Effects of vehicle type, driver experience and transport management during loading and in-transit on the welfare of road transported horses in New Zealand

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Abstract

The transport of horses for pleasure and commerce occurs frequently in New Zealand. In contrast to commercial livestock transport, most are transported by nonprofessional drivers in vehicles accommodating 2-3 animals; these do not have design standards that specifically address livestock welfare. The study identified if vehicle type and other factors were associated with transport related behavioural problems (TRBPs) during loading and in-transit. An online survey addressing transport practices and TRBPs was distributed throughout the New Zealand horse industry. Univariate and multivariate analyses identified risk factors for TRBPs ($P<0.2$) during loading and in-transit. Use of a whip or food during loading, feeding *en route*, travel frequency, and transport vehicle type were risk factors for TRBPs during loading ($P<0.02$). The ability to assess horse distress, feeding *en route*, the use of a whip for loading and vehicle type were risk factors for TRBPs in-transit ($P<0.03$). Commercial transport and transport in large trucks were associated with TRBPs during loading and in-transit respectively. Findings support other published evidence that adverse welfare outcomes for horses may be associated with vehicle types and other factors. Further study is required to differentiate the role of vehicle design or type from horse loading and transport practices in New Zealand.

Keywords: horse; road transport; welfare; behavioural problems; injury

Introduction

The road transport of horses and farm animals can result in adverse welfare outcomes, including injuries that result in morbidity or death of the animals, financial loss, and distress for transporters (Weeks et al. 2012; Padalino 2015). The transport of horses for work, pleasure, sport and commerce occurs frequently in New Zealand with approximately 99,000 horses (Rogers et al. 2017) participating in many road journeys each year. The patterns of horse movements by road have been reported for the non-racing (Rosanowski et al. 2013a), Thoroughbred and Standardbred breeding (Rosanowski et al. 2013b) and racing (Rosanowski et al. 2015) sectors in New Zealand, but until recently there has been no critical review of the welfare and injury risks for horses transported by road. Animal injuries resulting from commercial transport have been attributed to animal-associated, vehicle design and driver-associated factors (Padalino 2015; Friend 2001; Riley et al. 2016). Of the factors associated with transport vehicle design, debate has predominantly revolved around the optimal direction of travel (rearward, forward, or side facing) for horses within the vehicle (Friend 2001; Padalino 2015).

In contrast to commercial livestock carriers, most horses transported in New Zealand are moved by nonprofessional drivers in small trucks or floats that accommodate two to three horses over shorter distances (Padalino 2015). With the exception of trucks with a gross vehicle mass of > 4.5 tons, these private animal transportation vehicles are not subject to design, maintenance and testing regulations that are comparable to those required of commercially operated vehicles used for livestock. Although their operation for the road transport of animals is specified to some degree by minimum standards within the Animal Welfare (Transport within New Zealand) Code of Welfare 2011, the design and construction of these vehicles for animal conveyance are not regulated in New Zealand.

Transport-related behavioural problems (TRBPs) have been identified as a significant welfare concern and recently as a significant risk factor for injury (Padalino et al. 2017a; Padalino et al. 2017b), but their association with the type of transport vehicle is unclear. As part of a wider programme of research into transport-related welfare and economic issues for the equine industry in New Zealand, the aim of this study was focused on identifying if vehicle type and other factors were associated with TRBPs (and therefore the risk of injury) during the loading and in-transit phases of the road transport of horses in New Zealand.

Materials and methods

A cross-sectional online survey of horse transport practices (Qualtrics, New Zealand), TRBPs and injury was distributed throughout New Zealand industry organisations via member email addresses, web and social networking sites such as Facebook, between February and May 2017. With a target population of approximately 90,000 industry participants (IER 2010; Matheson & Akoorie 2012), eligible respondents had one or more horses in their care and organised transport of horses for professional or recreational reasons during the two years prior to the survey. A sample size calculation determined that to achieve a confidence level of 95% and a sampling error less than 5% would require 383 completed surveys. The survey included questions about the respondent (gender, equine industry sector involvement, amateur or professional industry

status, horse handling experience, ability to identify equine distress, number of horses in care), the journey (frequency, duration), transport management, (type of vehicle, position in the vehicle, use of sedation and protective equipment, type of restraint used, presence of food en route), the use of specific training for loading and travelling, the use of equipment or food for loading, and during which phase of transport (if any) TRBPs occurred. Two separate models were derived for loading and in-transit TRBPs (GenStat® Version 14, VSN International, Hemel Hempstead, UK). The outcome was binary (1/0, TRBP indicated/TRBP not indicated by the respondent) and for the two initial models univariate logistic regression analyses were performed and P values were calculated using the Wald test. Each predictor variable returning a P-value <0.25 (Table 1) with univariate analysis was then tested for significance in two separate multivariate models for loading and in-transit TRBPs. A stepwise backward elimination procedure was conducted whereby predictive variables were removed beginning with the least significant until all variables in the final models had a P-value <0.05 indicating significance (Tables 2a and 2b). The findings are presented as odds ratios (OR) and confidence intervals (95% CI) for each predictive variable. Wald test's P values were reported on each association.

Table 1 Associations between the predictive study variables examined for transport related behaviours of New Zealand horses displayed during loading or in-transit.

Predictive variable	Loading	In-transit
	P[a]-value	P[a]-value
Gender of respondent	0.879	0.507
Industry sector (e.g., racing, eventing, pleasure, etc.)	0.093	0.367
Amateur or professional industry involvement	0.890	0.654
Number of horses managed	0.157	0.165
Duration of horse handling experience	0.012	0.879
Ability to identify a horse in distress	0.486	0.022
Type of training used to prepare horse for transport	0.409	0.091
Use of whip for loading	<0.001	0.044
Use of food for loading	0.001	0.767
Use of a bum rope during loading	0.012	0.995
Use of sedation for transport	0.358	0.497
Use of protective equipment for transport	0.172	0.219
Use of rug during transport	0.771	0.074
Use of lower limb boots during transport	0. 517	0.778
Type of tie restraint used within the vehicle	0.139	0.139
Provision of food *en route*	0.002	0.013
Frequency of horse transport	0.034	0.453
Average journey distance	0.725	0.806
Design of vehicle (i.e., type, capacity)	<0.0001	0.211
Direction of travel within the transport vehicle	0.036	0.221

P[a]: P value calculated using Wald's test

Results

There were 1,124 respondents that answered questions on the presence or absence of TRBPs, resulting in a sample size with a confidence level of 95%, with an error level of ±3% for the study population. Of these 22.2% (249/1124) reported a horse showing a TRBP. Most (53.0%; 132/249) occurred in-transit (vehicle in motion) or during loading 31.3% (78/249), with fewer prior to loading (8.4%; 21/249) and at unloading (7.2%; 18/249). Sufficient data were available for separate modelling of loading and in-transit associated TRBPs. The predictive study variables examined for TRPBs displayed during loading and in-transit are given in Table 1 with their Wald test P values, and the findings of the multivariate regression analyses are reported in Tables 2a and 2b. The model for loading was significant ($\chi 2 = 84.8$, $P<0.01$) as was the model for transit ($\chi 2 = 41.0$, $P<0.01$).

Discussion

The distribution and demographics of respondents were similar to other data published for the New Zealand equine industry (Gronqvist et al. 2016). The sample size provides data that are representative of the experiences of New Zealanders involved in horse transport. Although 22% of respondents had experienced a TRPB, the study design did not permit an estimate of risk per transport event.

The number of individuals reporting TRBPs and their relative distribution between loading and transit were similar to those reported within the literature (Lee et al. 2001; Padalino et al. 2017a). However, the relative distribution of TRPBs within the New Zealand sample was biased towards transit and may reflect some unique characteristics of the road transport of horses in New Zealand, such as geographic topography, fewer motorways or interstate roads, and shorter travel durations in comparison with Australia (Padalino et al. 2017b).

As a social flight animal the loading of a horse onto a vehicle can be a period of high risk (Hartmann et al. 2017). Within the multivariate model, years of handling experience may be protective during loading, with a threshold of risk associated with less than five years of experience, but a lack of linearity thereafter. Therefore, targeted education programmes could be most effective for this group, as after five years most individuals appear to have achieved a level of expertise that does not appear to moderate the risk of a TRPB associated with loading.

The increase in TRBP risk associated with using food as a positive reward during loading, and the whip as a negative stimulus during loading and unloading highlights the difficulty in interpreting cross-sectional data. The use of a negative stimuli (i.e., whip) is often ineffective for loading, can increase horse arousal levels, and the chance of a TRPB (McLean & Christensen 2017; Padalino et al. 2017a). Positive rewards such as food should theoretically reduce risk, but are often used when a high probability of a TRPB with certain horses is anticipated (Baragli et

Table 2a Results of the multivariate regression analysis for the outcome of transport related problem behaviour of New Zealand horses reported to occur at loading.

Variable	Category	Estimate	Standard Error	Odds Ratio	95%CI	Wald Statistic	Pa
Duration of horse-handling experience (years)	51+	Ref[1]				15.52	0.017
	41-50	0.43	1.15	1.54	0.16-14.67		
	31-40	1.79	1.03	5.98	0.80-44.62		
	21-30	1.52	1.03	4.59	0.60-34.64		
	11-20	2.14	1.02	8.51	1.15-62.74		
	6-10	0.94	1.16	2.55	0.26-24.78		
	1-5	2.40	1.10	11.01	1.27-94.90		
Design of vehicle (e.g. type, capacity)	Small truck – 2 to 3 horses	Ref				30.77	<0.001
	Float/trailer – straight load	1.02	0.61	2.72	0.83-9.20		
	Float/trailer – angle load	0.39	0.75	1.47	0.33-6.50		
	Large truck – more than 3 horses	0.23	0.74	1.26	0.29-5.44		
	Use of a commercial trucking company	2.73	0.68	15.38	3.99-59.18		
Use of food for loading	No	Ref				18.12	<0.001
	Yes	1.14	0.27	3.14	1.85-5.33		
Use of whip for loading	No					5.94	0.015
	Yes	0.71	0.29	2.05	1.15-3.65		
Provision of food *en route*	No	Ref				5.37	0.020
	Yes	0.63	0.27	1.87	1.01-3.17		

[1]Reference group; P[a]: P value calculated using Wald's test. This model was significant (χ^2=84.8, df=13; p<0.01, estimate of the constant= -6.08, standard error of the constant=1.16, odds ratio of the constant=1.54)

Table 2b Results of the multivariate regression analysis for the outcome of a transport related problem behaviour of New Zealand horses reported to occur in-transit.

Variable	Category	Estimate	Standard Error	Odds Ratio	95%CI	Wald Statistic	Pa
Ability to identify a horse in distress[1]	5 – very high	Ref				8.91	0.012
	4 – high	0.63	0.21	1.87	1.24-2.84		
	3,2 – moderate, some	0.36	0.44	1.43	0.60-3.40		
Design of vehicle (e.g. type, capacity)	Small truck – 2 to 3 horses	Ref				10.73	0.030
	Float/trailer – straight load	0.54	0.37	1.71	0.81-3.61		
	Float/trailer – angle load	0.27	0.48	1.31	0.51-3.33		
	Large truck – more than 3 horses	1.06	0.41	2.90	1.29-6.51		
	Use a commercial trucking company	-0.26	0.69	0.77	0.19-3.01		
Type of training used to prepare horse for transport	Habituation	Ref				11.30	0.023
	None	-0.62	0.31	0.53	0.29-0.99		
	R-P+	0.35	0.24	1.42	0.87-2.31		
	R+	-0.39	0.56	0.67	0.22-2.03		
	Self-loading	-0.06	0.33	0.94	0.49-1.80		
Use of rug during transport	No	Ref					0.042
	Yes	0.47	0.23	1.59	1.01-2.51	4.12	
Provision of food *en route*	No	Ref				10.33	0.001
	Yes	0.67	0.21	1.96	1.30-2.97		

[1]No respondents answered none (0) or low (1) ability to detect distress in a horse; Negative reinforcement (R-) and positive punishment; (P+); Operant conditioning using positive reinforcement (R+), P[a]: P Value calculated using Wald's test. This model was significant (χ^2 = 41.0, df=12; p<0.01, estimate of the constant= -3.40, standard error of the constant=0.45, odds ratio of the constant=0.03)

al. 2015). The use of positive reinforcement is often not effective when the arousal of the horse is too high or when food is used to motivate the animals rather than as a reward for the wanted behaviour (McLean & Christensen 2017). Similar considerations may apply to the provision of food *en route*, and conflicts with perceptions that this strategy had a normative effect (Anonymous 2013).

The associations of TRBPs during loading with use of commercial transporters and larger trucks in-transit in the multivariable model were significant; a finding that concurs with that of Riley et al. (2016). A small increment in risk associated with straight floats at loading lacked precision, but Padalino et al. (2017a) showed a greater than three-fold increased risk of TRPBs in floats compared with other vehicle types. In the case of commercial transport, the higher risk may be related to vehicle design, but methods of loading and the increased likelihood of horse encountering a novel social environment should be considered. Individuals with larger trucks may have a greater frequency of horse transport events, or move animals with a greater range of handling or transport experiences. To further investigate these findings, additional study of the impact of vehicle type and design in comparison with loading and transport practices (including driver behaviours) is warranted.

In conclusion sigificant associations between vehicle type, respondent experience and transport management, and TRBPs were found that merit futher investigation.

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