Initial outcomes of a harmonized approach to collect welfare data in sport and leisure horses

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Abstract

A truthful snapshot of horse welfare conditions is a prerequisite for predicting the impact of any actions intended to improve the quality of life of horses. This can be achieved when welfare information, gathered by different assessors in diverse geographical areas, is valid, comparable and collected in a harmonized way. This paper aims to present the first outcomes of the Animal Welfare Indicators (AWIN) approach: the results of on-farm assessment, and a reliable and harmonized data collection system. A total of 355 sport and leisure horses, stabled in 40 facilities in Italy and in Germany, were evaluated by three trained assessors using the AWIN welfare assessment protocol for horses. The AWINHorse app was used to collect, store and send data to a common server. Identified welfare issues were obesity, unsatisfactory box dimensions, long periods of confinement and lack of social interaction. The digitalized data collection was feasible in an on-farm

environment, and our results suggest that this approach could prove useful in identifying the most relevant welfare issues of horses in Europe or worldwide.

Keywords: AWIN, animal-based indicator, data collection, horse, welfare assessment

Implications

This study reports the initial outcomes deriving from the application of the approach developed in the Animal Welfare Indicators project to assess the welfare status of stabled sport and leisure horses. For the first time, the authors present an innovative approach to collecting welfare data in a harmonized way that could prove useful for creating a common database of the general welfare status in different horse categories.

Introduction

Horses are a peculiar species: they can be classified as farm or companion animals; they can be owned for several reasons, ranging, for example, from use in Animal Assisted Therapies to food production. It follows that horses are managed heterogeneously and they are exposed to diverse welfare issues. For the same reasons, the assessment of horse welfare poses several challenges to researchers, e.g. collecting data in different housing systems, or linking equids to their responsible person (World Horse Welfare and Eurogroup for Animals, 2015). A scientifically sound method to assess horse welfare on-farm represents the foundation for a strategic plan aimed at improving the welfare of horses. A subsequent step includes the collection of reliable and uniform data in different countries to identify the most relevant welfare issues. By definition, harmonization is: to create the possibility to combine data from heterogeneous sources into integrated, consistent and unambiguous information products. Harmonized data collection is essential in order to obtain a reliable picture of horse welfare conditions in different countries on

which to base a roadmap to its improvement. Although significant progress has been made in this field over the past 15 years (Burn *et al.*, 2010; Neijenhuis *et al.*, 2011; Popescu and Diugan, 2013; Pritchard *et al.*, 2005;Vervaecke*et al.*, 2011; Visser *et al.*, 2014), limited data on welfare of European horses is yet available.

The Animal Welfare Indicators (AWIN) project, funded by the European Commission in the Seventh Framework Programme, aimed to improve the welfare of several species, including horses, by developing scientifically sound and practical on-farm welfare assessment protocols (Battini *et al.*, 2015). AWIN research was grounded on and progressed from the approach defined in the Welfare Quality® research project (Botreau *et al.* 2007; Blokhuis *et al.* 2010; Rushen *et al.* 2011) and by Visser et al. (2014). As for horses, AWIN research was not only focused on developing a welfare assessment protocol grounded on valid animal-based indicators (Dalla Costa *et al.*, 2014), but also on finding innovative methods to standardise on-farm data collection (Dai *et al.*, 2014). This study aims to report the first outcomes of the AWIN approach on the development of a strategy to improve horse welfare: it presents the results of on-farm assessment and the use of a harmonized data collection system.

Material and methods

Facilities and horses

The welfare of horses stabled in 40 facilities in Italy (N = 20) and in Germany (N = 20) was assessed between March and July 2014. Considering that the number of horses stabled in each facility can be very different and that this can be associated with specific welfare issues, a stratified random sample of very small (≤4 horses), small (5-10 horses), medium (11-30 horses) and large (>31 horses) horse facilities was selected. All the selected facilities were contacted over the phone and participated in the study on a voluntary basis. In each facility, all the single-stabled horses (for at least half of the day) more than 5 years

old were included in the study. A total of 355 sport and leisure horses (females = 146; geldings = 190; stallions = 19), of different breed and riding discipline (Show jumping = 118; Dressage = 22; Western = 18; Endurance = 8; Eventing = 8; School = 28; Leisure = 73; Pet = 12 Other = 40; NA = 28), aged between 5 and 33 years old (mean = 12.7) were assessed.

Assessors

Three veterinarians (two females and one male), aged between 30 and 37, experienced in horse behavior and welfare, were recruited to perform the assessments. Before carrying out the on-farm evaluation, they underwent a joint training period to learn how to perform and score all the indicators included in the AWIN welfare assessment protocol for horses (AWIN, 2015a). The training of assessors consisted of two phases: first e-learning and then face-to-face. The e-learning phase was developed in order to reduce time and costs related to the face-to-face training, without losing accuracy in the assessment. Each welfare indicator was transferred into a learning object organized in different sections: description, how to assess, how to score, examples and self-assessment exercises. The online material was available to the trainees for one month (December 2013). Then, a face-to-face training phase lasting two days and consisting of theoretical and practical on-farm training was performed in order to acquire the practical skills necessary to perform and score all the indicators accurately and reliably. During the training on-farm, assessors worked in pairs with silver standard, that is two AWIN researchers with experience in assessing horse welfare. Both phases ended with an assessment of learning: as for the e-learning phase, assessors had to answer 58 questions (including videos and/or pictures); whilst at the end of the face-to-face phase, assessors conducted live assessments of horses until they performed a minimum of five consecutively accurate assessments. The

training was considered complete when the assessors achieved ≥ 80% agreement with the silver standard, on both e-learning and live scoring.

Welfare assessment

The assessment was conducted using the AWIN welfare assessment protocol for horses. This document (AWIN, 2015a) reports the description, the assessment and scoring methods of the welfare indicators used in the present work. The AWIN welfare assessment protocol for horses is based on the Welfare Quality® principles and criteria, developed following the methods reported by Dalla Costa and colleagues (2016) and includes animal-, resource- and management-based indicators (Table 1) evaluated in terms of their validity, reliability and feasibility. In the present study, the welfare assessment was conducted at least one hour after feed distribution, as recommended in the protocol.

Data collection

A digital system to collect, store and download the indicators included in the AWIN welfare assessment protocol for horses was created (Dai *et al.*, 2015b); the AWINHorse app was developed for Android devices and it is now freely available on Google Play Store (AWIN, 2015b). A preliminary version of the AWINHorse app was installed on tablets or smartphones and tested on-farm in order to evaluate its feasibility during the assessments. The welfare assessors learned how to use the app to collect data on-farm during their training.

Statistical analysis

Data collected on-farm by assessors was downloaded from the app to a Comma-Separated Value (CSV) file before performing descriptive statistics using SPSS statistical package (IBM Corp., 2012). The proportion of horses with different scores for each welfare

129 indicator was calculated. For the fear test, minimum, maximum values, and mean and
130 standard deviation were calculated; an analysis of variance (ANOVA) was used to identify
131 possible links between fear behavior shown by horses (e.g. freezing, prancing, vigilance,
132 defecation/urination) (Christensen *et al.,* 2005; Forkman *et al.*, 2007; Le Scolan *et al.*,
133 2002; Wolff *et al.*, 1997) and the latency to approach the novel object in the fear test.
134 Latency was considered the dependent variable, and fear behavior was introduced in the
135 model as fixed effect. Data was tested for normality using a Kolmogorov-Smirnov test. As
136 variables were not normally distributed, a Chi-square test was used to identify a possible
137 relationship between variables.
138
139 **Results**
140 This section initially reports, for each welfare principle presented in Table 1, the results of
141 the welfare assessment; then explores feasibility aspects related to the data collection
142 system.
143 *On-farm welfare assessment*
144 No safety issues were encountered and time required to perform the assessment varied
145 from five to 25 mins per horse. For each welfare indicator, the proportions of horses with
146 different scores are reported in Table 2 (for the principle “good feeding”), Table 3 (“good
147 housing”), Table 4 (“good health”) and Table 5 (“appropriate behaviour”).

148 As regards the principle “good feeding” (Table 2), most of the assessed animals enjoyed
149 appropriate nutrition (BCS = 3). Extreme scores, BCS = 1 and BCS = 5, were observed in
150 a few cases, whereas dressage horses presented a significantly higher prevalence
151 (54.5%; Chi-square P = 0.002) of overweight subjects (BCS > 3) compared to different
152 riding disciplines. Our results show that the vast majority of horses had free access to a

153 water point. However, the water points were often dirty or partially dirty, meaning that they
154 were not checked or cleaned regularly by the stable staff.

155 As regards the principle “good housing” (Table 3), bedding provided to the horses was in
156 the majority of cases sufficient and clean; however, box dimensions were scored as
157 satisfactory only in 68.6% of cases.

158 About half the horses had the possibility to exercise (free or ridden) on a daily basis.
159 Remarkably, this study uncovered that 9.3% of subjects did not have the chance to get out
160 of their box. In these cases, reported justifications were: “the owner does not have time to
161 ride the horse”, “the horse is old and no paddock for free exercise is available”, “giving the
162 horse the possibility to spend free time in the paddock increases the risk of injuries”.
163 Sometimes it was not possible to gather information about exercise (proportion of NA in
164 Table 3) because the stable manager was not always available to answer the questions for
165 every horse present in the stable. In the considered sample, the majority of show jumping
166 horses (60.5%) spent less than two hours a day outside their box, the situation was
167 different for dressage and leisure horses with a proportion of 22.7% and 16.4%
168 respectively.

169 As regards the principle “good health” (Table 4), the majority of the horses did not present
170 swollen joints, lameness, prolapse, unhealthy coat, discharges, abnormal breathing,
171 coughing, signs of pain (Horse Grimace Scale score < 2), hoof neglect, and lesions at
172 mouth corners. The most frequent integument alteration was alopecia, followed by
173 superficial skin lesions and swellings. The HGS score was ≥ 2 in 2% of cases, always
174 linked with other signs of pain (e.g. lameness). Lesions at mouth corners sometimes were
175 not assessed (NA) because handlers were not available to hold the horse's head. In some
176 cases, the horse was head shy and it was not safe to touch the corners of the mouth to
177 assess the possible presence of lesions. It was not possible to evaluate lameness (NA) for

178 14.4% of horses. Another indicator that could not be assessed in quite a high number of
179 cases was the faeces evaluation (manure), as most of the time boxes were clean at the
180 moment of the inspection and no faeces were present.

181 Table 5 reports results regarding the principle “appropriate behavior”. In 22.3% of cases,
182 horses had no possibility to interact with conspecifics, not even visually.

183 In our sample, evidence of stereotypic behavior (e.g. cribbing, weaving) was significantly
184 related to the reduced possibility of social contact (Chi-Square P = 0.001). Most
185 particularly, western riding horses presented the highest prevalence of these behaviors
186 (27.8%) and they also had the highest prevalence of lack of social contact (27.8%).

187 Most of the assessed horses showed a positive reaction to an unknown human interacting
188 with them during three behavioral tests, with a small prevalence of horses showing
189 avoidance or negative reaction. Testing the Avoidance Distance to a human approaching
190 the box door was not possible in 23.3% of the cases, mostly when horses were inattentive
191 to the human presence.

192 In the fear test, after the novel object was dropped in the box, the horses needed 34 ± 52 s
193 (MIN = 0, MAX = 285 s) to approach it. Latencies were significantly related to the presence
194 of behavioral fear reactions (e.g. freezing, prancing, vigilance, defecation/urination)
195 (ANOVA, $P < 0.01$).

196

197 *Data collection system*

198 All three assessors successfully completed both phases of training, reaching a good level
199 of agreement with the silver standard (≥ 80%).

200 All our assessors quickly learned how to use the digitalized system to collect data and
201 upload it to a server. Thanks to the use of tablets or smartphones, in one or two minutes

the assessors were able to insert the data for a particular horse and upload it to a central server. When an internet connection was not available on farm, data could be stored on the device and sent to the server later on. The use of tablets on-farm caused some minor difficulties: as these devices could be cumbersome, horses sometimes approached and sniffed them, thus interfering with some of the behavior tests; the use of smartphones that can be safely stored in a pocket could reduce these problems.

Discussion

The results highlight that the approach described in this paper was useful to assess the welfare status of stabled sport and leisure horses. Even though no cases of cruelty and no major welfare problems were encountered, the authors consistently uncovered issues such as being overweight, unsatisfactory box dimensions, long periods of confinement and lack of social interaction. These issues are unsurprisingly similar to those reported as commonly perceived by respondents to a recent European survey (World Horse Welfare and Eurogroup for Animals, 2015). The number of facilities assessed was relatively limited; for this reason, the sample of horses assessed does not necessarily represent the welfare status of all horses in Europe, because conditions vary within and between countries. Obesity is a serious and largely under-reported equine welfare and health problem (Wyse *et al.*, 2008); overweight horses are predisposed to the development of several pathological conditions such as hyperlipemia, laminitis, and osteoarthritis (Geor, 2008; Watson *et al.*, 1992). The prevalence of overweight horses found in the present study is in line with the findings of Visser *et al.* (2014), confirming that, fat subjects are becoming more common than thin ones. Unlike other issues, this one can be addressed by changes to husbandry practices such as nutrition management and exercise routine.

Box dimension can affect the lying behavior of horses: Raabymagle and Ladewig (2006) observed that when insufficient lying space is provided, horses do not lie in lateral recumbency and they are unlikely to achieve paradoxical sleep. As for the AWIN protocol, box dimensions were considered satisfactory when responding to the requirements of the Swiss Animal Welfare Ordinance (2008). In order to prefigure the impact and consequences deriving from any possible large-scale prescriptions about horse box dimensions, it is essential to obtain a representative picture of their actual characteristics in the relevant geographical areas.

Our results show that horses can be confined for long period of time. Spending some time outside the box is important to prevent health and behavioral problems (Cooper and Albentosa, 2005; Visser *et al.*, 2014), as for example, it has long been known that respiratory problems are closely associated with improper housing microclimate (Halliwell *et al.*, 1993) and that activity level affects the presence of abnormal locomotory behaviors (McGreevy *et al.*, 1995a). An increasing number of organizations of the equine sector nowadays agree that many common horse welfare problems, including the lack of adequate free exercise, would be effectively improved by the promotion of responsible ownership (World Horse Welfare and Eurogroup for Animals, 2015). Horses are social animals, in nature they rely on survival strategies centred on the formation of cohesive social bonds within their family or bachelor bands (Mills and Nankervis 1999), and interacting with conspecifics is a basic behavioral need. Frustration of this need represents a serious welfare issue that can lead to the development of undesired behaviors (Cooper and Albentosa, 2005; McGreevy et al., 1995a). In our sample, lack of social interaction is common. The prevalence of stereotypic behavior, we found, is in line with findings of previous studies on sport and leisure horses (Kennedy et al., 1993; McGreevy et al., 1995b; Muñoz-Alonzo et al., 2015). For example, McGreevy et al. (1995) reported that the prevalence of stereotypies for dressage, eventing and endurance horses ranged from

19.5% to 32.5% and found that the time a horse spends out of the stable is negatively correlated with an increased risk of abnormal behavior. Therefore, if the stable is constructed so that horses cannot have any social contact, it should be remodelled as soon as possible and, in the meanwhile, different solutions should be implemented, e.g. offering daily access to paddocks where horses can interact with conspecifics.

Other minor welfare issues encountered were that water points were not regularly cleaned by the stable staff.

Here, as in the case of overweight horses, a key role is played by education on the importance of evaluation of body condition and regular checks to ensure that water points are clean and no blockages are present.

As regards the principle good health, that is patently of primary importance for horse welfare, some of the present findings seem to differ from what is described elsewhere in the literature (Asknes and Mejdell, 2012; Neijenhuis *et al.*, 2011; Visser *et al.*, 2014). For example, Visser *et al.* (2014) in their inspiring paper reported a prevalence of lameness (4.8%), higher than that registered by the authors (1.7%). The discrepancies with these studies are probably due to the different degrees of sensitivity of their indicators which required more extensive training (i.e. one week on-farm) and a deeper understanding of animal handling (i.e. evaluation of horses trotting in a straight line on a firm underground for 40 metres). In fact, grade 3 lameness on the AAEP Lameness Grading Scale is difficult to observe at a walk (Dyson, 2011). It is known that back pain is a potentially highly relevant welfare problem in sport and leisure horses (Visser et al., 2014); however, its accurate assessment requires extensive training and considerable animal handling. For this reason, a specific indicator for back pain was not included in the AWIN welfare assessment protocol. Despite the commitment to select and develop highly feasible indicators, some practical issues posed difficulties during this research. Lameness assessment consisted of walking the horse outside its box on a hard and even surface.

The main feasibility issue in this case was that the stable manager would not always take the responsibility for moving the horse out of its box without the owner's formal consent. Whereas on the one hand this result highlights the possible constraints that can be faced assessing animal-based measures on-farm, on the other it suggests that handling problems that could lead to safety issues are relatively frequent. This should be addressed by teaching the owners how to prevent them through the adoption of appropriate handling techniques, taking into account the behavior and learning characteristics of the horses.

As the relationship between horses and humans relies on repeated interactions, our results indicate that most of our horses maintained a positive relationship with humans (showing positive reaction in all the tests), this being of paramount importance to prevent negative emotional states and reactions potentially leading to accidents (Hausberger *et al.*, 2008). Sometimes, we found that horses were inattentive towards humans, even if the assessors signalled their presence (clicking three times with the tongue); this result may be due to that, in some cases, the human-horse interactions are neutral, even if neither negative nor positive.

The training formula, online and face-to-face, proved to be valuable, as it limited the time spent with the trainer to two days. In previous studies, the time needed for reliable training of assessors ranged from eight days to six months (Burn *et al.*, 2009; Visser *et al.*, 2014). Our experience demonstrated that the AWINHorse app is friendly and practical to use and it does not require a long training period. The app permits insertion of data reducing possible errors of transcription and immediately provides an output of welfare status that can be used to open a dialogue with the stable manager. Furthermore, once uploaded, data is immediately available for further analysis on the server. Therefore, the app would be a useful tool for the development of an accessible data repository on animal welfare

304 and for increasing data and knowledge accessibility to all European countries. The
305 digitalized data collection system proved to be feasible on-farm, it should however be
306 applied in other contexts (e.g. working horses, competitions) to further evaluate its
307 potential in improving the efficiency of welfare data collection.
308
309 Our findings suggest that education of horse owners and stable managers is needed to
310 make them more aware of some aspects of horse welfare and incentivize the uptake of the
311 information. This study presents, for the first time, an innovative data collection system that
312 could prove useful in creating a larger and more geographically distributed database of
313 welfare issues in horses. As regards the welfare assessment, there are still some
314 important challenges to address. Although the AWIN protocol reports suggestions for
315 adaptation to some specific management situations (group housed horses), further
316 scientific research is needed and it is forecast that the protocol will be updated for use in
317 different conditions in the light of new scientific knowledge.
318
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Table 1 *Names of the AWIN indicators for horse welfare assessment presented by principles and criteria. Detailed descriptions of each welfare indicator are reported in the AWIN welfare assessment protocol for horses (*AWIN, 2015a*).*

Welfare principles	Welfare criteria	Welfare indicators
Good feeding	Appropriate nutrition	Body Condition Score
	Absence of prolonged thirst	Water availability
		Bucket test
Good housing	Comfort around resting	Bedding
		Box dimensions
	Ease of movement	Exercise
Good health	Absence of injuries	Integument alterations
		Swollen joints
		Lameness
		Prolapse
	Absence of disease	Hair coat condition
		Discharges
		Consistency of manure
		Abnormal breathing
		Coughing
	Absence of pain and pain induced by management procedures	Horse Grimace Scale
		Signs of hoof neglect
		Lesions at mouth corners
Appropriate behavior	Expression of social behavior	Social interaction
	Expression of other behaviors	Stereotypies

	Good human-animal relationship	Fear test Human-animal relationship tests

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458 **Table 2** *Results of the AWIN welfare assessment protocol for horses related to the*
459 *principle "good feeding". Detailed descriptions of different scores for each welfare indicator*
460 *are reported in the AWIN welfare assessment protocol for horses (*AWIN, 2015a*).*

Welfare indicator	Score	Prevalence of each score (%)
Body Condition Score	1	0.6
	2	8.5
	3	58.8
	4	28.0
	5	4.2
Water availability – Type of water point	Not present	0.8
	Trough	7.3
	Automatic drinker	91.8
Water availability – Cleanliness of water point	Dirty	17.5
	Partially dirty	24.5
	Clean	53.0
	NA[1]	5.1
Water availability – Functioning of automatic drinkers	Not functioning	0.6
	Functioning	91.0
	NA[1]	8.5

461 [1] NA = Not Applicable

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Table 3 *Results of the AWIN welfare assessment protocol for horses related to the principle "good housing". Detailed descriptions of different scores for each welfare indicator are reported in the AWIN welfare assessment protocol for horses (*AWIN, 2015a*).*

Welfare indicator	Score	Prevalence of each score (%)
Bedding - Quantity	No bedding	0.3
	Insufficient[1]	19.2
	Sufficient/rubber mat	80.6
Bedding – Cleanliness	Dirty	11.0
	Clean	88.5
	NA[2]	0.6
Box dimensions	Not satisfactory[3]	30.4
	Satisfactory	68.2
	NA[2]	1.4
Exercise	Never	9.3
	Sometimes (less than 1/week)	1.7
	Weekly (1-4 times/week)	28.2
	Daily	51.5
	NA[1]	9.3

[1] Insufficient bedding = floor areas not covered by bedding are clearly visible

[2] NA = Not Applicable

[3] Not satisfactory = the area of the box is less than the satisfactory dimensions reported in the Swiss Animal Welfare Ordinance (TSchV) of 23 April 2008 (position as at 1 April 2011)

475 **Table 4** *Results of the AWIN welfare assessment protocol for horses related to the*
476 *principle "good health". Detailed descriptions of different scores for each welfare indicator*
477 *are reported in the AWIN welfare assessment protocol for horses (*AWIN, 2015a*).*

Welfare indicator	Score	Prevalence of each score (%)
Integument alterations	Present	34.6
	Absent	65.4
Swollen joints	Present	2.3
	Absent	97.7
Lameness	Lame	1.7
	Not lame	83.9
	NA[1]	14.4
Prolapse	Absent	100
Hair coat condition	Unhealthy[2]	2.8
	Healthy	96.9
	NA[1]	0.3
Ocular discharge	Present	1.1
	Absent	98.9
Nasal discharges	Present	0.3
	Absent	99.7
Discharge from vulva or penis	Absent	100
Consistency of manure	Abnormal	2.0
	Normal	75.2
	NA[1]	22.8
Abnormal breathing[3]	Present	0.6

	Absent	99.4
Coughing	Coughing	0.6
	No coughing	99.4
Horse Grimace Scale[4]	Signs of pain (HGS ≥ 2)	2.0
	No signs of pain (HGS < 2)	97.7
	NA[1]	0.3
Signs of hoof neglect[5]	Present	3.1
	Absent	96.9
Lesions at mouth corners	Open wounds	0.8
	Redness	0.8
	Hardened spots	7.6
	No lesions	82.8
	NA[1]	7.9

[1] NA = Not Applicable

[2] Unhealthy coat = dull, dry coat with or without rough coat

[3] Abnormal breathing = it is characterized by an exaggerated effort to breathe under standard climate conditions and at rest

[4] Horse Grimace Scale = it is a standardized method to evaluate changes in a horse facial expression due to pain (Dalla Costa *et al.*, 2014)

[5] Signs of hoof neglect = hooves are overgrown, rarely trimmed or trimmed incorrectly

Table 5 *Results of the AWIN welfare assessment protocol for horses related to the principle "appropriate behavior". Detailed descriptions of different scores for each welfare indicator are reported in the AWIN welfare assessment protocol for horses (*AWIN, 2015a*).*

Welfare indicator	Score	Prevalence of each score (%)
Social interaction	No possibilities for visual or physical contact	22.3
	Possibility to have visual contact	38.6
	Possibility to sniff other horses	29.0
	Possibility to nibble and partly groom	9.8
	NA[1]	0.3
Stereotypies	Evidence of stereotypies	19.4
	No evidence of stereotypies	80.6
Avoidance Distance[2]	Avoidance behavior	6.2
	No avoidance	70.1
	NA[1]	23.7
Voluntary Animal Approach	Negative signs[3]	2.3
	No interest	18.6
	Positive signs	72.4
	NA[1]	6.8
Forced Human Approach	Negative signs[3]	3.4
	Avoidance	16.1
	Positive signs	78.9
	NA[1]	1.7

[1] NA = Not Applicable

[2] Avoidance distance = presence of any avoidance behavior

[3] Negative signs = any signs of aggressive behaviors such as trying to bite and/or kick