



In brief, this survey gathered data on dogs from 170 breeds recognised by The Kennel Club (KC) and was administered via breed club secretaries. Owners were sent a questionnaire with a prepaid reply envelope and were asked to complete it anonymously for all dogs they owned of the breed for which the breed club had sent them the questionnaire. The questionnaire contained three sections pertaining to the health status of all dogs including questions covering the body systems, breeding of females and occurrence of birth defects. A fourth section dealt with dogs that had died in the previous 10 years. The questionnaire was designed and pretested in two breeds, the Norfolk terrier and German Spitz. Section B contained seven questions on the breeding history of all dogs owned and bred in the previous 10 years of which the questions "How many litters have your female dogs had in total?" and "How many litters were delivered by caesarean section?" were used in this study. The questionnaire is available on the KC website (The Kennel Club 2006). Data were available for 36,006 live dogs of 169 breeds (as the German Shepherd Breed Club did not participate) and owners reported reproductive conditions as open-ended responses in the first section of the questionnaire.

In this analysis, 151 breeds were included on which data were available for at least 10 litters (range 10 to 1415): this represented 13,141 bitches which had whelped 22,005 litters. The frequency of occurrence of caesarean sections was estimated as the percentage of litters that were reported to be born by caesarean section, and these are referred to as caesarean rates for each breed. The skull classification system outlined above was used to categorise the dogs into brachycephalic, mesocephalic and dolicocephalic breeds. The data were analysed using Excel (2002, Microsoft Corporation).

## RESULTS

The response rate to the survey was 24% (Adams and others 2010). There were seven breeds for which there were no reported caesareans (Table 1). These were the Australian silky terrier, curly

coated retriever, German Pinscher, Hamiltonstovare, Irish terrier, pharaoh hound and Portuguese water dog. The 10 breeds with the highest caesarean rates were the Boston terrier, bulldog, French bulldog, mastiff, Scottish terrier, miniature bull terrier, German wirehaired pointer, Clumber spaniel, Pekingese and Dandie Dinmont terrier.

From the reporting of disease occurrence in the first section of the 2004 survey, reproductive conditions were the most commonly reported overall and for many individual breeds (The Kennel Club 2006). Dystocia was the third most commonly reported reproductive problem after pyometra and false pregnancy. Five breeds, French bulldog, King Charles spaniel, Norfolk terrier, Norwich terrier and Yorkshire terrier, were reported to have more bitches that had suffered from dystocia due to physical blockage than due to uterine inertia. Nine breeds, Affenpinscher, beagle, Boston terrier, Bullmastiff, Clumber spaniel, deerhound, Irish wolfhound, Labrador retriever and Scottish terrier, were reported to have more bitches that suffered from uterine inertia than physical blockage. Seven breeds, Border collie, bull terrier, bulldog, Chihuahua, Dandie Dinmont terrier, Pekingese and St Bernard were reported to have approximately equal numbers of bitches that suffered from physical blockage and uterine inertia.

## DISCUSSION

A multi-centre, prospective case series studying dogs undergoing caesarean section in the USA and Canada was undertaken between 1994 and 1997 (Moon and others 1998). The five most common breeds to require emergency caesarean section were the bulldog, Labrador retriever, boxer, Corgi and Chihuahua, while the five breeds most commonly undergoing elective caesarean section were the bulldog, Labrador retriever, mastiff, Golden retriever and Yorkshire terrier. In 1997 the Labrador retriever and golden retriever were both in the top four dog breeds registered with the American KC, so the authors felt that they were present in the list of breeds most commonly undergoing caesarean section as a result of their large

populations. However they concluded that, as boxers and bulldogs were among the most common breeds to undergo surgery on an emergency basis, brachycephalic breeds are predisposed to the development of dystocia. Unfortunately it was impossible to differentiate between emergency and elective caesarean sections from the data collected in the Purebred Dog Health Survey. Despite this, the bulldog, Welsh Corgi Pembroke, Chihuahua and mastiff also had a high caesarean rate in the present study, with the bulldog being the only breed which had also been reported to be in the top five breeds requiring both emergency and elective caesarean section in the North American study. Recall bias is a potential limitation in this study as owners were asked for information relating to the breeding of bitches within the past 10 years. Nevertheless, owners appeared to be able to provide the information requested.

In the Swedish study of insured dogs, the Scottish terrier was found to be the breed at highest risk of dystocia, with an incidence rate of 38.3 cases per 1000 dog years (Bergström and others 2006). It should be noted that the Boston terrier, English bulldog and French bulldog were not represented in the Swedish database. Our data suggest that this may also be the case for UK Scottish terriers as they had the highest caesarean rate of all non-brachycephalic breeds, at 60%. It has been reported that some Scottish terriers have a dorso-ventrally flattened pelvic canal that increases the risk of obstructive dystocia and the need for emergency caesarean section (Eneroth and others 1999). However, the data for UK bitches suggest that uterine inertia may also be a problem in this breed (The Kennel Club 2006).

A study of feline dystocia found that cranial conformation was significantly associated with dystocia (Gunn-Moore and Thrusfield 1995). Interestingly, both dolicocephalic and brachycephalic types had a higher litter prevalence of dystocia than mesocephalic cats, with the highest prevalence occurring in dolicocephalic breeds such as the Siamese. The present data suggest that the dolicocephalic breeds of dog may not have a higher occurrence of dystocia compared to brachycephalic or mesocephalic breeds.

**Table 1. Number of litters reported and proportion born by caesarean section for 151 breeds for which data from the 2004 Purebred Dog Health Survey was available for 10 or more litters of puppies**

Breed	No. of forms	No. of dogs	No. of litters	Caesarean sections	
				Number	%
Affenpinscher	22	69	131	32	24.4
Afghan hound	23	50	61	13	21.3
Airedale terrier	25	71	127	22	17.3
Akita	13	24	49	5	10.2
Alaskan Malamute	10	14	20	7	35
American cocker spaniel	24	56	83	9	10.8
Australian cattle dog	9	22	35	9	25.7
Australian shepherd	8	26	56	1	1.8
Australian silky terrier	3	7	11	0	0
Australian terrier	4	13	22	1	4.5
Basenji	12	28	34	5	14.7
Basset Fauve de Bretagne	9	19	33	4	12.1
Basset hound	32	76	116	41	35.3
Beagle	74	187	312	66	21.2
Bearded collie	78	165	264	19	7.2
Bedlington terrier	30	72	164	10	6.1
Belgian shepherd	33	69	100	11	11
Bernese mountain dog	64	181	281	72	25.6
Bichon frise	13	69	142	8	5.6
Bloodhound	11	34	42	4	9.5
Border collie	51	134	227	24	10.6
Border terrier	94	297	542	95	17.5
Borzoi	17	30	36	5	13.9
Boston terrier	14	43	52	48	92.3
Bouvier des Flandres	12	26	39	8	20.5
Boxer	45	150	283	50	17.7
Briard	20	35	47	14	29.8
Brittany	17	35	57	10	17.5
Bull terrier	50	113	186	43	23.1
Bulldog/British bulldog	71	195	288	248	86.1
Bullmastiff	29	61	82	29	35.4
Cairn terrier	34	140	251	43	17.1
Canaan Dog	2	10	16	1	6.3
Cavalier King Charles spaniel	201	670	1207	158	13.1
Cesky terrier	3	13	18	4	22.2
Chesapeake Bay retriever	15	49	103	7	6.8
Chihuahua	17	137	262	90	34.4
Chinese Crested	9	21	37	4	10.8
Chow Chow	20	71	135	38	28.1
Clumber spaniel	17	44	62	28	45.2
English cocker spaniel	131	472	802	81	10.1
Collie	27	119	171	19	11.1
Curly coated retriever	13	21	28	0	0
Dachshund	72	305	504	157	31.2
Dalmatian	89	175	291	46	15.8
Dandie Dinmont terrier	20	43	70	29	41.4
Deerhound	55	110	153	43	28.1
Dobermann	28	57	93	10	10.8
Dogue de Bordeaux	9	11	18	5	27.8
English setter	69	195	270	60	22.2
English springer spaniel	49	118	195	20	10.3
English toy terrier	13	39	68	7	10.3
Field spaniel	21	46	60	5	8.3
Finnish Lapphund	6	12	18	3	16.7
Finnish Spitz	12	26	37	9	24.3
Flatcoated retriever	153	277	398	54	13.6
Fox terrier	24	67	126	19	15.1
French bulldog	24	53	80	65	81.3

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Breed	No. of forms	No. of dogs	No. of litters	Caesarean sections	
				Number	%
German Pinscher	10	16	25	0	0
German shorthaired pointer	74	144	245	25	10.2
German Spitz	35	91	156	33	21.2
German wirehaired pointer	11	19	23	11	47.8
Giant schnauzer	12	29	51	6	11.8
Glen of Imaal terrier	8	13	16	3	18.8
Golden retriever	278	779	1415	250	17.7
Gordon setter	49	115	183	17	9.3
Great Dane	32	90	140	38	27.1
Greyhound	13	29	37	14	37.8
Griffon Bruxellois	23	53	82	32	39
Hamiltonstovare	4	9	13	0	0
Havanese	4	11	22	2	9.1
Hungarian Puli	8	19	29	5	17.2
Hungarian Vizsla	18	40	68	8	11.8
Hungarian Wirehaired Vizsla	13	24	40	5	12.5
Irish red & white setter	44	97	144	15	10.4
Irish setter	115	238	343	38	11.1
Irish terrier	7	18	28	0	0
Irish water spaniel	24	49	73	4	5.5
Irish wolfhound	20	58	77	31	40.3
Italian greyhound	19	45	71	7	9.9
Italian Spinone	21	33	46	13	28.3
Japanese Chin	13	44	83	12	14.5
Japanese Spitz	7	17	35	1	2.9
Keeshond	25	63	90	11	12.2
Kerry Blue terrier	7	18	27	4	14.8
King Charles spaniel	15	52	78	17	21.8
Labrador retriever	197	492	866	175	20.2
Lagotto Romagnolo	3	5	12	1	8.3
Lakeland terrier	12	26	53	12	22.6
Lancashire Heeler	16	32	57	4	7
Large Munsterlander	17	30	35	7	20
Leonberger	22	48	72	17	23.6
Lhasa apso	37	130	216	29	13.4
Lowchen	10	54	108	8	7.4
Maltese	17	50	95	20	21.1
Manchester terrier	27	48	84	13	15.5
Maremma sheepdog	5	9	16	3	18.8
Mastiff	19	52	79	51	64.6
Miniature bull terrier	12	27	42	22	52.4
Miniature Pinscher	12	24	42	2	4.8
Miniature poodle	20	54	113	6	5.3
Miniature schnauzer	55	160	289	62	21.5
Neopolitan mastiff	3	7	11	4	36.4
Newfoundland	41	79	110	16	14.5
Norfolk terrier	77	181	324	56	17.3
Norwegian elkhound	15	33	56	6	10.7
Norwich terrier	24	78	134	49	36.6
Old English sheepdog	25	59	88	14	15.9
Otterhound	6	23	31	3	9.7
Papillon	44	106	189	33	17.5
Parson Russell terrier	23	81	165	37	22.4
Pekingese	20	101	178	78	43.8
Pharoah hound	5	8	10	0	0
Pointer	50	119	173	45	26
Polish lowland sheepdog	7	10	15	3	20
Pomeranian	16	87	168	37	22
Portuguese water dog	1	6	11	0	0

Breed	No. of forms	No. of dogs	No. of litters	Caesarean sections	
				Number	%
Pug dog	50	142	223	61	27.4
Pyrenean mountain dog	21	34	38	11	28.9
Pyrenean sheepdog	2	6	14	1	7.1
Rhodesian ridgeback	52	102	173	11	6.4
Rottweiler	29	70	127	22	17.3
Saluki	22	49	54	8	14.8
Samoyed	53	119	222	52	23.4
Schipperke	12	26	47	13	27.7
Schnauzer (standard)	16	29	48	9	18.8
Scottish terrier	26	99	164	98	59.8
Sealyham terrier	6	9	10	4	40
Shar-Pei	16	58	111	3	2.7
Shetland sheepdog	109	333	640	93	14.5
Shiba Inu (Japanese)	7	19	27	2	7.4
Shih Tzu	32	100	171	36	21.1
Siberian husky	62	121	175	43	24.6
Skye terrier	14	29	36	2	5.6
Soft coated wheaten terrier	54	82	149	16	10.7
St Bernard	11	32	34	14	41.2
Staffordshire bull terrier	64	135	220	42	19.1
Standard poodle	44	108	189	21	11.1
Sussex spaniel	19	40	62	12	19.4
Swedish Vallhund	9	14	20	6	30
Tibetan spaniel	57	149	252	39	15.5
Tibetan terrier	31	92	177	18	10.2
Toy poodle	6	25	43	5	11.6
Weimaraner	76	133	207	13	6.3
Welsh Corgi Cardigan	15	36	64	14	21.9
Welsh Corgi Pembroke	33	130	199	71	35.7
Welsh springer spaniel	61	127	205	17	8.3
Welsh terrier	16	40	84	6	7.1
West Highland white terrier	54	166	366	69	18.9
Whippet	145	317	438	66	15.1
Yorkshire terrier	14	66	139	14	10.1

In humans, it is currently thought that a caesarean rate of between 5 and 10% seems to achieve the best outcomes for the health of both mothers and neonates and that a rate of greater than 15%, a figure recommended by the World Health Organisation (WHO 1985), “seems to result in more harm than good” (Alathabe and Belizán 2006).

Some studies suggest that, in humans, elective caesarean section offers no real health advantages to either mothers or neonates, and may actually carry increased health risks compared with vaginal delivery (Armson 2007). However, it has been shown that there are fewer complications associated with planned caesarean sections than with unplanned, emergency caesarean sections (Häger and others 2004). If this situation is mirrored

in bitches, it could be suggested that performing an elective caesarean section is preferable to letting labour commence and fail to progress. Leaving a bitch to whelp unassisted can lead to the need for an emergency caesarean section if it is anticipated that the bitch is likely to experience dystocia (due to previous dystocia, size of sire or breeding history of female relatives, as has been suggested in humans (Tollanes and others 2008)). However, this raises concerns about animal welfare – such as, should that bitch have been mated (or mated with that dog) at all? The authors understand that The KC is seeking the support of veterinary organisations in the UK on a proposal to prevent the registration of a litter if the dam has already produced two litters delivered by caesarean section.

The results of this study cannot necessarily be generalised to all dogs because the 2004 health survey was a convenience sample rather than a random sample of the UK pedigree dog population. However, this large cross-sectional study provides evidence that the caesarean section rates appear to be high in several breeds. This study found that five of the 10 breeds with the highest reported caesarean rate were brachycephalic breeds. Indeed in three breeds, the Boston terrier, bulldog and French bulldog, the rate was greater than 80%. These data provide evidence for the need to monitor caesarean rates in certain breeds of dog.

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