A One Health Research Framework for Animal-Assisted Interventions

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Abstract: Background: The integration of animals into healthcare, referred to as animal-assisted intervention, is a rapidly growing research field and was previously related to One Health. However, the assessment of synergistic effects of animal-assisted interventions (AAI) has been poorly addressed to date. Method: We discuss experiences in integrated human and animal assessments in AAI and provide a methodical framework for One Health approaches in AAI research. We propose theoretical consideration of an integrated human and animal health assessment, as well as the use of such an integrated approach in research. Based on the existing research, we argue that, for a deeper understanding of AAI mechanisms, parallel research designs are needed. Results and Conclusion: Our paper shows that a One Health study design is necessary to ensure that a tradeoff in health of animals is prevented and that an added value, or synergistic benefit, can be achieved on both sides during animal-assisted interventions.

Keywords: animal-assisted interventions; animal-assisted therapy; animal welfare; human-animal relationship; One Health

1. One Health

One Health recognizes the inextricable linkage of humans, animals and their environment [1] and is defined as any added value in terms of human and animal health and wellbeing, reduced cost, or sustained environmental services that can be achieved by a closer cooperation of human and animal health and other disciplines which could not be achieved if the sectors work separately [2]. Previous research, for example, from vaccination campaigns, shows that a One Health approach provides a clear benefit for the health of humans and animals alike [3–5].

We address the benefits and possibilities of a closer cooperation of human and animal health in the context of animal-assisted interventions (AAI). Earlier work relates AAI to One Health but does not address the assessment of synergistic benefits of AAI [6–9]. In this paper, we discuss experiences in integrated human and animal assessments in AAI and provide a methodical framework for One Health approaches in AAI research.

2. Animal-Assisted Interventions

Animal-assisted interventions subsume different interventions that incorporate human-animal teams in formal human services, referred to as animal-assisted therapy, animal-assisted education, animal-assisted coaching and animal-assisted activities [10].
Numerous studies document the significant influence of the human-animal relationship on human wellbeing and health. Although the results are sometimes contradictory [11], there is increasing evidence that interaction with animals can improve human health [12] and that AAI is an effective treatment for mental, behavioral and neurological disorders across different demographic populations [13–20]. AAI leads to enhanced physical, social and emotional wellbeing, possibly modulated via common brain networks involved in reward, emotion, affiliation [21] and the interconnection of the oxytocin system of both humans and animals [22]. Therefore, AAI is increasingly used as an adjunct in healthcare within a broad range of physical and mental health problems in hospitals, rehabilitation clinics, psychiatric facilities, prisons, schools, nursing homes and many more.

3. A One Health Framework for AAI

From a One Health perspective, ethically justifiable AAI should generate an added value in health and wellbeing for humans as well as animals and avoid any suffering in both. In the last few years, One Health has been understood to be an important framework for AAI [6,7,9,23,24], and there is growing awareness within AAI practice that the animal’s health and welfare should as well be a focus. Internationally approved guidelines for AAI [10] are in place, and institutions in the field of human-animal interaction have defined standards and basic requirements (e.g., standards of the International Society for Animal-Assisted Therapy (ISAAT) and guidelines of the Veterinary Association for Animal Protection in Germany (TVT) [25,26]). In Italy, the legislative regulation process has a clear connection to the One Health concept [8], while in other countries, such as Sweden and Austria, legal regulations are developing. The international guidelines from the International Association of Human-Animal Interaction Organizations (IAHAIO) stipulate that all animals involved must enjoy this type of activity and not be overworked, overwhelmed or jeopardized in their safety and comfort [10]. These guidelines are squarely in line with the principles of One Health, but the question arises of how to assess joy or exhaustion in the animal during AAI. This requires evidence-based knowledge.

Most research on AAI focuses on the human side, but there is specific literature on dogs [27], horses [28] and guinea pigs [29]. To ensure that the interdependencies between human and animal health are taken into account, we propose a One Health framework for AAI research which would demonstrate under which circumstances there is no tradeoff of human benefits against animal health and wellbeing and under which circumstances animals could actually benefit from such interactions with humans. This is an ethical standard to which those who utilize animals are bound [30,31]. In addition, ensuring and fostering the health and wellbeing of the animals leads to positive rebound effects.

4. One Health Research Designs

We propose two broad areas of questions within this One Health framework of AAI research. On one hand, benefits and risks of AAI in the participation for humans and animals need to be identified. Applying this on the animal’s behalf implies that research identifies conditions that enable as much enrichment behavior and welfare as possible and minimize distress and health risks. This must be evaluated across different species but also take the personality of the individual animal into account [29,32]. These questions can be addressed in a sequential study design, where separate studies look at the effects on either the animals or the humans.

Additionally, the interrelation and the reciprocal influence of the relationship between participating humans and animals during animal-assisted interventions need to be further investigated. What happens between a human and an animal? What is their relationship, and how do the individuals react to and influence each other? For these questions, parallel study designs are needed in which humans and animals are investigated simultaneously.

Most existing research addressing effects of AAI in animals uses sequential designs, investigating the animals before, during and/or after AAI, and thus provides insight on factors influencing stress
and wellbeing of participating animals [32–37]. For example, client age [38], as well as the amount of work experience a dog has [39] and whether it is working off- vs. on-lead [40] significantly influences the amount of stress for dogs. A recent study investigating the effects of AAI on guinea pigs under different conditions demonstrated that the possibility for retreat and free interactions during AAI reduces stress and fosters enrichment behaviors in guinea pigs [29].

An example of parallel research design is examining salivary cortisol levels of human-dog dyads showing that both dog handlers and dogs had higher cortisol concentrations on therapy days than on control days, indicating a higher stress level [41]. Schöberl and colleagues [42] investigated the cortisol response of human-dog dyads in response to different challenging situations, concluding that both owner and dog social characteristics influenced dyadic cortisol variability. Recent research measured heart rate and heart rate variability simultaneously in horses and humans [43] and applied this approach also to assess effects during AAI [44–46]. However, such designs are still scarce, and more are needed to understand the reciprocal influence of the relationship between the humans and the animals taking part in interventions.

5. Conclusions

Implementing a One Health framework in AAI research shows that more studies addressing the health and wellbeing of participating animals are needed. We suggest that parallel research designs are needed to improve understanding of AAI mechanisms. Moreover, future research addressing animals should focus on stress reduction as well as enhancement of positive welfare indicators to identify conditions that might provide benefits to animals participating in AAI [27]. There is a growing body of literature describing assessment of animal welfare which can be used in AAI research [27,28,47–49]. Future research should combine different methods to investigate the relationship between behavioral and physical outcomes and use multidimensional, systemic approaches that include environmental factors and the social context [42]. Also, studies investigating long-term consequences of AAI on the quality of life in participating animals are warranted.

The proposed One Health framework for AAI requires a transdisciplinary approach and mutual interest from both scientists and practitioners. Accordingly, a One Health framework, as proposed, could overcome differences in terminology and different discipline-specific outcomes and lead to an added-value just through capturing a One Health perspective in AAI research. An integrated One Health study design is necessary to avoid a tradeoff between human and animal health and ensure that an added value in terms of synergistic benefits can be achieved on both sides during animal-assisted interventions. More specific guidelines for AAI and human animal interaction should be developed on the basis of such evidence-based knowledge.

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References

1. Zinsstag, J.; Schelling, E.; Walter-Toews, D.; Whittaker, M.; Tanner, M. One Health: The Theory and Practice of Integrated Health Approaches; CAB International: Oxfordshire, UK, 2015.
2. Schelling, E.; Wyss, K.; Bechir, M.; Moto, D.D.; Zinsstag, J. Synergy between public health and veterinary services to deliver human and animal health interventions in rural low income settings. BMJ 2005, 331, 1264–1267. [CrossRef] [PubMed]
3. Mindekem, R.; Lechenne, M.S.; Naissengar, K.S.; Oussiguere, A.; Kebkiba, B.; Moto, D.D.; Afaroukh, I.O.; Ouedraogo, L.T.; Salifu, S.; Zinsstag, J. Cost Description and Comparative Cost Efficiency of Post-Exposure Prophylaxis and Canine Mass Vaccination against Rabies in N’Djamena, Chad. Front. Vet. Sci. 2017, 4, 38. [CrossRef] [PubMed]
4. Roth, F.; Zinsstag, J.; Orkhon, D.; Chimed-Ochir, G.; Hutton, G.; Cosivi, O.; Carrin, G.; Otte, J. Human health benefits from livestock vaccination for brucellosis: Case study. *Bull. World Health Organ.* 2003, 81, 867–876. [PubMed]

5. Zinsstag, J.; Dürr, S.; Penny, M.A.; Mindekekm, R.; Roth, F.; Menendez Gonzalez, S.; Naissengar, S.; Hattendorf, J. Transmission dynamics and economics of rabies control in dogs and humans in an African city. *Proc. Natl. Acad. Sci. USA* 2009, 106, 14996–15001. [CrossRef] [PubMed]

6. Chalmers, D.; Dell, C.A. Applying One Health to the Study of Animal-Assisted Interventions. *EcoHealth* 2015, 12, 560–562. [CrossRef] [PubMed]

7. Pirrone, F. Animal assisted intervention (AAI) for children in either research, practice or policy from a One Health perspective. Editorial. *Ann. Ist. Super. Sanita* 2017, 53, 273–274.

8. Simonato, M.; De Santis, M.; Contalbrigo, L.; Benedetti, D.; Finocchi Mahne, E. The Italian Agreement Context. *People Anim. Int. J. Res. Pract.* 2018, 1, 1–11.

9. Takashima, G.K.; Day, M.J. Setting the One Health agenda and the human-companion animal bond. *Int. J. Environ. Res. Public Health* 2014, 11, 11110–11120. [CrossRef]

10. IAHAIO. IAHAIO White Paper 2014, Updated for 2018. The IAHAIO Definitions for Animal Assisted Intervention and Guidelines for Wellness of Animals Involved in AAI. 2018. Available online: http://iahiao.org/wp/wpcontent/uploads/2018/04/iahiao_wp_updated-2018-final.pdf (accessed on 10 December 2018).

11. Torske, M.O.; Krostad, S.; Stamatakis, E.; Bauman, A. Dog ownership and all-cause mortality in a population cohort in Norway: The HUNT study. *PLoS ONE* 2017, 12, e0179832. [CrossRef]

12. Mubanga, M.; Byberg, L.; Nowak, C.; Egenvall, A.; Magnusson, P.K.; Ingelsson, E.; Fall, T. Dog ownership and the risk of cardiovascular disease and death—A nationwide cohort study. *Sci. Rep.* 2017, 7, 15821. [CrossRef]

13. Bernabei, V.; De Ronchi, D.; La Ferla, T.; Moretti, F.; Tonelli, L.; Ferrari, B.; Forlani, M.; Atti, A.R. Animal-assisted interventions for elderly patients affected by dementia or psychiatric disorders: A review. *J. Psychiatr. Res.* 2013, 47, 762–773. [CrossRef] [PubMed]

14. Kamioka, H.; Okada, S.; Tsutani, K.; Park, H.; Okuizumi, H.; Handa, S.; Oshio, T.; Park, S.J.; Kitayuguchi, J.; Abe, T.; et al. Effectiveness of animal-assisted therapy: A systematic review of randomized controlled trials. *Complement. Ther. Med.* 2014, 22, 371–390. [CrossRef] [PubMed]

15. Lundqvist, M.; Carlsson, P.; Sjodahl, R.; Theodorsson, E.; Levin, L.A. Patient benefit of dog-assisted interventions in health care: A systematic review. *BMC Complement. Altern. Med.* 2017, 17, 358. [CrossRef] [PubMed]

16. Maujean, A.; Pepping, C.A.; Kendall, E. A Systematic Review of Randomized Controlled Trials of Animal-Assisted Therapy on Psychosocial Outcomes. *Anthrozoös* 2015, 28, 23–36. [CrossRef]

17. Nimer, J.; Lundahl, B. Animal-assisted therapy: A meta-analysis. *Anthrozoös* 2007, 20, 225–238. [CrossRef]

18. O’Haire, M.E.; Guerin, N.A.; Kirkham, A.C. Animal-Assisted Intervention for trauma: A systematic literature review. *Front. Psychol.* 2015, 6, 1121. [CrossRef]

19. O’Haire, M.E.; McKenzie, S.J.; Beck, A.M.; Slaughter, V. Social behaviors increase in children with autism in the presence of animals compared to toys. *PLoS ONE* 2013, 8, e57010. [CrossRef]

20. Souter, M.A.; Miller, M.D. Do animal-assisted activities effectively treat depression: A meta-analysis. *Anthrozoös* 2007, 20, 167–180. [CrossRef]

21. Stoeckel, L.E.; Palloy, L.S.; Collhub, R.L.; Niemi, S.M.; Evins, A.E. Patterns of brain activation when mothers view their own child and dog: An fMRI study. *PLoS ONE* 2014, 9, e107205. [CrossRef]

22. Nagesawa, M.; Mitsu, S.; En, S.; Ohtani, N.; Ohta, M.; Sakuma, Y.; Onaka, T.; Mogi, K.; Kikusui, T. Social evolution. Oxytocin-gaze positive loop and the coevolution of human-dog bonds. *Science* 2015, 348, 333–336. [CrossRef]

23. Hediger, K.; Beetz, A.M. The Role of Human-Animal Interactions in Education. In *One Health: The Theory and Practice of Integrated Health Approaches*; Zinsstag, J., Schelling, E., Walter-Toews, D., Whittaker, M., Tanner, M., Eds.; CAB International: Oxfordshire, UK, 2015; pp. 74–84.

24. Turner, D.C. Non-Communicable Diseases: How Can Companion Animals Help in Connection with Coronary Heart Disease, Obesity, Diabetes and Depression? In *One Health: The Theory and Practice of Integrated Health Approaches*; Zinsstag, J., Schelling, E., Walter-Toews, D., Whittaker, M., Tanner, M., Eds.; CAB International: Oxfordshire, UK, 2015; pp. 222–229.
25. Wohlfarth, R.; Sandstedt, L. Animal Assisted Activities with Dogs. Guideline for Basic Requirements & Knowledge; Publishing House of Janusz Korczak Pedagogical University in Warsaw: Warsaw, Poland, 2016.

26. Wohlfarth, R.; Olbrich, E. Qualitätsentwicklung und Qualitätssicherung in der Praxis tiergestützter Interventionen; ESAAT, ISAAT: Zürich, Switzerland, 2014.

27. Glenk, L.M. Current Perspectives on Therapy Dog Welfare in Animal-Assisted Interventions. *Animals* 2017, 7, 7. [CrossRef] [PubMed]

28. De Santis, M.; Contalbrigo, L.; Borgi, M.; Cirulli, F.; Luzi, F.; Redaelli, V.; Stefani, A.; Toson, M.; Odore, R.; Vercelli, C.; et al. Equine Assisted Interventions (EAs): Methodological Considerations for Stress Assessment in Horses. * Vet. Sci.* 2017, 4, 44. [CrossRef] [PubMed]

29. Gut, W.; Crump, L.; Zinstag, J.; Hattendorf, J.; Hediger, K. The effect of human interaction on guinea pig behavior in animal-assisted therapy. *J. Vet. Behav.* 2018, 25, 56–64. [CrossRef]

30. Ng, Z.; Albright, J.; Fine, A.H.; Peralta, J. Our Ethical and Moral Responsibility: Ensuring the Welfare of Therapy Animals. In *Handbook on Animal-Assisted Therapy: Foundations and Guidelines for Animal-Assisted Interventions*; Fine, A.H., Ed.; Elsevier: San Diego, CA, USA, 2015; pp. 357–377.

31. Zamir, T. The moral basis of animal-assisted therapy. *Soc. Anim.* 2006, 14, 179–199. [CrossRef] [PubMed]

32. Pyle, A.A. Stress Responses in Horses Used for Hippotherapy; Texas Tech University: Lubbock, TX, USA, 2006.

33. Fazio, E.; Medica, P.; Cravana, C.; Ferlazzo, A. Hypothalamic-pituitary-adrenal axis responses of horses to therapeutic riding program: Effects of different riders. *Physiol. Behav.* 2013, 18, 138–143. [CrossRef] [PubMed]

34. Gehrke, E.K.; Baldwin, A.; Schiltz, P.M. Heart Rate Variability in Horses Engaged in Equine-Assisted Activities. *J. Equine Vet. Sci.* 2011, 31, 78–84. [CrossRef]

35. Johnson, R.A.; Johnson, P.J.; Megarani, D.V.; Patel, S.D.; Yaglom, H.D.; Osterlind, S.; Grindler, K.; Vogelweid, C.M.; Parker, T.M.; Pascua, C.K.; et al. Horses Working in Therapeutic Riding Programs: Cortisol, Adrenocorticotropic Hormone, Glucose, and Behavior Stress Indicators. *J. Equine Vet. Sci.* 2017, 57, 77–85. [CrossRef]

36. Kaiser, L.; Heleski, C.R.; Siegf, J.; Smith, K.A. Stress-related behaviors among horses used in a therapeutic riding program. *J. Am. Vet. Med. Assoc.* 2006, 228, 39–45. [CrossRef]

37. McKinney, C.; Mueller, M.K.; Frank, N. Effect of Therapeutic Riding on Measures of Stress in Horses. *J. Equine Vet. Sci.* 2015, 35, 922–928. [CrossRef]

38. Marinelli, L.; Normando, S.; Siliprandi, C.; Salvadoretti, M.; Mongillo, P. Dog assisted interventions in a specialized centre and potential concerns for animal welfare. *Vet. Res. Communities* 2009, 33, 93–95. [CrossRef]

39. King, C.; Watters, J.; Mungre, S. Effect of a time-out session with working animal-assisted therapy dogs. *J. Vet. Behav.* 2011, 6, 232–238. [CrossRef]

40. Glenk, L.M.; Kothgasser, O.D.; Stetina, B.U.; Palme, R.; Kepplinger, B.; Baran, H. Therapy dogs’ salivary cortisol levels vary during animal-assisted interventions. * Anim. Welf.* 2013, 22, 369–378. [CrossRef]

41. Haubenhofer, D.K.; Kirchengast, S. Dog handlers’ and dogs’ emotional and cortisol secretion responses associated with animal-assisted therapy sessions. *Soc. Anim.* 2007, 15, 127–150. [CrossRef]

42. Schöberl, I.; Wedl, M.; Beetz, A.; Kotrschal, K. Psychobiological Factors Affecting Cortisol Variability in Human-Dog Dyads. *PLoS ONE* 2017, 12, e0170707. [CrossRef] [PubMed]

43. Lanata, A.; Guidi, A.; Valenza, G.; Baragli, P.; Scilingo, E.P. The role of nonlinear coupling in Human-Horse Interaction: A preliminary study. *Conf. Proc. IEEE Eng. Med. Biol. Soc.* 2017, 2017, 1320–1323. [PubMed]

44. Drinkhouse, M.; Birmingham, S.S.W.; Fillman, R.; Jedlicka, H. Correlation of Human and Horse Heart Rates during Equine-Assisted Therapy Sessions with At-Risk Youths: A Pilot Study. *J. Stud. Res.* 2012, 1, 22–25.

45. Gehrke, E.K.; Myers, M.P.; Garman, K. Pilot Study on Impact on Balance of Autonomic Nervous System During Equine-Assisted Coaching: Simultaneous Heart Rate Variability in Horses, Coach, and Client. *Int. J. Hum. Caring* 2016, 20, 12–14. [CrossRef]

46. Naber, A.; Kreuzer, L.; Zink, R.; Millesi, E.; Palme, R.; Hediger, K.; Jensen-Jarolim, E.; Glenk, L.M. Heart rate, heart rate variability and salivary cortisol as indicators of arousal and synchrony in horses, therapist and clients with intellectual disability during equine-assisted interventions. E. motion, Vienna, Austria. 2018; Unpublished manuscript.

47. Hawkins, P. Progress in assessing animal welfare in relation to new legislation: Opportunities for behavioural researchers. *J. Neurosci. Methods* 2014, 234, 135–138. [CrossRef]
48. Martin, P.; Czycholl, I.; Buxade, C.; Krieter, J. Validation of a multi-criteria evaluation model for animal welfare. *Animal* 2017, *11*, 650–660. [CrossRef]

49. Protopopova, A. Effects of sheltering on physiology, immune function, behavior, and the welfare of dogs. *Physiol. Behav.* 2016, *159*, 95–103. [CrossRef]