

Survey of horse transportation in Switzerland: practices and issues

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Umfrage zu Pferdetransporten in der Schweiz: Praktiken und Probleme

Ziel dieser Studie war es, die Praktiken von Pferdetransporten sowie transportbedingte Verhaltens- und Gesundheitsprobleme bei Pferden in der Schweiz zu beschreiben und mögliche Zusammenhänge zu identifizieren. Eine Online-Umfrage wurde an Mitglieder der Schweizer Pferdeindustrie versendet, um Einzelheiten, Transportpraktiken (vor, während und nach der Fahrt), Verhaltensstörungen im Zusammenhang mit dem Pferdetransport (TRPBs) und Gesundheitsproblemen (TRHPs), die sie in den letzten zwei Jahren erlebt hatten, abzufragen.

Die Umfrage wurde von 441 Personen beantwortet. Die Daten wurden mithilfe deskriptiver Statistiken und logistischer Regressionsmodellen analysiert (Ergebnisse: TRPBs, TRHPs, Verletzungen, Durchfall).

Die Befragten waren hauptsächlich Frauen (79,5%), jünger als 50 Jahre (75%) und Privathalter (80%). Die meisten Befragten transportierten ein oder zwei Pferde (88,7%), für eine kurze Fahrt (< 2 Stunden) (75,5%). Vor dem Transport übten 72,1% der Befragten mit den Pferden und in der Mehrzahl der Fälle (66,5%) wurde die Reise-tauglichkeit der Pferde beurteilt. Während der Fahrt wurden die Pferde angebunden (92,6%) und überwacht (52,7%). Die Mehrheit der Befragten (74,9%) bewertete auch die Fitness der Pferde nach der Reise. TRPBs wurden von 13,4% der Befragten gemeldet. Die Wahrscheinlichkeit von TRPBs stieg, wenn es sich bei den Befragten um Frauen handelte, die vor dem Transport Übungen und Schulungen für den Transport durchführten, das Trinkverhalten und den allgemeinen Gesundheitszustand vor der Reise nicht beurteilten und bei den Pferden ebenfalls TRHPs auftraten. TRHPs wurden von 34% der Befragten gemeldet und standen im Zusammenhang mit jüngeren Befragten, der Nutzung von Lastkraftwagen, der Durchführung von Praktiken vor dem Transport, dem Tragen von Schutzvorrichtungen, der Nichtüberwachung von Pferden während des Transports und bereits bestehenden TRPBs. Unter den TRHPs waren Verletzungen (72,1%) und Durchfall (41%) am häufigsten. Die Wahrscheinlichkeit von Verletzungen stieg bei jüngeren Befragten, der Nutzung von Lastkraftwagen, dem Tragen von Schutzvor-

Summary

This study aimed to describe equine transportation practices and transport-related behavioural and health problems in Switzerland and to identify possible associations between them. An online survey was disseminated to Swiss equine industry members and questioned respondents' details, transport practices (before, during, and after journeys), horse transport-related behavioural (TRPBs) and health problems (TRHPs) experienced in the previous 2 years.

The survey generated 441 valid responses, analysed using descriptive statistics and logistic regression models (outcomes: TRPBs, TRHPs, injuries, diarrhea).

Respondents were mainly women (79,5%), younger than 50 years (75%), and amateurs (80%). Most of the respondents transported one or two horses (88,7%), for a short (< 2 hours) journey (75,5%). Pre-transport practices were performed by 72,1% of respondents and horses' fitness for travel was assessed in the majority of cases (66,5%). During the journey, horses were tethered (92,6%) and monitored (52,7%). The majority of respondents (74,9%) assessed also the horses' fitness after travel. TRPBs were reported by 13,4% of respondents. TRPBs' likelihood increased when the respondents were women, performed pre-transport practices and training for transport, did not assess drinking behaviour and general health before journey, and the horses experienced also TRHPs. TRHPs were reported by 34% of the respondents and were associated with younger respondents, use of trucks, doing pre-transport practices, wearing protections, not monitoring horses during transport and preexisting TRPBs. Among TRHPs the most frequent were injuries (72,1%) and diarrhea (41%). The likelihood of injuries increased with younger respondents, use of trucks, wearing protections, lack of monitoring during transport and TRPBs. While younger respondents, longer journeys, wearing protections, lack of monitoring during transport, measuring rectal temperature after journeys and TRPBs increased the odds of reporting diarrhea. Even though our findings must be interpreted with caution due to survey limitations, considering that the found associations do not always mean causation, they highlight the strengths and weaknesses of transport practices in Switzerland and report

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richtungen, mangelnder Überwachung während des Transports und TRPBs. Das Auftreten von Durchfall erhöhte sich bei jüngeren Befragten, längeren Fahrten, mit dem Tragen von Schutzausrüstung, mangelnder Überwachung während des Transports, der Messung der Rektaltemperatur nach der Fahrt und TRPBs.

Obwohl unsere Ergebnisse aufgrund der Einschränkungen der Umfrage mit Vorsicht interpretiert werden müssen und die gefundenen Zusammenhänge nicht immer auf einen Kausalzusammenhang schliessen lassen, verdeutlichen sie die Stärken und Schwächen der Transportpraktiken in der Schweiz und liefern Belege für die Umsetzung der geltenden Vorschriften zum Schutz des Wohlergehens von Pferden auf Transporten.

Schlüsselwörter: Verhalten, Gesundheit, Pferd, Schweiz, Transport, Wohlergehen

evidence to implement current regulations on the protection of horse welfare during transport.

Keywords: behaviour, health, horse, Switzerland, transport, welfare

Introduction

Transport is an integral part of horse management, with horses being often moved for competition, sales, breeding, and slaughter.^{7,25,26} Transportation is defined as «*a mosaic of stressors*», which might affect both the mental and physical state of the horses, and might cause behavioural and health issues.^{23,24} During each travel phase horses may exhibit abnormal behaviour like anxiety, refusal to load, flight responses, kicking, rearing, pulling back, scrambling and pawing.^{15,26} These behaviours, known as transport-related problem behaviours (TRPBs), can lead to injuries to horses and horse handlers.^{11,26} In horses, transportation could not lead only to TRPBs but also to injuries, gastrointestinal, respiratory, and muscular disorders.^{10,26,34} Unfortunately, some transport-related health problems (TRHPs) may be fatal. Transport-related morbidity and mortality are associated with transport conditions (e.g., journey duration, vehicle type, space allowance). To reduce these issues, transport conditions must comply with the regulations.^{10,20,22,26,34}

Several codes of animal transportation exist and they present differences among countries.³¹ For instance, in the European Union (EU), animal transportation is regulated by EC 1/2005.⁹ Switzerland is geographically part of Europe, but not an EU member state, and therefore animal transportation within the territory of Switzerland is regulated by the Swiss *Animal Protection Ordinance (AniPO)* and *Animal Welfare Acts (AniWA)*, which illustrate the minimum requirements for the keeping and use of animals in Switzerland.^{1,2} Regarding transport, they set requirements for maximum journey duration (i.e. 8 hours) and minimum space allowance depending on horse category (e.g. 1,60 m²/medium weight horse).¹ Moreover, the art. 160 of the *AniPO* states that adult «*equids must be tethered during transport*»

but this is not in line with the current literature.^{1,19,26} Additional rules and mandatory continuing education of animal transport personnel are required for commercial transport of horses, and not for non-commercial transportation (horses moved by their owners or riders for free). However, owners/riders may be less experienced in horse handling and driving in comparison with professional animal transport drivers and in the literature, it has been reported that those horses may be at higher risk of transport-related behavioural and health problems.^{21,27,28}

There are several studies on the effects of the commercial transportation of horses toward slaughterhouses, but there is less evidence on transport practices and welfare consequences of commercial and non-commercial transportation toward other destinations.²⁰ Surveys have been used to gather this information in Australia, New Zealand, the United Kingdom and Italy.^{8,12,26,27} However, no such information was available in many other European countries. This online cross-sectional study aimed to collect information on transport-related practices and behavioural and health issues experienced by equine industry members in Switzerland and to determine possible associations among them.

Materials and Methods

Survey

The study was based on a cross-sectional online survey conducted in Switzerland from June to October 2022. The survey, based on Padalino et al., 2016, included 23 multiple-choice and 1 open-ended question. It questioned respondents' demographic details; role in equestrian activities (professional/amateur, number of horses in care, journey frequency and journey duration); transport practices during

all transport phases (preloading, loading, transport, unloading); horses transport-related problem behaviours (TRPBs) and transport-related health problems (TRHPs).²⁶ The survey was translated into French (Table S1) and German (Table S2) and digitized using Qualtrics Software (© 2022 Qualtrics; Qualtrics, Provo, UT, USA, <https://www.qualtrics.com>), obtaining two different links. French and German invitation letters with the respective link to the survey were sent to the newsletter subscribers of the Institut Équestre National Avenches (IENA) and the Swiss Equestrian Federation (SEF) by email. IENA and SEF newsletter subscribers were first contacted on June 16th and August 15th respectively, and then two reminders were sent. Moreover, the survey link was shared via QR Code during a Congress organized at IENA. The survey was available until October 15th.

Respondents

The target population was people who experienced at least one-horse transport for commercial or non-commercial purposes over the previous 2 years. The total reached population consisted of 25,185 Swiss equine industry members, including 385 IENA and 24 800 (18 800 French and 6000 German) SEF newsletter subscribers. A power calculation (<https://statulator.com/samplesize.html>) determined that the representative sample size was 379 (with 5 % absolute precision (α) and 95 % confidence interval). However, this sample size could be overestimated because some respondents may have not met the criteria of having experienced at least one-horse transport over the previous 2 years.

Data handling

The raw data were downloaded from Qualtrics and then handled in Excel. The open-ended answers to the question «Have you used any training to aid in transporting your horses? If so, describe the training tools» were categorized into habituation, operant conditioning, and no training (Table 1).^{3,14} Moreover, categories within the variables that had an incidence below 5 % were merged. All information on data handling can be found in Table S3.

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Statistical Analysis

Predictive variables investigated in the study are reported in Table 2. Descriptive statistics of the survey data were obtained using Statulator® (<https://statulator.com/>). Data were reported as the number of responses and as percentages. However, the percentage of responses to some questions did not always add to 100 because some questions allowed multiple responses. Chi-squared tests were conducted to determine the association between respondents' background (amateur or professional) and the number of horses in care, the number of horses transported, journey duration, TRPBs, and TRHPs. A list of the TRHPs considered is reported in Table 2.

Univariate and multivariate logistic regression models were performed to identify possible associations between the predictive variables (Table 2) and the outcomes which had at least a 5 % of incidence (TRPBs, TRHPs, injuries, and diarrhea). A univariate regression model was built for each binary outcome (i.e., TRPBs, TRHPs, injuries, and diarrhea; 1/0) and P values were calculated using Wald Test. Then, for each outcome, each predictive variable returning a $P < 0,25$ from the univariate modelling was considered for inclusion in a multivariate model for that outcome. A step-wise backward elimination procedure was then conducted whereby predictive variables were removed until all variables in the final model had a $P < 0,05$ indicating significance. Findings are presented as odds ratio (OR) and confidence interval (95 % CI) for each predictive variable value. Statis-

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Table 1: Definitions and examples in English and in the original language (DE= German or FR= French) of respondents' replies for the training category on a survey of horse transportation in Switzerland.

Training category	Definition	Open-ended answer	Original language answers (German)	Original language answers (French)
Habituation	Included techniques used to habituate horses to transport such as familiarizing young horses to the vehicle, repeating loading and unloading before travel or taking the horse on short trips before undertaking longer journeys. ¹⁴	1. Get the horses used to transport at a very young age. Transport to the pasture with the mare. 2. Frequent loading and unloading of young foals	1. die Pferde schon in sehr jungem Alter an den Transporter gewöhnen, sei es auch nur um mit der Zuchtstute auf eine andere Weide gefahren zu werden. 2. Mehrmaliges Be- und Entladen junger Fohlen	
Operant conditioning	Negative or positive reinforcement. ³	1. Horsemanship training abroad and at home 2. Parelli training level three 3. Ethological desensitisation	1. Horsemanship-Kurse im In- und Ausland	2. Formation Pat parelli niveau 3. Désensibilisation éthologique
No training	Respondents did not train their horse to load or travel	1. No. My horses live with me and are personally cared for. They trust us. 2. No training, just age of experience	1. Nein. Meine Pferde leben bei mir und werden persönlich betreut. Sie vertrauen uns.	2. Aucune formation, juste l'âge de l'expérience

Table 2: Predictive variables on a survey of horse transportation in Switzerland. Name, description and categories of the predictive variables included in the subsequent descriptive statistical analysis and logistic regression.

Name	Description	Categories
Respondents details		
Gender	Sex of the respondents	Female; Male
Age	Age of the respondents	20–30; 31–40; 41–50; 51–70
Sector	Respondents' sector of horse industry in which they are involved	Equestrian sports (dressage, eventing, jumping, reining, driving, vaulting); Recreational riding; Racing; Other (breeding, horse therapy, horse trade)
Background	Relationship with the horses	Professional; Amateur
Number of horses in care	Number of horses in care or owned by respondents	1–4; 5–10; 11–30; 31–50; >50
Journey Frequency	Frequency of organized transport	Daily or twice a week; Weekly; Fortnightly; Monthly
Number of horses transported	Number of horses respondents' transported on average	1; 2; ≥3
Journey duration	Mean journey duration	<2 hours; 2–4 hours; >4 hours
Transport management before journey (BJ)		
Pre-transport practices	Practices done to prepare the horse for transport	Yes; No
Ad libitum hay/water BJ	Ad libitum access to hay and water	Yes; No
Protections	Application of protection equipment (e.g., bandages, boots and tail guards)	Yes; No
Rug	Wearing of rug	Yes; No
Oral supplement	Administration of electrolytes; Vitamins	Yes; No
Other pre-transport practices	Other pre-transport practices adopted	Yes; No
Fitness for travel	If and by whom fitness for travel was assessed	A veterinarian; Non-veterinary staff; No assessment
Feeding behaviour BJ	Monitoring of feeding behaviour	Yes; No
Drinking behaviour BJ	Monitoring of drinking behaviour	Yes; No
General health BJ	Monitoring of general health	Yes; No
Rectal temperature BJ	Monitoring of rectal temperature	Yes; No
Other assessment BJ	Other assessments for travel	Yes; No
Training	If and how respondents do transport training	Operant conditioning; Habituation; No training
Transport management during journey (DJ)		
Vehicle	Vehicle used to transport horses	1–2 horse trailer; 3–4 horse trailer; Truck
Position	Position of the horse in the vehicle during transport	Forward; Backward; Sideways (at a 45° angle)
Tying	Tying up horses during transport	Yes; No
Lower the head	When tied, the possibility to lower the head below the withers height	Yes; No
Monitoring	If and how monitor horses and environment during transport	By video camera; by weather station; Regular stops; No monitor
Access to food/water DJ	If horses had access to food and/or water whilst travelling	Yes; No
Transport management after journey (AJ)		
Fitness after travel	If and by whom fitness for travel was assessed	A veterinarian; Non-veterinary staff; No assessment
Feeding behaviour AJ	Monitoring of feeding behaviour	Yes; No
Drinking behaviour AJ	Monitoring of drinking behaviour	Yes; No
General health AJ	Monitoring of general health	Yes; No
Rectal temperature AJ	Monitoring of rectal temperature	Yes; No
Other assessment AJ	Other assessments after travel	Yes; No
Transport-related problems		
Transport-related problem behaviours (TRPBs)	Presence of transport-related behavioural problems and in which phase	Preloading; Loading; Travelling; Unloading
Transport-related health problems (TRHPs)	Presence of transport-related health problems	Lesions; Diarrhea; Respiratory problems (nasal discharge, coughing, fever, and airway infection); Overheating/sunstroke; Muscular problems; Laminitis; Colic; Other
Death/Euthanasia	Horses died or being euthanized for transport-related problems	Yes; No

tical analysis was performed using Gen Stat® Version 21.1 (VSNInternational, Hemel Hempstead, UK).

Results

The survey generated 455 responses, of which 14 were excluded as they did not meet the main inclusion criteria of having organized at least one horse movement over the previous 2 years. The response rate was 1,8%, calculated on the remaining 441 responses and the sample size was therefore significant. In particular, the IENA subscribers' response rate was 32%, while the SEF members' response rate was 1,3%. Out of the 441 responses, 351 were completed, giving a completion rate of 79,6%.

Respondents' details

Respondents' details are summarized in Table 3. The survey was completed mainly by women and by respondents younger than 50 years old (330/441, 75%) involved mostly in equestrian sports. Amateurs (e.g., horse owners, riders) were the majority, while professionals (e.g., horse trainers, stud managers, riding teachers) were only a quarter of the respondents. Respondents who have a professional relationship with horses were more likely to be involved in the racing sector (all $P \leq 0,001$, Figure 1).

Most of the respondents had <30 horses (372/440, 84,5%) in care, rarely >50 horses. Respondents more frequently transported one (203/425, 47,8%) or two (174/425, 40,9%) horses. Professionals had in care and transported more horses than amateurs (all $P \leq 0,001$, Figure 1). Journeys were performed mainly weekly (132/437, 30,2%) and journey duration was usually less than 2 hours, while long transports (> 4 hours) were sustained rarely and mainly by professionals (all $P \leq 0,001$, Figure 1).

Management

One-two horse trailer was the most common vehicle (265/351, 75,5%) whereas trucks were less used (41/351, 11,7%). In the vehicles, horses were more commonly arranged facing forward (281/421, 66,5%) or sideways (95/421, 22,6%), but 10,7% (45/421) of respondents reported positioning their horses backwards.

Most respondents (318/441, 72%) applied at least one pre-transport practice on their horses, namely offering *ad libitum* hay and water, wearing protections or a rug (Figure 2), and about one-fifth of respondents (77/427, 18%) trained their horses for transport.

More than half (290/436, 66,5%) of respondents assessed the horses' fitness for travel. This assessment was mainly performed by non-veterinary staff (259/290, 89,3%), looking at general health (231/436, 53%) and feeding behaviour (103/436, 23,6%). Other parameters assessed before trav-

elling were drinking behaviour (62/436, 14,2%), rectal temperature (38/436, 8,7%), and only a few respondents assessed «other» parameters (26/436, 6%), such as horse weight and heart rate.

During transport, horses were tethered by almost all respondents (326/352, 92,6%), with the possibility to lower their head to or below withers height (277/325, 85,2%). The majority (304/354, 85,9%) of respondents offer food and/or water *en route*. Approximately half of the respondents

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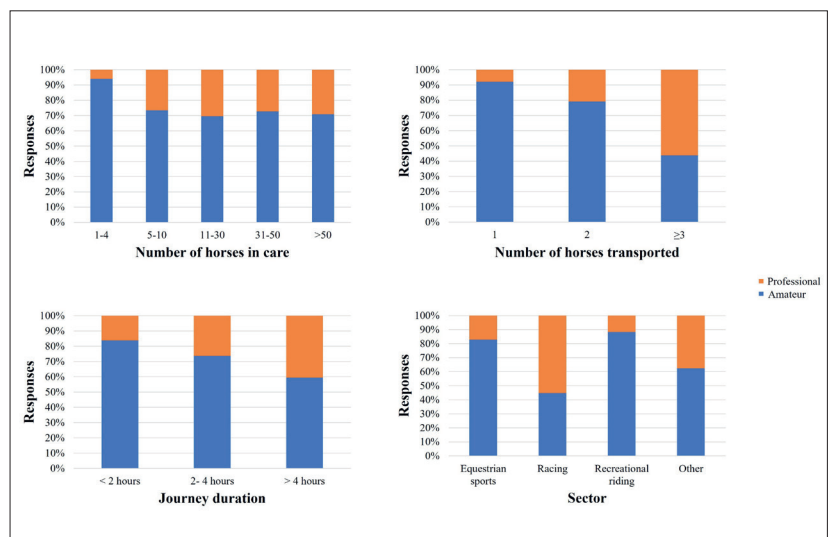


Figure 1: Chi-squares test for comparison between respondents' background (amateur/professional) and number of horses in care (A), number of horses transported (B), journey duration (C) and sector (D) in a survey of horse transportation in Switzerland. There was a significant association between amateur/professional status and all the studied variables ($P \leq 0,001$).

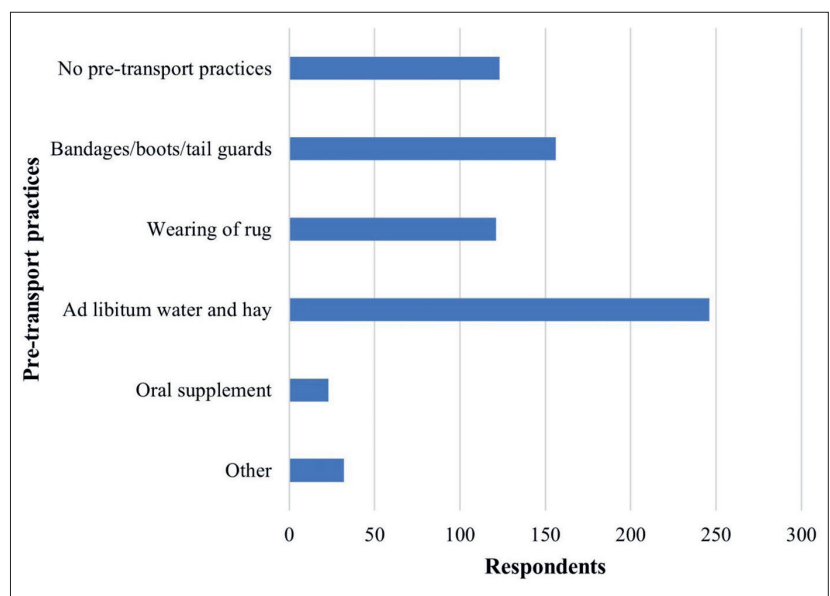


Figure 2: Strategies reported by survey respondents to prepare horses for transportation (Pre-transport practices) in Switzerland. The question allowed multiple responses.

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(184/349, 52,7%) reported monitoring the horses or the environmental indicators inside the vehicle during the journey. More than one-third (128/349, 36,7%) had a video

camera installed inside the vehicle, while 16,6% (58/349) did regular stops to check the horses when they heard unusual noises from the cab. Only 2,6% (9/349) of the respondents used a weather station to monitor the vehicle environment. Horses' fitness after travel was assessed by 74,9% (308/411) of respondents, almost exclusively (292/308, 94,8%) by non-veterinary staff, looking especially at general health (247/411, 60,1%) and feeding behaviour (128/411, 31,1%).

Table 3: Respondents demographic and transport details found with the present survey of horse transportation in Switzerland. Data are reported as frequency (n) and percentage (%). The total number of answers and the missing values are indicated separately.

Variable	Frequency (n)	Percentage
Gender		
Female	349	79,5%
Male	90	20,5%
Number of answers	432	100%
Missing values	9	2%
Age		
20–30	101	22,9%
31–40	131	29,7%
41–50	98	22,2%
51–70	111	25,2%
Number of answers	441	100%
Missing values	0	0%
Sector		
Equestrian sports	310	70,3%
Recreational riding	78	17,7%
Racing	29	6,6%
Other	24	5,4%
Number of answers	441	100%
Missing values	0	0%
Background		
Amateur	353	80,2%
Professional	87	19,8%
Number of answers	440	100%
Missing values	1	0,2%
Number of horses in care		
1–4	168	38,2%
5–10	99	22,5%
11–30	105	23,9%
31–50	44	10%
>50	24	5,5%
Number of answers	440	100%
Missing values	1	0,2%
Journey frequency		
Daily or twice a week	96	22%
Weekly	132	30,2%
Fortnightly	98	22,4%
Monthly	111	25,4%
Number of answers	437	100%
Missing values	4	0,9%
Number of horses transported		
1	203	47,8%
2	174	40,9%
≥3	48	11,3%
Number of answers	425	100%
Missing values	16	3,6%
Journey duration		
<2 hours	333	75,5%
2–4 hours	76	17,2%
4–8 hours	27	6,1%
>8 hours	5	1,1%
Number of answers	441	100%
Missing values	0	0%

Transport-related problem behaviours (TRPBs)

TRPBs were reported by 13,4% (59/441) of respondents. There was no association between the respondents' background (amateur or professional) and the incidence of TRPBs ($P = 0,349$). The loading was the phase where TRPBs happened the most (40/59, 67,8%), followed by travelling (20/59, 33,9%), preloading (13/59, 22%), and unloading (4/59, 6,8%).

In the univariate logistic regression model, the predictive variables gender, pre-transport practices, *ad libitum* access to hay/water before journey (BJ), drinking behaviour BJ, access to food/water during journey (DJ), training, TRHPs, and general health after journey (AJ) were significantly associated with TRPBs (Table S4). Table 4 shows the final multiple regression model for TRPBs (model $P < 0,001$). The odds of reporting horses with TRPBs were increased by five times when the respondent was a woman, by four times when the respondent performed pre-transport practices, by eight times when drinking behaviour BJ was not assessed, by almost two times when general health AJ was not assessed, and by two and a half times when the horse was trained for transport and showed TRHPs.

Transport-related health problems (TRHPs)

One-third of respondents (122/359, 33,8%) reported at least one TRHP. There was no difference between the amateur and professional background and their incidence ($P = 0,881$). Among TRHPs, the most frequently reported were injuries (88/122, 72,1%), diarrhea (50/122, 41%), overheating/sunstroke (15/122, 12,3%), muscular problems (12/122, 9,8%) and respiratory problems (12/122, 9,8%). Colic (10/122, 8,2%) and laminitis (5/122, 4,1%) were less frequently reported. Horses' death/euthanasia due to transport was reported by 1,1% (4/378) of respondents. Unfortunately, none of the 4 respondents provided more details on the cause of death/euthanasia.

In the univariate logistic regression model, age, pre-transport practices, protections, fitness AJ and TRPBs were significantly associated with TRHPs (Table S5). Table 5 shows the final multiple regression model for TRHPs (model $P < 0,001$). The odds of reporting at least one TRHP were increased by almost three and a half times when the respondents were young (20–30 years old), by almost three times

when horses travelled in a truck, by approximately two times when the respondents performed pre-transport practices and did not monitor horses DJ and when horses wore protection and showed TRPBs.

In the univariate logistic regression model, age, number of horses in care, vehicle, pre-transport practices, protections, and TRPBs were significantly associated with injuries (Table S6). Table 6 reports the final multiple regression model for the presence of injuries (model $P < 0,001$). The odds of reporting to have experienced a transport-related injury while moving horses were increased by four times when the respondents were young (20–30 years old), by four and a half times when horses were transported in a truck, by two times when the horses were not monitored DJ, and by two and a half times when the horses wore protections and showed TRPBs. In the univariate logistic regression, age, pre-transport practices, *ad libitum* access to hay/water BJ, protections, TRPBs and feeding behaviour AJ were significantly associated with increased odds of having at least one horse with diarrhea during or after travel (Table S7). Table 7 reports the final multiple regression model for the presence of diarrhea (model $P < 0,001$). The odds of reporting a case of transport-related diarrhea were increased by four and a half times when the respondents were young (20–30 years old), by four times when the journey duration was more than 4 hours, by two and a half times when the horses were not monitored DJ and by three times when the horses wore protections, showed TRPBs and the respondents assessed rectal temperature AJ.

Discussion

This cross-sectional study documented for the first time the equine industry members' demographic characteristics and the horse transport practices and issues in Switzerland, exploring the association between transport practices and TRPBs and TRHPs. Compared with other studies conducted in Australia and New Zealand, our investigation described a lower prevalence of TRPBs and TRHPs. Probably the stricter requirements reported in the Swiss law (*AniPO*) contributed to these better findings.^{1, 26, 27} However, we are still far from no transport-related welfare consequences, and in this study, the prevalence of injuries is still high, also compared with others.^{8, 12} Hence, our findings could be useful to highlight possible weaknesses and strengths in the Swiss equine transport system, to increase transport welfare knowledge of Swiss equine industry members and suggest best practices that could be useful worldwide.

The respondents to the survey were mainly young women, involved in equine sports as amateurs. Our population characteristics are comparable with what was reported in Australia, New Zealand and Italy, and reflect those of the Switzerland equine industry members' population.^{8, 12, 26, 27} Our data

showed that respondents who identified as professionals had in care for and transported more horses, and organized longer journeys than amateurs. These findings agree with the literature and confirm the higher use of transportation in horses involved in competition and racing.^{26, 29} Journeys were mainly short (< 2 hours), probably because Switzerland is a small country, with a maximum extension of 348 km from West to Est, and the maximum journey duration allowed is 8 hours. Since journey duration has been considered a risk factor for transport-related problems, the higher frequency of short journeys reported in our study may in part have contributed to the lower values of TRPBs and TRHPs.¹⁷

Surprisingly, only two-thirds of respondents reported performing practices to prepare horses for transport (pre-transport practices). Given the legal obligation stated in AniPO to perform pre-transport practices, the proportion found was lower than expected.¹ Offering *ad libitum* hay and water was the most frequently performed pre-transport practice, as suggested by the code. However, the second most frequently applied practice was wearing protections, which may be questionable. Some studies suggested that horses should be transported without leg wraps or boots to avoid overheating or panic due to protections turning hot or loose.⁶ This is why it is not surprising that the non-application of the pre-transport practices by part of the respondents and the wide use of leg wraps or boots resulted associated with the reported transport-related issues.

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Table 4: Final multiple regression model for the outcome of horses transport-related problem behaviours (TRPBs) in a survey of horse transportation in Switzerland. Data are presented as Estimate, standard error (S.E.), Odds Ratio (OR), confidence interval (95% CI), and P value. Ref=reference category.

OUTCOME: TRPBs (model $P < 0,001$)					
Predictive variables	Estimate	S.E.:	OR	95% CI	P value
Gender					0,030
M	Ref				
F	1,64	0,76	5,15	1,17–22,63	
Pre-transport practices					0,006
No	Ref				
Yes	1,42	0,51	4,14	1,51–11,33	
Drinking behaviour BJ					0,039
Yes	Ref				
No	2,11	1,02	8,23	1,12–60,67	
General health AJ					0,050
Yes	Ref				
No	0,67	0,34	1,95	1,00–3,81	
Training					0,015
No	Ref				
Yes	0,94	0,39	2,56	1,20–5,46	
TRHPs					0,012
No	Ref				
Yes	0,86	0,34	2,35	1,21–4,59	

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More than half of the respondents assessed horses' fitness for travel, mainly looking at general health. In addition, most of the assessments were made by owners themselves or by non-veterinary staff. Swiss laws on animal protection emphasises the importance of transporting only animals able to sustain the journey without suffering any harm.^{1,2} However, the pathological conditions that may predispose the horse to such suffering are not specified. A clear list of health problems which impair the ability of the horse to be transported has been recently published.²⁰ The AniPO could be implemented including this list in order to better protect the welfare of travelling horses and to provide a practical document for those who perform this assessment and have to decide whether or not horses are fit for transport.

Half of the respondents report applying some methods to monitor the journey, namely a video camera and regular stops to check the horse. In the authors' view, this self-regulated practice can be considered as a good transport practice, since in the EU travel monitoring is mandatory only for long journeys (> 8 hours).⁹ Moreover, the percentage of

respondents monitoring travel in our study is higher than what was reported in Australia.²⁶ In compliance with Swiss law, almost all respondents tied their horses during the journey but allowed them to lower their heads to wither's height or below.¹ These good practices may explain the low values of transport-related issues reported in this survey. In fact, monitoring the horses' behaviour DJ by video cameras could be useful for the early identification of horses in distress and allowing horses to lower their head reduces the possibility of developing airway inflammation and improve their welfare.^{10, 20, 26, 30}

In this study, the prevalence of TRPBs resulted lower than in other investigations.^{8, 26, 27} In agreement with the literature, no association was found between respondents' amateur/professional backgrounds and the presence of TRPBs, and loading was the transport phase where TRPBs were commonest.^{18, 26} TRPBs were positively associated with the performing of pre-transport practices and the lack of assessment of drinking behaviour before the journey and general health after the journey. This could be due to the fact that those respondents are less attentive in recognizing signs of distress in their horses, or they perform pre-transport practices, such as wearing protections because they know that their horses are «bad travellers».³³ Moreover, an association between the presence of TRPBs and TRHPs was found, with horses having behavioural problems being more likely to develop transport-related issues and vice versa. This is not surprising, since horses performing «flight or fight» responses or frequently kicking and biting during travel, may increase the possibility of hurting themselves.^{11, 26} As expected, TRPBs were also positively associated with training, which usually prevents them.³³ However, this association could be related also to the fact that horses underwent transport (re)training to correct pre-existing TRPBs. So, the training was used to correct their abnormal behaviour and not only to prevent them. It is worth highlighting that the nature of associations cannot be clearly defined; often associations should be interpreted as good practices and not as the cause.⁵ In our investigation, the association between training and TRPBs is a good example of this situation.

In our study, one-third of the respondents reported having experienced at least one TRHP, mainly injuries and diarrhea. This value is almost half that one reported using the same questionnaire in Australia.²⁶ A possible explanation could be the different weather conditions and the shorter journeys compared with Australia. In fact, long journeys conducted during extreme weather conditions, such as the ones that could occur in Australia, have been reported to cause dehydration-related TRHPs (e.g. colics and pneumonia).^{22, 24} In this study, TRHPs were associated with possible risk factors, including handlers' age, performing pre-transport practices, not monitoring horses DJ and the use of protections. Younger handlers were significantly associated with increased odds of having horses with TRHPs,

Table 5: Final multiple regression model for the outcome of horses transport-related health problems (TRHPs) in a survey of horse transportation in Switzerland. Data are presented as Estimate, standard error (S.E.), Odds Ratio (OR), confidence interval (95% CI), and P value. Ref=reference category.

OUTCOME: TRHPs (model P < 0,001)					
Predictive variables	Estimate	S.E.:	OR	95% CI	P value
Age					0,011
51–70	Ref				
20–30	1,23	0,38	3,42	1,61–7,25	
31–40	0,85	0,37	2,34	1,14–4,78	
41–50	0,53	0,41	1,70	0,77–3,74	
Pre-transport practices					0,049
No	Ref				
Yes	0,70	0,35	2,00	1,01–4,00	
Protections					0,024
No	Ref				
Yes	0,65	0,29	1,91	1,09–3,35	
Other AJ					0,029
No	Ref				
Yes	0,81	0,37	2,25	1,09–4,65	
Vehicle					0,005
1–2 horse trailer	Ref				
3–4 horse trailer	0,97	0,38	2,64	1,25–5,58	
Truck	1,05	0,42	2,87	1,25–6,57	
Monitoring					0,005
Yes	Ref				
No	0,79	0,28	2,21	1,28–3,82	
TRPBs					0,029
No	Ref				
Yes	0,78	0,36	2,19	1,09–4,41	

particularly injuries and diarrhea. This is in line with what was found in Australia and confirms the common assertion reported in the literature, that horses should be managed by experienced people, especially during transport.^{16, 24, 32} The link between performing pre-transport practices and TRHPs should be interpreted once again as good practice for the prompt identification of these issues, as before mentioned for TRPBs and training. On the contrary, not monitoring horses during the journey could represent a real cause for increasing the prevalence of TRHPs. Regular checks during the journey could help to identify risky situations and consent to a prompt resolution of them.¹²

TRHPs, injuries, and diarrhea were associated with the use of protections. Even if some respondents may have started using protections due to past injuries and consequently to prevent health problems during transport, their improper use or application on nervous horses could increase the risk of having horses with TRHPs. In this regard, the use of protections has been dissuaded or suggested only if they are properly applied on horses used to wear them and checked regularly *en route*.^{16, 24} Diarrhea was also associated with the measurement of rectal temperature after the journey; as before, this could be identified as a good practice and the association should not be interpreted as a cause, but as an increased likelihood of noticing the presence of diarrhea immediately after the transport in the respondents which have the habit to measure temperature or who have decided to check RT due to the diarrhea. Furthermore, the possibility to have a horse with transport-related diarrhea resulted to be associated with a longer journey duration (> 4 hours). Long transport times have been known to have a strong effect on both horses' physiology and mental state.²¹ It is therefore not surprising that prolonged stress, caused by improper journey conditions (e.g. lack of feed and water *en route*) can result in more transport-related welfare consequences when journeys are longer.²⁰ Journey duration (>24 h) was indeed also associated with more severe transport-related problems including death.²² Despite Switzerland being a small country and our respondents performing mainly short journeys, in our study, four respondents reported having experienced a horse dead or euthanised due to transport, which is still a scary value. Unfortunately, the respondents did not give more details concerning the reason for the death/euthanasia of their animals, this is certainly a limitation of online surveys. Therefore, epidemiological studies may be useful to investigate further the major reasons of death/euthanasia and the effects of both commercial and non-commercial horse transportation in Switzerland.

Our findings need to be interpreted with caution since our study has some limitations common to survey-based studies.⁴ First of all, a selection bias could be present. Asking respondents about transport practices and issues could have selected the most attentive part of the population or, on the

contrary, people who experienced transport-related problems. Therefore, our results could both under- or overestimate the prevalence of transport-related issues. Furthermore, a recall bias could be present as the survey was completed based on the respondents' memories, and the interpretation of some pathologies may not have a correct diagnostic basis. Finally, there could be an accountability bias if respondents, although anonymous, had been reluctant to reveal certain aspects when answering the survey. Notwithstanding these limitations, our study is the first to describe transport practices and issues in Switzerland suggesting how to minimise them.

Conclusions

This cross-sectional survey provided initial insight into practices associated with transport-related issues in Switzerland. TRPBs and TRHPs had a lower prevalence compared with other studies but were positively associated, in line with the literature. Our findings also confirmed the associations between transport practices, journey conditions and poor welfare of the transported horses. The prevalence of transport-related horses death was still high, indicating that horse transport is a welfare concern and best practices could be recommended also in Switzerland. Our data, therefore, add scientific-based evidence on the importance to improve

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Table 6: Final multiple regression model for the outcome injuries in a survey of horse transportation in Switzerland. Data are presented as Estimate, standard error (S.E.), Odds Ratio (OR), confidence interval (95% CI), and P value. Ref=reference category.

OUTCOME: Injuries (model P < 0,001)					
Predictive variables	Estimate	S.E.:	OR	95 % CI	P value
Age					0,015
51–70	Ref				
20–30	1,35	0,43	3,85	1,67–8,89	
31–40	0,84	0,42	2,32	1,03–5,23	
41–50	0,60	0,46	1,82	0,75–4,45	
Protections					0,002
No	Ref				
Yes	0,85	0,28	2,34	1,35–4,06	
Vehicle					<0,001
1–2 horse trailer	Ref				
3–4 horse trailer	1,12	0,41	3,05	1,38–6,73	
Truck	1,52	0,45	4,58	1,89–11,10	
Monitoring					0,014
Yes	Ref				
No	0,76	0,31	2,14	1,17–3,93	
TRPBs					0,007
No	Ref				
Yes	0,99	0,37	2,69	1,31–5,54	

Table 7: Final multiple regression model for the outcome diarrhea in a survey of horse transportation in Switzerland. Data are presented as Estimate, standard error (S.E.), Odds Ratio (OR), confidence interval (95% CI), and P value. Ref=reference category.

OUTCOME: Diarrhea (model P < 0,001)					
Predictive variables	Estimate	S.E.:	OR	95% CI	P value
Age					0,033
51–70	Ref				
20–30	1,44	0,54	4,24	1,48–12,09	
31–40	0,55	0,55	1,74	0,59–5,13	
41–50	0,68	0,57	1,97	0,65–5,97	
Journey duration					0,012
2–4 hours	Ref				
< 2 hours	-0,33	0,50	0,72	0,27–1,92	
> 4 hours	1,38	0,66	3,97	1,08–14,58	
Protections					0,003
No	Ref				
Yes	1,02	0,34	2,78	1,42–5,43	
Monitoring					0,015
Yes	Ref				
No	0,94	0,38	2,55	1,20–5,40	
Rectal temperature AJ					0,031
No	Ref				
Yes	1,01	0,47	2,74	1,09–6,88	
TRPBs					0,004
No	Ref				
Yes	1,17	0,41	3,23	1,45–7,20	

transportation practices to safeguard horse health and welfare, confirming the need for precise guidelines and standards. However, further epidemiological investigations are recommended to confirm our survey results to better identify the risk factors leading to equine transport-related problems in Switzerland.

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Conflict of interest:

The authors declare no conflict of interest.

Enquête sur le transport des chevaux en Suisse: pratiques et enjeux

Cette étude a pour but de décrire les pratiques de transport de chevaux et les problèmes de comportement et de santé liés à ces transports en Suisse et d'identifier les associations possibles entre ces deux éléments. Une enquête en ligne a été diffusée auprès des membres de la filière équine suisse et a permis de recueillir les coordonnées des répondants, les pratiques de transport (avant, pendant et après les trajets), les problèmes de comportement (TRPB) et de santé liés (TRHP) au transport des chevaux rencontrés au cours des deux années précédentes. L'enquête a généré 441 réponses valides, analysées à l'aide de statistiques descriptives et de modèles de régression logistique (résultats: TRPB, TRHP, blessures, diarrhée). Les répondants étaient principalement des femmes (79,5%), âgées de moins de 50 ans (75%) et amateurs (80%). La plupart des personnes interrogées ont transporté un ou deux chevaux (88,7%), pour un trajet court (< 2 heures) (75,5%). Des mesures préalables au transport ont été prises par 72,1% des répondants et l'aptitude des chevaux au voyage a été évaluée dans la majorité des cas (66,5%). Pendant le voyage, les chevaux étaient attachés (92,6%) et surveillés (52,7%). La majorité des répondants (74,9%) ont également évalué l'état des chevaux après le voyage. Des cas de TRPB ont été signalés par 13,4% des répondants. La probabilité de TRPB augmente lorsque les personnes interrogées sont des femmes, qu'elles ont pris des

Indagine sul trasporto dei cavalli in Svizzera: pratiche e problematiche

Lo scopo di questo studio era di descrivere le pratiche di trasporto dei cavalli e le problematiche comportamentali e di salute ad esse correlate in Svizzera, nonché di identificare le possibili associazioni tra esse. Un sondaggio online è stato inviato ai membri del settore equino svizzero con lo scopo di raccogliere dettagli, pratiche di trasporto (prima, durante e dopo i viaggi), problemi comportamentali dovuti al trasporto (TRPB) e problemi di salute legati al trasporto (TRHP) riscontrati nei due anni precedenti. Il sondaggio ha generato 441 risposte valide, analizzate mediante statistiche descrittive e modelli di regressione logistica (variabili: TRPB, TRHP, lesioni, diarrea). I partecipanti al sondaggio erano maggiormente donne (79,5%), un'età inferiore ai 50 anni (75%) e detentori privati (80%). La maggior parte dei partecipanti ha trasportato uno o due cavalli (88,7%) per un viaggio breve (<2 ore, 75,5%). Il 72,1% dei partecipanti ha dichiarato di aver allenato i cavalli prima del trasporto e nella maggioranza dei casi si è valutata l'idoneità del cavallo al viaggio (66,5%). Durante il viaggio, i cavalli sono stati legati (92,6%) e monitorati (52,7%). La maggior parte dei partecipanti (74,9%) ha valutato anche l'idoneità dei cavalli dopo il trasporto. Il 13,4% dei partecipanti ha segnalato TRPB. La probabilità di TRPB aumentava quando gli intervistati erano donne, effettuavano pratiche ed esercizi prima del trasporto, non valutavano il

mesures préalables au transport et ont entraîné le transport, qu'elles n'ont pas évalué le comportement d'abreuvement et l'état de santé général avant le voyage et que les chevaux ont souffert de TRHP. Les TRHP ont été signalées par 34 % des personnes interrogées et ont été associées à des personnes plus jeunes, à l'utilisation de camions, aux mesures préalables au transport, au port de protections, à l'absence de surveillance des chevaux pendant le transport et à des TRPB préexistantes. Parmi les TRHP, les plus fréquentes étaient les blessures (72,1 %) et la diarrhée (41 %). La probabilité de blessures augmente avec la jeunesse des répondants, l'utilisation de camions, le port de protections, l'absence de surveillance pendant le transport et la présence de TRPB. En revanche, les répondants plus jeunes, les trajets plus longs, le port de protections, l'absence de contrôle pendant le transport, la mesure de la température rectale après les trajets et les TRPB augmentent la probabilité de déclarer une diarrhée. Même si nos résultats doivent être interprétés avec prudence en raison des limites de l'enquête, considérant que les associations trouvées ne signifient pas toujours une causalité, ils soulignent les forces et les faiblesses des pratiques de transport en Suisse et rapportent des preuves pour mettre en œuvre les réglementations actuelles sur la protection du bien-être des chevaux pendant le transport.

Mots clés: Comportement, santé, cheval, Suisse, transport, bien-être.

comportamento del bere e della salute generale prima del viaggio e i cavalli manifestavano anche TRHP. Il 34 % dei partecipanti ha riportato TRHP, che erano associati a partecipanti più giovani, all'uso di camion, alla pratica prima del trasporto, all'uso di protezioni, alla mancanza di monitoraggio dei cavalli durante il trasporto e alla presenza di TRPB preesistenti. Tra i TRHP, le lesioni (72,1 %) e la diarrea (41 %) erano le più frequenti. La probabilità di lesioni aumentava con partecipanti più giovani, l'uso di camion, l'uso di protezioni, la mancanza di monitoraggio durante il trasporto e TRPB. Partecipanti più giovani, viaggi più lunghi, uso di protezioni, mancanza di monitoraggio durante il trasporto, misurazione della temperatura rettale dopo i viaggi e TRPB aumentavano le probabilità di diarrea. Nonostante le limitazioni del sondaggio, è necessario interpretare con cautela i risultati, considerando che le associazioni trovate non implicano sempre una relazione di causa-effetto, esse mettono in luce i punti di forza e le debolezze delle pratiche di trasporto in Svizzera e forniscono evidenze per implementare le attuali normative sulla protezione del benessere del cavallo durante il trasporto.

Parole chiave: Comportamento, salute, cavallo, Svizzera, trasporto, benessere.

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