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Restraint of dogs in vehicles in the US, UK and Australia

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Abstract

Although dogs routinely travel in motor vehicles, there is a lack of evidence on if, how and why people choose to restrain their dogs when travelling. A lack of restraint is likely to be associated with an increased risk of serious injury or death in the case of an accident, and in some cases may even precipitate an accident. The aim of the present study was to determine the frequency in which dog restraints are used in the US, UK and Australia in a convenience sample, and the factors associated with whether or not a dog is restrained. Online surveys using SurveyMonkey® were distributed in the US, UK and Australia during 2017-2018. The survey consisted of questions related to owning a dog, owner and dog demographics, use of restraint when driving with the dog, reasons for restraining/not restraining the dog, and attitudes to restraint of dogs in vehicles. A logistic regression was used to determine factors associated with the use of restraint. There were 706, 692 and 637 completed surveys from the US, UK and Australia, respectively. A little over half of respondents restrained their dog in the US (55%) compared to 67% in Australia and 72% in the UK. The most common method of restraint in the US and UK was a cage/crate in the cargo area in the back of the vehicle; in Australia it was a harness and tether attached to a seat buckle. In the generalised linear model, country, dog size, owner age, dog age and vehicle type were all significant factors associated with the use of restraint for dogs in cars. Younger dog owners from the US who drove a pickup truck or utility van, had a large dog, and drove with their dogs less frequently were least likely to restrain their dogs. This research highlights the need for improved education and information regarding the use of restraints for dogs traveling in vehicles. , although the limitations in the convenience sample used mean further research is needed, including use of a more representative sample.

Keywords

42 Dog, Restraint; Vehicle; Safety; Welfare; Injury prevention

1. Introduction

A major cause of motor vehicle accidents around the world is distracted driving (Klauer et al., 2014, Department for Transport UK, 2018, Road Safety Commission, 2017). While much attention has been given to distraction caused by mobile phones (Young et al., 2010, Sullman, 2012, Sullman et al., 2015), another important source of distraction may be travelling with an animal, such as a dog, in a car. Travelling with a dog, particularly if it is not restrained, could result in visual distraction if the owner is looking at the dog rather than the road, manual distraction if the person pats or moves their dog, and cognitive distraction if they are giving attention to their dog rather than driving (Huisingh et al., 2016, Blunck et al., 2013). In a 2011 study in the US it was estimated that out of 1000 people, three in ten admitted to being distracted by their dog while driving and 65% of dog owners admitted to engaging in at least one potentially distracting activity while driving with their dog (Kurgo, 2011). These behaviours included petting their dog, using hands or arms to restrict their dog's movement, and reaching into the backseat to interact with their dog. In addition, behavioral problems (such as jumping, vocalizing (barking, whining) can also be a source of distraction for drivers (Mariti et al., 2012).

If there is a motor vehicle accident when driving with a dog, there is risk of injury to both human and animal passengers. While use of a restraint for human occupants, such as a seatbelt, is mandated in most countries around the world (World Health Organisation, 2015), restraint of dogs in a vehicle is less regulated. In the US there are only six states with specific regulations. Hawaii, for example, has a law that prohibits dogs from sitting on the driver's lap or being "in the driver's immediate area" (Haw.Rev.Stat.291C-124(b) 2013). There are 14 other states with regulations indicating one should not drive with an unrestrained dog in the car but these laws are not specific enough to determine if one can be penalized. An additional seven states have had dog restraining bills proposed but defeated (Orvis, 2019). In the UK the

Highway Code states "(w)hen in a vehicle make sure dogs or other animals are suitably restrained so they cannot distract you while you are driving or injure you, or themselves, if you stop quickly." (Department for Transport, 2015). Regulations in Australia vary between States and Territories (RSPCA Australia, 2014). In all jurisdictions even if specific regulations are available, enforcement is challenging.

In a survey of 100 veterinarians conducted by Direct Line Pet Insurance, 22 reported witnessing dogs dying as a result of road accidents when travelling in a car and 18 reported treating animals with injuries due to being poorly restrained in a vehicle (Anon, 2016). Injuries to unrestrained dogs in vehicles can occur in several ways, including being propelled against the windshield or out of the car if a window is open. Expulsion from a car during an accident increases the risk of death or serious injury for both dogs and humans, evidenced by a 75% death rate for people involved in accidents that result in being expulsed from the car (United Nations Road Safety Collaboration, 2009). Even if the dog is not injured when propelled from the vehicle, it is still at risk of being hit by another vehicle on the road. If a dog is sitting in the front seat, air bags are likely to cause injury or death in the case of an accident (NRMA Insurance, 2014).

Unfortunately, even when restraints are used, injuries and deaths may still occur as there are no regulations controlling the efficacy of products marketed for restraint of dogs in vehicles. A case report from the Czech Republic discussed serious injuries leading to euthanasia in a Border Collie wearing a safety harness at the time (Zeleny and Grusova, 2015). The accident was not severe; the car was going 60kph (37 mph) and skidded in snow before hitting a tree. The driver only received minor injuries. The Center for Pet Safety (CPS) in the US publish crash test data on pet harnesses, crates and carriers, with a limited number (e.g. three harnesses) successfully passing a crash test (Center for Pet Safety, 2015). However, there are hundreds of products on the market and the majority have not been crash

tested. The National Roads' and Motorists' Association (NRMA) in Australia tested 25 pet harnesses in 2013, with only two restraining the animal in both a simulated 20km/h (12 mph) crash and a "drop" test at 35km/h (22 mph) (NRMA Insurance, 2017). The founder of the CPS, Lindsey Wolko, has suggested product oversight would improve if harnesses and crates were classified as consumer products (Coleman, 2018).

The current study was designed to determine the percentage of people in convenience samples of respondents living in the US, UK and Australia who report restraining their dogs when driving. A comparison between these countries is of interest due to the varying regulations for restraint of dogs in cars both within and between jurisdictions. The study also aimed to determine what factors, such as dog owner age and dog size, are associated with the use of restraint when driving with a dog. Finally, we asked dog owners from these three countries to share their views on restraining dogs in vehicles, including reasons why they did not restrain their dogs and factors most important when choosing a method of dog restraint.

2. Material and Methods

2.1 Participant Recruitment

An online open-access survey was distributed using SurveyMonkey® and social media between October 2, 2017 and December 31, 2017 for the US, April 1 and May 1, 2018 for the UK and February 17, 2018 and March 14, 2018 for Australia. The US survey was open longer due to a delay in social media promotion, compared to surveys in the UK and Australia which were promoted immediately. Participants were a convenience sample from each country who responded to the survey. Respondents were required to be over 18 years of age, living in the country the survey was covering (US, UK, Australia), currently own a dog and drive a vehicle. Participants were also required to drive with their dog in the vehicle. Participants provided informed consent to the online survey, and no identifying personal data were collected. Where participants owned multiple dogs, they were asked to choose one dog

and complete the questionnaire for this dog. No specific instructions were provided on which dog they should choose.

2.2 Questionnaire Design

The US survey consisted of 22 questions divided into five categories: 1) Dog and owner demographics (number of dogs owned, dog breed, age and size, location, age and sex of owner), 2) Vehicle ownership (type of vehicle) 3) Driving with dogs (frequency of driving with dog, location of dog during driving), 4) Restraint of the dog in vehicle (whether dog is restrained while driving, methods used to restrain dog, reasons for restraint, and ranking of reasons for the use of restraint methods), and 5) Agreement level with statements relating to the restraint of dogs in cars (e.g. "There is enough guidance when buying dog restraint equipment for vehicles"). The survey included both open and closed-ended questions and Likert scales. Where open-ended questions responses were used, thematic analysis was used to identify themes in the answers. In the US regions were divided as per the US census (U.S. Census Bureau, nd). The UK survey consisted of the same 24 questions divided into the same five categories, but without an option for truck/ute in the choices of vehicle most commonly used when driving with their dog. This survey also included a question asking drivers how long they had been driving. Dog owners in the UK and Australia, but not in the US, were also asked the most important features in a car restraint for their dog/s. The Australian survey consisted of 24 questions in the same five categories. This survey, similar to the UK survey, included a question asking drivers how long they had been driving. In the US survey the question asking why they did not always restrain their dog was given specific categories, but in the UK and Australian surveys the responses were free text and were subsequently coded to fit the same categories as in the US survey.

The study was classified as exempt by the ethical review board at Colorado State University and approved by the Hartpury University Ethics Committee (ETHICS2016-34).

144 *2.3 Statistical Analysis*

145 Differences between study participants in the three countries were tested using chi-
146 square analysis for categorical variables (e.g. gender, owner age) and non-parametric tests for
147 continuous variables (dog age, number of years driving a car).

148 The outcome of interest was whether the dog was always restrained or not in the
149 vehicle. For the purpose of statistical analysis the 'sometimes' and 'no' responses were
150 combined and compared to the 'yes' response. The 'sometimes' category had 90 (12.7%), 40
151 (5.8%) and 77 (12.1%) of total responses for the US, UK and Australia, respectively.
152 Combining the 'no' and 'sometimes' responses' gave a binary outcome.

153 A logistic regression was used to test the most important factor/s influencing whether
154 or not restraint was used for dog/s in the vehicle. The outcome was 'yes' or 'no/sometimes'
155 and the initial model included the demographics of the owner and dog (owner age, gender,
156 and length of time they had been driving, dog size), vehicle (type of vehicle), factors relating
157 to driving with the dog (frequency of driving with dog in vehicle, position of dog in vehicle)
158 and country, all two-way interactions were included in the initial model. The Box-Tidwell
159 (1962) procedure was conducted to test the assumption that the logit of the outcome variable
160 had a linear relationship to the continuous independent variables, age of the dog and the
161 length of time the owner had been driving. An interaction terms between dog age and its
162 natural log, and length of time the owner had been driving and its natural log were added to
163 the model and examined for significance. Both continuous independent variables were found
164 to be linearly related to the logit of the outcome variable (restrained). Factors that were not
165 significant ($p>0.05$) were removed using stepwise backward elimination, until only
166 significant factors remained. Variables that achieved statistical significance ($p<0.05$) were
167 retained in the final model, while all other variables were retested by adding them
168 individually back into the final model. Outliers and influential observations were evaluated

by residual diagnostics using standardised residuals. There were no standardised residuals above 3. Goodness-of-fit of the final logistic regression model was assessed using the Hosmer-Lemeshow technique (Hosmer and Lemeshow, 2000).

Comparisons of always using restraint or not between regions within the countries, and differences in the methods of restraint used and location in the car were statistically tested using chi-square analysis.

Statistical tests were run using SPSS® Version 28. Statistical significance was set at $p<0.05$ and data are presented as mean +/- SEM unless otherwise stated.

3. Results

3.1 Study participants

Responses from people who did not own a dog, did not drive, or did not drive with their dog in the car were removed from further analyses. Where people stated an 'Other' type of car that should have been one of the named categories, the data was recoded. Examples include a Jeep Wrangler (coded as 4WD/SUV), Land Rover (coded as 4WD/SUV) and Skoda Fanta Estate (coded as a small car).

There were 706, 692 and 637 complete responses from the US, UK and Australia, respectively (Table 1). There were differences in the demographic factors excepting the owner gender, which was female biased in all three countries. In the US respondents were older than in the UK and Australia, and more owners had toy dogs and multiple dogs. In the UK fewer people drove with their dog in a 4WK/SUV than in the US and Australia.

Table 1 Descriptive statistics for the study participants from the US, UK and Australia. Percentages represent the percentage within the column (i.e. country).

	US	**UK**	**Australia**	**Total**	**p-value**
Owner Age	n (%)	n (%)	n (%)	n (%)	p<0.001

18 to 30	101 (14)	197 (29)	143 (22)	441 (22)	
31 to 40	164 (23)	160 (23)	139 (22)	463 (23)	
41 to 50	150 (21)	140 (20)	171 (27)	461 (23)	
51 to 60	169 (24)	121 (18)	107 (17)	397 (20)	
61 or more	117 (17)	67 (10)	77 (12)	261 (13)	
Total	701	68**5**	637	2023	
Owner Gender					
Female	645 (91)	624 (91)	582 (91)	1851 (91)	p=0.7
Male	46 (7)	54 (8)	49 (8)	149 (7)	
Prefer not to say	11 (2)	9 (1)	6 (1)	26 (1)	
Total	702	687	637	2026	
Dog Age					
	7.3 ± 0.1	5.0 ± 0.1	5.1 ± 0.1	2024	p<0.001
Dog Size					
Toy	67 (10)	30 (4)	44 (7)	141 (7)	p<0.001
Small	158 (22)	124 (18)	134 (217)	416 (21)	
Medium	354 (50)	396 (58)	296 (47)	1046 (52)	
Large	119 (17)	127 (19)	131 (21)	377 (19)	
Giant	8 (1)	10 (2)	32 (5)	50 (3)	
Total	706	687	637	2030	
No of dogs owned					
1	283 (40)	376 (55)	323 (51)	982 (48)	p<0.001
2	240 (34)	210 (31)	212 (33)	662 (33)	
3	106 (15)	60 (9)	59 (9)	225 (11)	
4	48 (7)	22 (3)	17 (3)	87 (4)	
5 or more	29 (4)	18 (3)	26 (1)	73 (4)	
Total	702	687	637	2026	
Type of Car					
Small Car	115 (16)	151 (22)	87 (14)	353 (17)	p<0.001
Mid-sized car	110 (16)	214 (31)	172 (27)	496 (24)	
Large car	8 (1)	42 (6)	36 (6)	86 (4)	
Station wagon/Estate	58 (8)	89 (13)	57 (9)	204 (10)	
4WD/SUV	315 (45	129 (19)	238 (37)	682 (34)	
Pickup truck/Ute	25 (4)	NA	34 (5)	59 (3)	
Van/Minivan/people carrier	73	61	13	147 (7)	
Other	2	1	0	3 (0.1)	
Total	**706**	**687**	**637**	**2030**	
Frequency of driving with dog					
> once a day	59 (8)	97 (14)	42 (7)	200 (10)	p<0.001
Once a day	65 (9)	87 (13)	65 (10)	218 (11)	
2-5 days/week	276 (39)	226 (33)	243 (38)	747 (37)	
Once a week	132 (19)	136 (20)	152 (24)	420 (21)	
1-3 times/ month	121 (17)	105 (15)	102 (16)	328 (16)	
< once per month	53 (8)	36 (5)	32 (5)	121 (6)	
Total	706	687	636	2029	
How long have you been driving?	NA*	16.1 ± 0.5 years	24.3 ± 0.5** years	1322	p<0.001

193 *NA: The pickup truck/ute option was not provided in the UK survey questions; The question
194 on how long have you been driving was not included in the US survey.
195 ** p<0.001
196
197 *3.2 Factors associated with always using dog restraint*
198 A binary logistic regression was used to test which factors were significantly
199 associated with the use of restraint for dogs when driving in a vehicle (Table 2). Factors
200 which were not significant in the model included owner gender, number of dogs owned,
201 frequency of driving with the dog, how long the owner had been driving and all two-way
202 interactions. The final model was statistically significant (P<0.001) and explained 21%
203 (Nagelkerke R^2) of the variation in dog restraint use. The final model included country
204 (p<0.001), dog size (p<0.001), owner age (p<0.001), dog age (p<0.001) and vehicle type
205 (p=0.005) . Pairwise comparisons were performed using Bonferroni adjustment for
206 significance levels. Respondents from the US were less likely to use restraint than those from
207 Australia and the UK (p<0.001), with no significant difference between the latter two
208 countries (p>0.05). Toy dogs were more likely to be restrained than large (p=0.047) and giant
209 (p=0.019) dogs, and small dogs were more likely to be restrained than medium (p=0.000),
210 large (p=0.000) and giant (p=0.001) dogs. Drivers using a minivan/van were more likely to
211 restrain their dogs than in a small or med-sized car, or driving a 4WD/SUV (p=0.001).
212 Owners aged 61 years of older were more likely to use restraint than those aged 18 to 30
213 (p=0.001), 31 to 40 (p=0.001) or 41 to 50 (p=0.004), while owners aged 51 to 60 were more
214 likely to use restraint than those 18 to 30 (p=0.000) and 31 to 40 years (p<0.001). Increased
215 dog age was associated with a decrease in the likelihood of the dog being restrained.
216 **Table 2**: Factors associated with always using restraint in dogs travelling in vehicles in the
217 US, UK and Australia; logistic regression with restraint (yes/no) as the dependent variable.

Variable		Coefficient (β)	s.e.	OR	95% CI	p value
Country						
	Australia	Reference category				
	UK	0.25	0.13	1.28	1.0,1.65	0.05
	US	-0.56	0.12	0.57	0.45,0.73	0.00
Dog Size						
	Toy	Reference category				
	Small	0.26	0.22	1.29	0.84,2.00	0.243
	Medium	-0.35	0.20	0.71	0.48,1.05	0.083
	Large	-0.59	0.22	0.55	0.36,0.86	0.008
	Giant	-1.12	0.35	0.33	0.16,0.66	0.002
Owner Age						
	18 to 30	Reference category				
	31 to 40	0.03	0.14	1.03	0.78,1.36	0.86
	41 to 50	0.42	0.15	1.52	1.14,2.03	<0.01
	51 to 60	0.72	0.16	2.05	1.50,2.80	<0.01
	61 or older	1.05	0.19	2.86	1.97,4.14	<0.01
Type of vehicle						
	Minivan/Van	Reference category				
	Pick up truck/ute	-1.06	0.35	0.35	0.17,0.69	<0.01
	4WD/SUV	-0.84	0.23	0.43	0.27,0.68	<0.01
	Station wagon/estate	-0.77	0.27	0.46	0.27,0.78	<0.01
	Large car	-0.86	0.33	0.42	0.22,0.81	0.01
	Medium car	-0.92	0.24	0.40	0.25,0.64	<0.01
	Small car	-1.06	0.35	0.36	0.22,0.58	<0.01
Dog Age		-0.08	0.01	0.93	0.90,0.95	<0.01

3.3 Comparison of use of dog restraint between regions within countries

The use of restraint for dogs in cars was compared between regions within the countries (US, UK and Australia). There was no significant difference between use of dog restraint in vehicles in the different regions of the UK (p=0.958, df=2, n=692). In the UK, there were 597 responses from England, six from Northern Ireland, 54 from Scotland, 29 from Wales and five classified as 'other'. Only England, Scotland and Wales had adequate responses to for three or more responses per category in the chi-square tests

In the US there was a significant difference in dog restraint depending on which region the respondent was from (chi-square p=0.014, df=3, n=702; Table 3). The highest

proportion of respondents always using restraint was in the Western (61%) and Northeast (60%) regions, with the lowest level of dog restraint in the Southern region (47%).

'In Australia analysis was only performed in states with enough data for three or more responses per category in the ch-square tests (Table 3).' Proportions of respondents restraining their dogs was higher in New South Wales and Queensland (77%, 72%) and lower in South Australia (62%) and Victoria (63%) with the lowest proportion in Western Australia (43%) (chi-square $p<0.001$, df=4, n=607).

Table 3: Use of dog restraint when driving in a vehicle in regions and States of the US and Australia.

Independent variable	**Restrained**	**No/sometimes restrained**	**Total**	**P value**
US State	n (%)	n (%)		
Southern	84 (46.7)	96 (53.3)	180	0.014
Western	135 (61.4)	85 (38.6)	220	
Northeast	103 (59.5)	70 (40.5)	173	
Midwest	67 (51.9)	62 (48.1)	129	
Australian State				
New South Wales	129 (76.8)	39 (23.2)	168	<0.001
Queensland	70 (72.2)	27 (27.8)	97	
South Australia	98 (62.4)	59 (37.6)	157	
Victoria	94 (62.7)	56 (37.3)	150	
Western Australia	15 (42.9)	20 (57.1)	35	

3.4 Types of dog restraint used and location in the car

The most common method of restraint used in the US and UK was a cage/crate in the cargo area in the back of the vehicle, while in Australia it was a harness and tether attached to a seat buckle (Table 4). A harness and tether attached to a seat belt, dog guard, or cage/crate on the backseat were the other common options chosen. There were differences between the countries in the use of a harness and tether attached to a seat belt, cage/crate in car in cargo

area in the back, dog guard and a collar attached to the seat belt/buckle. Most dog owners in the UK and Australia travelled with their dog in the back seats, while in the US it was in the boot/cargo area behind the back seats. The front passenger area was the next most common location of the dog when travelling in all countries. All locations in the car differed between countries, excepting the back seats laid down or removed and 'other' categories.

Table 4: Methods of restraint and location of dog in a vehicle in the US, UK and Australia. Owners were able to choose more than one method of restraint.

	US	**UK**	**Australia**	**TOTAL**	
Method of Restraint	n (%)	n (%)	n (%)	n (%)	p-value
Harness and tether attached to seat buckle	89 (12.6)	133 (19.2)	202 (31.7)	424 (20.8)	p<0.0001
Cage/crate in car in cargo area in back	246 (34.8)	194 (28.0)	76 (11.9)	516 (25.4)	p<0.05
Harness and tether attached to seat belt	122 (17.3)	112 (16.2)	122 (19.2)	356 (17.5)	P=0.36
Dog Guard	17 (2.4)	93 (13.4)	26 (4.1)	136 (6.7)	p<0.00001
Collar attached to seat belt/buckle	12 (1.7)	19 (2.7)	49 (7.7)	80 (3.9)	p<0.00001
Other	11 (1.6)	16 (2.3)	11 (1.7)	38 (1.9)	p=0.55
Attached to hook/link in cargo area	13 (1.8)	11 (1.6)	11 (1.7)	35 (1.7)	p=0.94
Harness/tether attached to child seat anchor	18 (2.5)	21 (3.0)	26 (4.1)	65(3.2)	p=0.27
Cage/crate in back of open vehicle/trailer	NA	10 (1.4)	10 (1.6)	20 (1.0)	p=0.85
Total	**706**	**687**	**637**	**2029**	
Location in Car					
Back seat(s)	239 (33.9)	348 (50.3)	343 (53.8)	930 (45.7)	p<0.00001
Boot/Cargo area (behind the back seats)	324 (45.9)	213 (30.8)	185 (29.0)	722 (35.5)	p<0.00001
Front passenger seat/foot well/driver lap	77 (10.9)	105 (15.2)	74 (11.6)	256 (12.6)	p<0.05
Cage/Crate	30 (4.2)	7 (1.0)	16 (2.5)	53 (2.6)	p<0.001
Back seats laid down/removed	13 (1.8)	19 (2.7)	16 (2.5)	48 (2.4)	p=0.51
Other	8 (1.1)	15 (2.2)	13 (2.0)	36 (1.8)	p=0.28
Back of open vehicle/trailer	0	3 (0.4)	32 (5.0)	35 (1.7)	
Free to roam	4 (0.6)	18 (2.6)	4 (0.6)	26 (1.3)	p<0.001
Total	**682**	**706**	**637**	**1660**	

3.5 Respondent attitudes to types and use of dog restraints

The question for the US survey provided responses for owners to select. In the UK and Australian surveys owners provided free text reasons for not restraining their dog and these have been manually coded. The responses that could not be coded into a category are not included in the table, there were 2 (2.6%), 33 (23.6%) and 26 (19.3%) of this type of response from the US, UK and Australia, respectively. These responses included things like 'gets tangled' and 'his seatbelt is in my dad's car'. The most common reasons not to restrain their dog were they didn't think it was necessary (17.6%) and their dog does not move (14.4%). In the UK respondents were less concerned about their dog's comfort than in the US and Australia (2.1% vs 18.4% and 14.8%, respectively). More Australian than UK respondents did not use restraint if it was only a short journey (26.7% vs 8.7%).

Table 5: Reasons why dog owners in the US, UK and Australia do not always restrain their dogs when driving.

Reason not to Restrain	**US** n (%)	**UK** n (%)	**Australia** n (%)	**TOTAL** n (%)
Don't think it is necessary[a]	26 (13.7)	34 (24.3)	22 (16.3)	82 (17.6)
My dog doesn't move	6 (3.2)	37 (26.4)	24 (17.8)	67 (14.4)
Don't think my dog would be comfortable/Dog hated it[a]	35 (18.4)	3 (2.1)	20 (14.8)	58 (12.5)
Not necessary due to dog crate/guard		23 (16.4)	29 (21.5)	52 (11.2)
Concern restraint would upset my dog[a]	24 (12.6)	14 (10.0)	11 (8.1)	49 (10.5)
Inconvenient/hard to use/too lazy[a]	25 (13.0)	2 (1.4)	10 (7.4)	37 (8.0)
Only a short journey		12 (8.6)	36 (26.7)	48 (10.3)
Concern it would increase risk of injury to my dog in case of accident	22 (11.6)	3 (2.1)	3 (2.2)	28 (6.0)
No evidence current devices work/Don't know which to choose	7 (3.7)	10 (7.1)	10 (7.4)	27 (5.8)
Never thought about it/did not know it was an option[a]	14 (7.4)	2 (1.4)	7 (5.2)	23 (4.9)
No room in car[a]	14 (7.4)	1 (0.7)	1 (0.7)	16 (3.4)
Expensive[a]	8 (4.2)	1 (0.7)	0	9 (1.9)
Concern it might hurt my dog during sudden stops[a]	4 (2.1)	0	1 (0.7)	5 (1.1)
Total	**192**	**140**	**135**	**465**

[a] : Options provided as checkboxes in the US survey

Note: In the US survey the options were provided excepting 'No evidence current devices work/Don't know which to choose' and 'My dog doesn't move' which were added from the 'Other' category. In the UK and Australian surveys free text was coded.

Dog owners in the UK and Australia, but not in the US, were asked the most important features in a car restraint for their dog/s. The most common response was that it was the best method for the safety of the dog (> 40% of owners; Table 6).

Owners were asked Likert type questions relating to information provided in their country on the use of dog restraint when driving (Table 6). A minority of dog owners felt that there is enough guidance when buying dog restraint equipment for vehicles. Most agreed that more information is needed and that restraint devices sold should be tested for safety.

Table 6: Importance of features of car restraints (owners could choose more than one feature) and broad agreement on questions relating to dog restraint by dog owners in the US, UK and Australia. The US survey did not include the question on importance of features of car restraints. There were 682 responses from the US, 687 responses from the UK and 637 responses from Australia.

	US n (%)	**UK n (%)**	**Australia n (%)**	**Total Responses**
Best method for safety of the dog		313 (45.6)	259 (40.7)	572
It's the most comfortable for the dog		232 (33.8)	187 (29.4)	419
Best method for the dogs size/behaviour		133 (19.4)	148 (23.2)	281
Best method for the car size/style		117 (17.0)	89 (14.0)	206
How easy it is to attach the dog to the car		112 (16.3)	158 (24.8)	270
Convenience of method		103 (15.0)	100 (15.7)	203
Cost of equipment		25 (3.6)	48 (7.5)	73
Only method I was aware of		17 (2.5)	35 (5.5)	52

There is enough guidance when buying dog restraint equipment for vehicles	42 (6.1)	67 (9.7)	66 (10.4)	2006
More information needs to be available about the importance of dog restraint devices in vehicles	610 (89.4)	603 (87.8)	579 (90.8)	2006
All vehicle restraint devices for dogs sold in the X should be tested for safety	647 (95.0)	648 (94.3)	610 (95.7)	2006

286

287

288 **4. Discussion**

289 This study is the first published to our knowledge comparing use of restraint for dogs
290 in cars in the US, UK and Australia. It highlights that dogs in all countries are restrained in
291 the majority of cases, however, there remains a significant proportion of dogs not restrained
292 when driving with their owner in a vehicle. The most important factors associated with the
293 use of restraint for their dog/s were country (US, UK or Australia), the age of the owner, the
294 size and age of the dog, and the type of vehicle used.

295 People were most likely to restrain their dog if they lived in the UK, and least likely in
296 the US, with restraint in Australia intermediate between the two. Regulations for the restraint
297 of dogs in vehicles are stronger in the UK versus the US. In the US there are only six of 50
298 States with specific regulations for dogs in vehicles (Orvis, 2019), but in the UK the Highway
299 Code includes a specific statement on suitable restraint of dogs when driving (Department for
300 Transport, 2015). In the UK, if owners do not comply they may invalidate their insurance,
301 meaning an insurance company would be within their rights not to pay a claim for a motor
302 vehicle accident, which is an even stronger incentive (Coleman, 2018). Australia appears to
303 have an intermediate level of regulation, with some but not all States having provision for
304 dog restraint in a car. While the differences in regulation are a possible contributor, further
305 research is required to confirm or disprove their role in dog owners' behaviour.

As well as differences between countries, there were also differences between regions of a country in use of dog restraints. In the US, a higher proportion of respondents always used restraint in the Western (61%) and Northeast (60%) regions, with the lowest level in the Southern region (47%). There are five Northeast States with regulations concerning restraining dogs in vehicles (Maine, New Hampshire, Massachusetts, Rhode Island and Connecticut) (Orvis, 2019). However, there are no Western States that currently have regulations. Interestingly, this does not appear to correspond to seat belt use rates for US regions. Several states that have a seat belt use rate over 90% are in the South (U.S. Department of Transport, 2018).

There were also differences between Australian States in the proportions of people always restraining their dogs when driving. Proportions of respondents restraining their dogs was highest in New South Wales and Queensland (>70%), lower in South Australia (62%) and Victoria (63%) and lowest in Western Australia (43%). This does not seem to fit with differences in regulation across States; in Victoria and South Australia dogs must be restrained only when travelling in the back of a truck/ute (utility vans) (Vetwest, 2019). In New South Wales a driver must not drive a vehicle if an animal is in the driver's lap or they will incur a significant fine and loss of driving points (a driver loses their licence if they lose a certain number of points) (Rule 297 (1A), Road Rules 2008 (NSW Government, 2018). However, the only advice for New South Wales drivers is that when driving with a dog, it 'should be seated or housed in appropriate areas.' (NSW Government, 2018). Additionally, fines in New South Wales apply if a dog is injured as a result of being unrestrained. In Western Australia it is illegal for a dog to travel on a driver's lap, and there were no dog owners from this State who reported driving with their dog on their lap.

Improvements in the safety of dogs and humans in vehicles will depend on education programs. The present study highlights some of the factors associated with a reduced use of

dog restraint in vehicles, which may enable better targeting of limited resources for education campaigns. Younger dog owners were less likely to always restrain their dogs than older owners. This may reflect a higher rate of risk-related behaviours in younger versus older people (Hatfield and Fernandes, 2009), although to better understand the behaviours of these groups qualitative interviews would be needed. Other significant associations related to the type of dog or vehicle and frequency of driving with their dog. Small dogs were more likely to be restrained than larger dogs. It is possible that people perceive that small dogs can be hurt more easily than large dogs, but also that small dogs are more likely to run around and interfere with the driver, resulting in greater use of restraint. As the age of the dog increased, the likelihood of being restrained in a vehicle decreased. Respondents who drove with their dog in the car more frequently were more likely to restrain them, which may be related to people thinking that there is a low risk of their dog being injured in an accident if they drive with them only occasionally. Vehicle type also had a significant association with use of restraint. The lowest levels of restraint use were in pickup trucks or utes. In some pickup trucks or utes there is a canvas covering which can be used to cover the cavity, although the dog is not restrained by a leash or other form of attachment. Further research is needed into types of restraint used in different types of vehicles. In a US study of factors associated with different vehicle ownership, pickup truck owners were more likely to be from lower education levels, full-time employees, service-related jobs, middle incomes, and two-vehicle households (Choo and Mokhtarian, 2004). It would be interesting in the future to assess other human-related safety behaviours in the dog owners, such as use of a seat belt, and determine if they are associated with use of dog restraint.

A range of restraint methods were used by owners, however, the most common method used overall was a harness and tether attached to a seat belt or buckle. While some harnesses are safety tested and would protect the welfare of the dog in an accident, there are

many untested pieces of equipment on the market which would not protect the dog in the case of an accident (NRMA Insurance, 2014). In fact respondents recognised this, and a reason not to use a restraint method given by respondents was that they did not believe many of them had been safety tested. Other methods, such as a dog guard, may protect the people in the car from the dog becoming a projectile in an accident, but may not protect the dog itself from serious injury. People may not have considered this, as a number of respondents stated that use of a dog guard was the main reason they did not use restraint. In future studies it is suggested that methods that might protect the dog and methods that might protect the people in the car are separated, as some respondents were confused about whether a dog guard was a method of restraint or not. Another reason given by people not to use a restraint was that it would affect the comfort of their dog. There is evidence that the type of restraint used can affect dog comfort, as in working dogs, transport in a larger cage was associated with behavioural signs of greater comfort versus smaller cage size (Skanberg et al., 2018). Respondents also indicated they did not use restraint as their dogs tended to get tangled up in them. Another aspect to consider is the behaviour of the dog during a journey in a vehicle. If a dog is restricted to a location, there is the potential for the dog to manipulate the restraint device. Dog manipulation and damage of vehicle restraint devices could affect pet safety as a damaged restraint device could break, or have its efficacy otherwise compromised, in a traffic accident.

A clear message from this study was the majority of participants desired more information about the importance of dog restraint in vehicles, and more guidance on the safest type of restraint. Greater public information about the need for appropriate restraint of dogs in cars is warranted. This is particularly the case considering that approximately a quarter of the total respondents did not always restrain their dog when driving. A better understanding of why dog vehicular restraint is important, and which dog restraint devices

offer the most protection, may be beneficial in encouraging more owners to restrain their dogs during car trips. The lack of regulations around the efficacy of restraint devices on the market is a major hurdle. A majority of dog owners in all countries agreed that devices used to restrain dogs when driving should be tested for safety prior to being sold.

It is clear that compulsory testing on dog restrained devices is required. Not only are there hundreds of dog restraint devices on the market, but they also differ between countries. Furthermore, the range of devices also needs to be acknowledged. For example, there are both collars and harnesses used, in addition to tethers from the collar/harness to the belt buckle. There is a need for safety tests to be conducted via test crashs similar to human restraint tests (e.g. Pet Safety Center, US) and also modelling of test crash scenarios in a virtual environment.

There were several limitations associated with this study. For example, all surveys were distributed through social media and thus is likely to result in a biased sample potentially resulting in an over- or under-representation of those who restrained there dogs. Use of a convenience sample for online surveys is unlikely to be representative of the total population (Bethlehem 2010), and this research needs to be repeated in a representative sample of dog owners. The US survey was open for a longer period as the social media push was delayed compared to the UK and Australia, and in all countries a convenience sample was obtained that is likely not to be representative of the total population of dog owners. In addition, in choosing their dog participants were instructed to select one of their dogs if they had more than one, and future studies might want to provide more detailed instructions on which dog to select (Thompson 2018). A possible confounder in the results is that the question asked was about restraining their dog, and some people differed in their interpretation of using restraint versus containment. In future surveys it would be better to ask

405 separately about containment (e.g. a dog guard), being kept in a crate/cage and physical
406 restraint with a harness and/or leash/tether.
407
408 **5. Conclusions**
409 This study has been the first to compare use of restraint in dogs in vehicles in the US,
410 UK and Australia. Results suggest that the use of restraint was the lowest in the US and
411 highest in the UK, with levels of restraint intermediate in Australia. Use of restraint was
412 positively associated with older respondents who drove more frequently, had a smaller dog,
413 and did not drive a pickup truck. The information provided should spur policy development
414 for driving with dogs in vehicles to protect both human and animal welfare.
415
416 **Conflict of Interest**
417 No conflict of interest declared.
418
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