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VETERINARY STUDENTS
SYMPOSIUM 2025
Where Science Meets Passion

Understanding the Human-Pet Connection and Insights

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Original research performed by Purina in 2023-2024

International Society for Applied Ethology

IAHAIO International Associati Human-Animal Inter Organizations

- The Impact of Animal-Assisted Therapy on the Functional, Physiological, and Emotional States of Patients Undergoing Inpatient Stroke Rehabilitation (in review)
- Behavioral and Physiological Responses of Therapy Dogs to Animal-Assisted Treatment in an Inpatient Stroke Rehabilitation Program. Animals 2025,15,121. https://doi.org/10.3390/ ani15020121

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What is a stroke?

- A stroke occurs when the blood supply to the brain is reduced, resulting in deprivation of oxygen and nutrients to brain tissue, which in turn leads to hypoxic injury and neuronal death

- It is a medical emergency that requires prompt treatment to minimize potential complications, such as paralysis, difficulty talking, dysphagia, memory loss, mood disorders, pain, behavioral changes, and functional decline

Key objectives of stroke rehabilitation

Maximizing functional recovery and facilitating physical independence through formal rehabilitation:

- physical therapy and occupational therapy
  - prevent complications resulting from prolonged inactivity (e.g., loss of joint protection, muscles and ligament atrophy) and improving motor function recovery (e.g., gait, upper and lower extremity function, balance, and muscle strength)
- speech therapy
  - restoring language, understanding, and communication skills (e.g., functional communication, reading, and writing)

Challenges associated with stroke rehabilitation

Commonly reported barriers to comply include

- lack of motivation, desire, and energy
- lack of companionship
- lack of interest
- depression and anxiety

This has been linked to poorer functional outcomes

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AAT and stroke rehabilitation in the literature

Authors	Title	Participants	Results
Cross (2019)	The effects of animal-assisted therapy on participation in rehabilitation in a patient post-stroke: a case study.	1	Increased participation
Macauley (2006)	Animal-assisted therapy for persons with aphasia: A pilot study	3	Increased (self-reported) motivation, enjoyment Decreased (self-reported) stress
Machová et al. (2019)	The Effect of Animal-Assisted Therapy on the State of Patients' Health After a Stroke: A Pilot Study	15	Heart rate and blood pressure ns Improved mood
Hediger et al. (2019)	Effects of animal-assisted therapy on social behaviour in patients with acquired brain injury: a randomised controlled trial.	19	More social behavior Increased verbal and non-verbal communication, positive emotion, motivation, satisfaction
Rondeau et al. (2010)	Effectiveness of a rehabilitation dog in fostering gait retraining for adults with a recent stroke: a multiple single-case study.	4	Improved gait, walk speed
An and Park (2021)	Effects of Animal-Assisted Therapy on Gait Performance, Respiratory Function, and Psychological Variables in Patients Post-Stroke.	30	Improved gait, pulmonary function, psychological state

Mayo Clinic

- The largest integrated, not-for-profit medical group practice in the world
- Campuses in Minnesota, Arizona, and Florida, a network of regional clinics and hospitals, and international locations
- Caring Canines are part of Mayo Clinic's commitment to healing of mind, body and spirit
  - The highly trained pets soften the impact of being a patient in a medical center by providing an opportunity to receive warmth and unconditional love from an animal

Aim of study

Investigation of the benefits of integrating AAT into stroke rehabilitation:

- A larger scale randomized controlled trial
- Quantify changes in patients' quality of life, mood, functional recovery, and physiology

Our working hypothesis was that the addition of therapy dogs to conventional rehabilitation therapy would have a positive effect on patients' overall wellbeing, and that they would exhibit improved functional outcomes

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Methodology

- 50 patients randomly assigned to control group (standard stroke rehabilitation; n=25) or experimental group (standard + AAT; n=25)
- All participants had a recent stroke, were hospitalized in the Stroke Rehabilitation Unit of Mayo Clinic and enrolled in the inpatient brain rehabilitation program (February 2023 to February 2024)
- Inclusion criteria: 18 years of age or older; recent stroke from any cause; able and willing to give informed consent; and speak English
- Exclusion criteria: allergic to or fearful of dogs; pacemaker; pregnant; and deemed inappropriate for the study by the medical or research personnel

Therapy dogs and handlers

- 14 therapy dog-handler pairs (Mayo Clinic's Caring Canine Program)
- All registered as therapy dogs with Alliance of Therapy Dogs or Pet Partners
- All therapy dogs were always accompanied by their handlers

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Therapy dogs and handlers

Breed	Age (y)	Sex	Weight (kg)	Experience	# of sessions
Old English Sheepdog x Standard Poodle	5	F (S)	29	1 y	13
Maltese x Yorkshire Terrier[2]	9	F (S)	5	5 y	5
Maltese x Yorkshire Terrier[2]	9	F (S)	5	5 y	12
Labrador Retriever x Golden Retriever	7	M (N)	23.6	4 y	13
Cardigan Welsh Corgi	6	M (I)	17.7	3.5 y	2
Australian Shepherd	9	F (S)	16.8	1 y	5
Australian Shepherd	6	M (N)	21.3	4 y	2
Corgi	3	F (S)	19.1	0.5 y	1
Yorkshire Terrier x Toy Poodle	12	F (S)	1.8	5 y	1
Labrador Retriever	6	F (S)	35.4	5 y	8
American Eskimo Dog	6	F (I)	14.5	0.75 y	1
English Springer Spaniel	5	M (N)	31.8	0.75 y	6
Chihuahua mix	4	M (N)	6.8	1 y	3
Australian Shepherd	3	F (S)	22.7	0.3 y	2

F= female; M= male; I= intact; N= neutered; S= spayed

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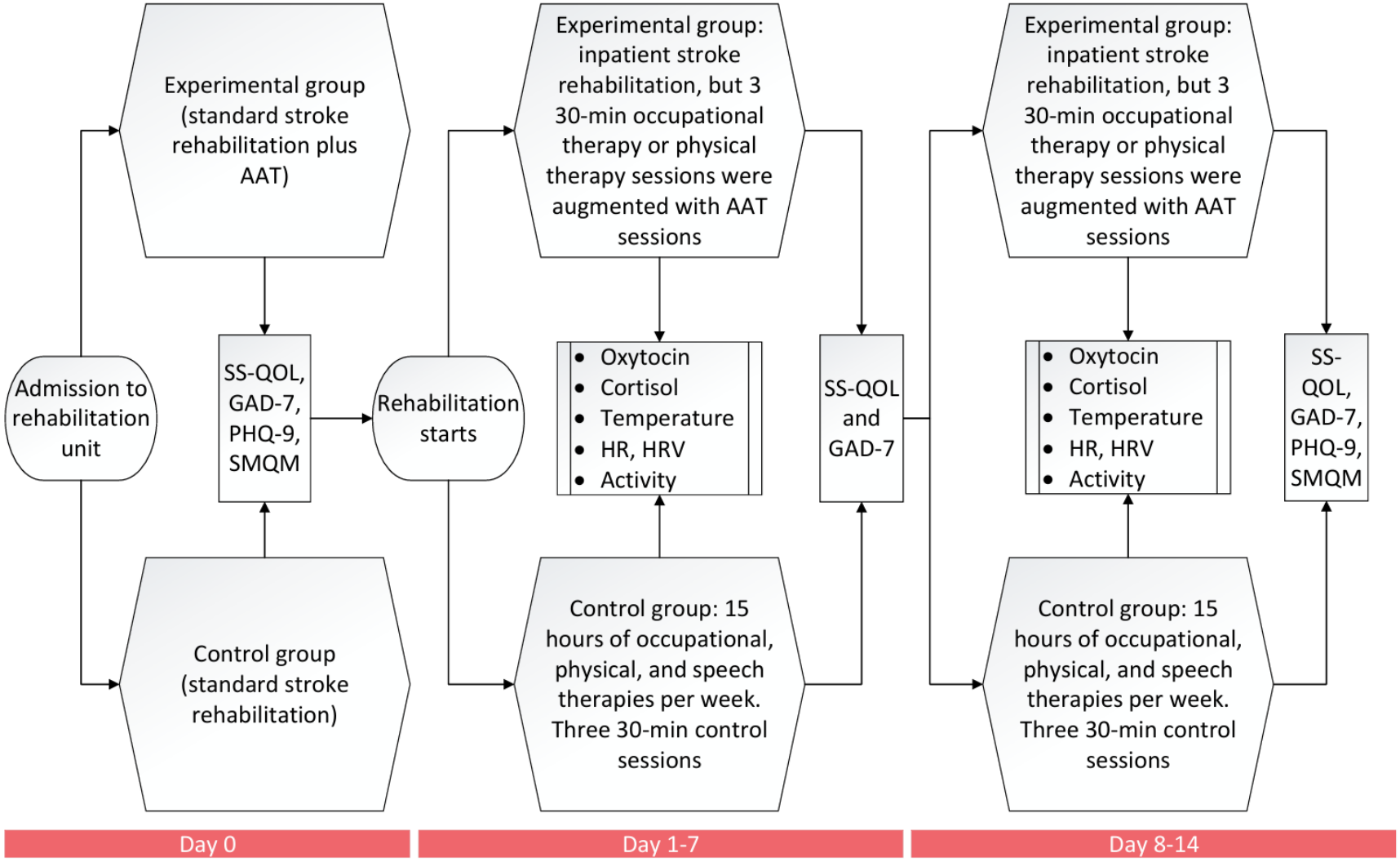
Validated questionnaires and scales

Questionnaire/scale	What it measures
Stroke Specific Quality of Life Scale	Health-related quality of life: mobility, energy, upper extremity function, work and productivity, mood, self-care, social roles, family roles, vision, language, thinking, personality
Generalized Anxiety Disorder-7	Presence and severity of generalized anxiety disorder
Patient Health Questionnaire-9	Presence and severity of depression
Pittsburgh Rehabilitation Participation Scale	Patients' participation and motivation in the rehabilitation
Self-Care and Mobility Quality Measures	Quantify the patient's functional recovery
Pain score	Presence and severity of experienced pain
Length of stay	Number of days at rehabilitation center

Non-invasive physiological parameters

Parameter	What it measures	Device
Cardiac activity (HR, HRV)	Emotional wellbeing/stress	Polar V800 and Polar Pacer Pro heart rate monitor ; Polar Flow; Kubios HRV Scientific
Physical activity	Functional recovery and movement	Actiwatch 2 Philips Healthcare
Tympanic membrane temperature	Emotional wellbeing/stress	Welch Allyn Thermoscan Pro 4000
Salivary cortisol	Arousal (“stress”)	Salimetrics Expanded Range High Sensitivity Salivary Cortisol Enzyme Immunoassay Kit
Salivary oxytocin	Emotional wellbeing	Liquid chromatography-mass spectrometry (LCMS)

Experimental design



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Experimental design for dogs

Pre-session (15 min)

- Saliva
- Tympanic membrane temperature
- HRV sensor
- FAS scale

Rehabilitation (30 min)

- Physical therapy
- Occupational therapy
- Speech therapy

Post-session (15 min)

- Saliva
- Tympanic membrane temperature
- HRV sensor
- FAS scale

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Treatment Space

Physical therapy gym

- Gait trainers, Stairs, Exoskeleton, Weights, Treadmill, Balance tools, Parallel bars, Exercise bikes

Occupational therapy gym

- Therapy mats, Fine motor coordination tools, Reaction trainer

Rehabilitation simulation apartment

- real-life home living environment: bedroom, kitchen, and bathroom

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Examples of activities performed

All therapy plans and exercises were designed based on patient needs, therapist input, and clinical goals

Stroke Rehabilitation Standard of Care Activities	Impairment/Function Addressed
Sit to stand holding large exercise ball	Balance, midline, neuromuscular reeducation, UE and LE function
Stringing beads on thread	Fine motor coordination, visual scanning, attention, cognition, UE function, ROM
Pinching/squeezing foam cube	Fine motor coordination, attention, UE function, neuromuscular reeducation, ROM
Reaching and retrieving objects from overhead shelf	Balance, trunk mobility, visual scanning, neuromuscular reeducation, UE and LE function, midline, ROM
Holding and moving small ball through diagonal range with visual tracking	Balance, visual scanning, UE function, trunk mobility, fine motor coordination

UE (upper extremity); LE (lower extremity); ROM (range of motion)

AAT Activities	Impairment/Function Addressed
Petting dog with unaffected extremity while therapist performing stretch and range of motion on affected extremity	Pain management, visual scanning, range of motion, UE function
Holding leash while walking dog	Balance, fine motor coordination, visual scanning, gait, attention, UE function, LE function
Holding leash and walking dog while performing marching, tandem gait, squats, heel raises, forward and back stepping	Balance, fine motor coordination, visual scanning, gait, attention, cognition, UE function, LE function, neuromuscular reeducation
Propelling wheelchair while holding leash and mobilizing with dog	Fine motor coordination, wheelchair skills, visual scanning, attention, UE function
Walking with dog while performing head turns and visual scans to the dog at side	Balance, gait, visual scanning, attention, UE and LE function
Standing on uneven and compliant surfaces while petting and reaching for dog	Balance, fine motor coordination, visual scanning, attention, UE and LE function

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Results: questionnaires, pain score, length of stay

	Control		Experimental		*p*
	Pre	Post	Pre	Post	
Self-care (SMQM)	23.4	32.17	23.52	31.39	ns
Mobility (SMQM)	43.52	65.28	40.48	62.4	ns
Health-related quality of life	146	166.28	151.43	173.02	ns
Depression	5.59	4.55	5.31	3.91	ns
Anxiety	4.38	2.63	5.75	2.48	ns
Experienced pain	0.88	0.98	1.02	0.76	ns
Motivation and participation in rehabilitation	4.96		5.6		0.0038
Length of stay (days)	12.16		13.14		ns

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Results: cardiac activity

		Control		Experimental		*p*
		Pre	Post	Pre	Post	
Heart rate		80.41	82.21	75.55	80.3	ns
Heart rate variability (time-domain metrics)	RR interval	763.88	753.86	818.24	767.78	ns
	RMSSD	11.84	13.33	11.69	15.47	0.04
	SDNN	14.36	15.1	13.95	17.3	0.032
	RMSSD:SDNN	0.88	0.81	0.9	0.83	ns

RR=time between heartbeat
RMSSD=variability in time between successive heartbeats
SDNN= standard deviation of normal-to-normal intervals

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Results: cortisol, oxytocin, and tympanic temperature

	Control		Experimental		*p*
	Pre	Post	Pre	Post	
Cortisol (µg/dl)	0.28	0.24	0.24	0.21	ns
Oxytocin (nM)	0.86	1.0	0.65	0.83	ns
Tympanic membrane temperature (°C)	L=36.77 R=36.8	L=36.62 R=36.67	L=36.55 R=36.65	L=36.6 R=36.7	ns ns

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Results: physical activity level

	Control	Experimental	*p*
Average activity count (per min)	199.65	272.57	0.023
Mean immobile %	18.57	10.26	0.006

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Discussion

- Patients in both groups improved over time
- Patients were more physically active, more motivated, and more engaged during the rehabilitation sessions when therapy dogs were incorporated into the program
- In addition, changes in some of the HRV metrics suggest that patients were also in a more positive emotional state
- However, there was no difference between the groups in terms of patient recovery, mood, pain level, and most physiological responses

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Discussion

- “patient positively responded to therapy dog as evidenced by vocalizing affection to dog and improving mood during session (positivity and outlook of therapy)”
- “patient had less neuromuscular fatigue relative to previous days (sessions without a dog)”
- “occupational therapist observed patient reported less instances of pain during dog therapy sessions”
- “patient recalled having no pain (0/10) when interacting with dog, but patient reported a pain score of 8/10 prior to seeing the dog when saliva was being collected”

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Discussion

How to explain the moderate effect of AAT in stroke rehabilitation?

- AAT session time accounted for less than 10% of the total rehabilitation treatment schedule
- The positive effect caused by therapy dogs may be short-term:
  - research has shown that the effect of reducing depressive and loneliness symptoms by AAT is more likely to be detected immediately after the subjects were visited by the animals, and the impact rapidly decreases over time
  - In our study, questionnaires were often administered hours or even days after the AAT sessions, rather than immediately after, due to logistical and patient factors

Discussion

- Physical activity influences cardiac and hormonal activities, as well as other baseline physiological factors
- In our study, the AAT patients were more physically active and thus participated to a greater extent in their stroke rehabilitation treatment plan
- This could have had a confounding effect on the physiological measures we used to evaluate the effects of AAT on people with stroke

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Results: therapy dogs

Physiological and behavioral parameters of therapy dogs pre- and post-therapy session

Parameter		Pre	Post	Post-Pre
		μ (SE or CI)	μ (SE or CI)	*p* value of the F-test
Heart rate (beats/min)		96.97 (4.91)	79.62 (4.88)	***p* <0.0001**
RR interval (ms)		640.96 (43.10)	798.78 (42.82)	***p* <0.0001**
RMSSD		133.48 (31.19)	253.30 (30.92)	***p* <0.0001**
SDNN		100.14 (17.46)	175.76 (17.31)	***p* <0.0001**
RMSSD:SDNN ratio		1.24 (0.067)	1.37 (0.066)	***p* =0.0005**
Salivary cortisol (μg/dl)		0.29 (0.21, 0.39)	0.27 (0.18, 0.36)	*p*=0.13
Salivary oxytocin (nM)		1.76 (1.08, 2.65)	1.47 (0.84, 2.30)	*p*= 0.17
Tympanic membrane temperature (°C)	Left	38.17 (0.10)	38.20 (0.10)	*p*= 0.50
	Right	38.18 (0.11)	38.27 (0.11)	***p*= 0.034**
Canine FAS		0.48 (0.17)	0.46 (0.17)	*p*= 0.86

RR interval (the time between two successive R-waves); RMSSD (root mean square of the successive differences of RR intervals); SDNN (standard deviation of normal RR intervals); RMSSD:SDNN ratio (ratio of RMSSD to SDNN); Canine FAS (Canine Fear, Anxiety, and Stress Scale

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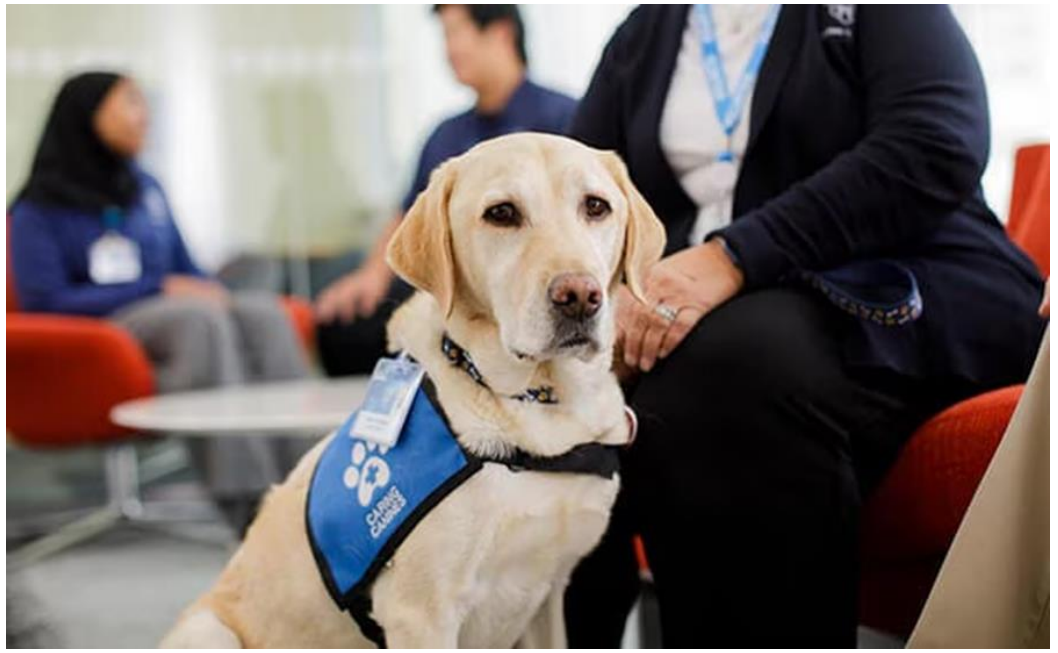
Discussion

- The dogs had a decreased HR and increased HRV values after participating in rehabilitation sessions, indicating parasympathetic dominance and thus lowered stress states
- The cortisol and oxytocin levels remained stable pre- and post-session
- The Canine FAS scores were similar pre- and post-session



The use of multiple noninvasive physiological indicators of stress provides solid evidentiary support for the positive welfare status of the dogs

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Thank you!