotional sounds such as an infant crying (Huber et al., 2017; Yong and Ruffman, 2014). Recent research has identified that the owner's social characteristics have an influence on a dog's cortisol variability (Schöberl et al., 2017). The present study supports handler-to-dog emotional contagion as dogs whose handlers were especially stressed at the beginning of the session were more likely to show signs of increased stress at the end of the session.

Our finding that handlers may have been the source of stress for a subpopulation of the therapy dogs in this study is supported by recent work by Pirrone et al. (2017) who examined dog-handler "social synchrony" during AAT sessions. In a small study of four dog-handler teams, these researchers found synchronous behaviors between therapy dogs and their handlers (i.e., in this study, low stress in both dogs and handlers was found at the same data collection points). Research within a prison context by Koda et al., (2015) also explored the link between handler and therapy dog stress in 47 dog-handler teams. Using self-reports of handler stress, handler observations of canine stress, and salivary cortisol as an indicator of canine stress, these researchers found overall low stress levels in working therapy dogs, however, comparable to our findings, identified a subpopulation (i.e., 11%) of dogs and handlers with elevated stress.

Research within the context of dog-owner dyads by Merola et al. (2012, 2013) also lends support to our interpretation that therapy dogs may pick up on the stress of handlers. Social referencing (the seeking of information from another individual to form one's own understanding) could help explain how stress may be transmitted from the handler to the dog within a session. Merola et al., (2013) posit that dogs socially reference their handler, especially when confronted with novel stimuli. This interpretation may explain why some of the dogs in our study may have experienced elevated stress from their handlers but not from the visiting students.

Thus, the finding that canine stress at the end of a session could be linked to handler stress at the start of the session highlights the importance of assessing both the dog and the handler for their suitability for participation in stress-reduction initiatives in the postsecondary setting. Furthermore, once handlers are certified for participation in CAI sessions, handlers must be cognizant that, when stressed, they are best to reschedule their volunteer shift or make efforts to reduce their stress so as to not contribute to the ill-being of the dogs under their care.

To increase the reliability of our ratings of canine stress, we used triangulated observations whereby three stakeholders (handlers, students, and researcher) independently completed ratings of perceived canine stress. Triangulation affords a rich and complex picture of the phenomenon being studied (Mathison, 1998). Despite these methodological advantages, findings may not always converge and may, in fact, be inconsistent or even contradictory (Mathison, 1998). Findings in our study revealed disparate ratings of canine stress across handler and researcher observers. Showcasing this inconsistency are the initial canine stress ratings taken ten minutes after arrival, which were rated significantly higher by the researcher than by the handlers. For subsequent ratings (at the mid-point and at the end), handlers rated their dog's stress level as higher than the researcher. This result may reflect the handler being more in-tune with his/her dog and sensitive to microchanges in stress that were not identified by an outside observer.

The use of self-ratings of stress may also account for these discrepant results. The handlers could rate their dog's stress level as low to avoid jeopardizing their position in the program (i.e., that a stressed dog may be asked to leave the session). Furthermore, the researcher, having more advanced knowledge and understanding of canine stress indicators, may recognize signs of canine stress overlooked by handlers. Taken together, these discrepancies may account for the inconsistent assessments between raters in our study.

### *Limitations and future directions*

There are several ways in which our study could be enhanced. First, both handlers and students self-assessed their stress levels, creating the potential for exaggeration or underrepresentation of true stress levels. To account for this bias, future studies may choose to use multiple methods to assess the stress of clients and handlers such as combining self-ratings with biomarker indicators of stress. Second, the forty dogs assessed in the present study were each assessed only once. Future research should incorporate assessments across multiple sessions to better tease apart individual-level effects, idiosyncrasies of the day, and actual predictors of stress. Third, a single assessment method was used (behavioral observations) in this study. The combination of multiple assessment methods (e.g., behavioral observations, salivary cortisol collection, and/or heart rate monitoring) would strengthen the interpretation of stress dynamics in dogs and people. Fourth, although baseline ratings of each dog's stress were done within each dog's home environment, the study design did not include a control group (i.e., dogs that did not attend a CAI session).

Despite these limitations, the present study contributes to our understanding of the experience of therapy canines and handlers when working in an on-campus stress-reduction program. Key findings include that, when compared with their homeostatic stress level within their home environment, therapy canines are rated as moderately more stressed, while working in a CAI session. This elevated stress may be akin to the stress (or excitement) that dogs might experience when in a new environment and future studies could examine how ratings of stress differ across different settings (e.g., veterinary clinic, dog park, CAI session). Furthermore, although their stress levels were found to be elevated when participating in CAI sessions compared with their home stress ratings, most therapy canines do not appear to be stressed by the experience of working in a session. Curiously, a key source of stress for canines may be transmitted from the handler rather than student clients. This finding reinforces the need to screen and select handlers to ensure they are well suited to volunteer work with their dog within a busy, on-campus setting. Once accepted into CAI programs, there must be heightened awareness of canine stress indicators and canine stress education (Serpell et al., 2010).

## Conclusion

With the surge in popularity of canine therapy programs, especially within the context of busy on-campus settings, there runs the risk that the very intervention designed to reduce stress in human participants could cause stress in canine participants. Crossman and Kazdin (2015) identified over 925 canine therapy programs across

North American campuses and, as the field of CAI grows, so too must our awareness for the welfare of therapy canines. The findings from the present study suggest that, providing handlers and their therapy canines are well screened and selected and well-suited to working with university students; it appears that the therapeutic process is therapeutic for all student and handler participants and despite potential stressors during the AAT session does not overly contribute to therapy canine stress. Further research assessing stress in working therapy canines is needed to confirm these findings.

## Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jveb.2019.03.009.

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