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Causes of loss or retirement from active duty for New Zealand police German shepherd dogs

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Abstract

The aim of this study was to determine the causes of loss from active duty amongst German shepherd dogs in service with the New Zealand Police Dog Section. Current or previous police dog handlers (n = 149) completed a postal survey for each dog they had worked with during their career including their current dog. Causes of loss were categorised as either retirement, euthanasia whilst still in active duty, death from illness/natural causes, or being killed whilst on duty. Of 182 dogs with completed questionnaires, 48 dogs were still in service, leaving 134 that were retired (94), had been euthanased (24), had died (11) or had been killed (5). The mean and median age at loss for all dogs no longer in service was 6.6 years. The nominal age for planned retirement (8 years) was only reached by 40% of dogs. The single most important cause of retirement was the inability to cope with the physical demands of the job (61/94 dogs or 65%). Degenerative musculoskeletal disease was cited as the primary factor in 42/61 of these dogs (69%). When both retired and euthanased dogs where considered together, 27% were retired or euthanased due to back/spinal problems, and a high proportion of these were believed to have involved the lumbo-sacral joint. Greater research efforts should be targeted at identification of the factors that lead to degenerative musculoskeletal and lumbo-sacral disease to determine methods of lowering their incidence in police working dogs. Such research could lead to increasing the average working life and 'in work' welfare of a police German shepherd dog in New Zealand.

Keywords: *animal welfare, canine, German shepherd, police, retirement, working dog*

Introduction

Like many civil enforcement agencies worldwide, the New Zealand (NZ) Police Dog Section (PDS) uses German shepherd dogs (GSDs) for tracking, patrol and apprehension duties. For any service animal there are animal welfare concerns which must be managed. When a service role places an animal at risk of injury or illness such risks need to be identified and actively reduced for the welfare of the dog. In addition, maximising longevity of service is important for the financial viability of the PDS. Approximately NZ$25,000 is invested in breeding and training costs per dog (Inspector Brendon Gibson, NZ PDS, personal communication 2012). It is therefore vital to identify injuries or illnesses that consistently lead to a police dog being withdrawn from active duty. Once identified, management strategies may be undertaken to improve animal welfare and mitigate losses to these causes. Only once accurate data and suitable analysis have been undertaken can suitable strategies to improve the health and welfare of GSD dogs be investigated.

The history of NZ PDS began in 1956 when the then Prime Minister, Sir Sidney Holland, recruited a police sergeant and his dogs from the English County Constabulary of Surrey (http://www.police.govt.nz/service/dogs/history.html). A dog training centre was set up in Trentham, Wellington in conjunction with the Police Training School. Whilst the Police Training School has since been relocated to Porirua (1981), the dog training centre remains at the original site. From those early beginnings the dog unit became well established and training of dogs for specialist police work began. The first drug-detection training course was held in 1976. This event was closely followed by the introduction of explosive detection courses in 1977. More recent developments have seen the introduction of the Armed Offenders Squad dog (1992), Accelerated Detection (1997) and Search and Rescue (1998) courses. There are currently 115 NZ police dog handlers with 90–95 operational dogs and 10–15 in training at any one time.

There are little published data for police dogs on the causes of loss from service. Kippenes and Gondalen (1999) inves-

tigated the cause of early retirement of Norwegian police patrol dogs by comparing them to a control group of non-working (pet) dogs. The study was performed between 1985 and 1995 on a population of 228 working dogs (208 GSDs). Ninety-seven dogs were retired early (defined as prior to ten years of age), 38 (39%) of which were retired due to skeletal disease. Neoplasia was the second most common cause of early retirement (13 dogs). The police dogs had a higher risk of developing skeletal lesions than did the pet animals. In several countries, GSDs and Belgian shepherd dogs (Malinois and Tervuren) are also used by the military for security patrol and detection duties. Military working dogs share many training and service characteristics with their civilian counterparts. A study by Moore *et al* (2001) found the leading causes of death or euthanasia of military working dogs in the United States to be appendicular degenerative joint disease (19%), neoplasia (18%), spinal cord disease (16%), non-specific geriatric decline (14%) and gastric dilatation-volvulus (GDV) (9%). German shepherds were more likely to be affected by spinal cord disease (including lumbo-sacral disease) than Belgian Malinois. In GSDs, the three leading causes of death or euthanasia were appendicular degenerative joint disease (20%), spinal cord disease (19%) and geriatric decline (15%).

The operational life of a NZ Police GSD is considered to be approximately eight or nine years (Sergeant Mark Sandford, Breeding Unit Manager, NZPDS, personal communication 2009) but precise reasons for withdrawal of dogs from service in NZ are not documented. According to NZ PDS policy, when a police dog reaches seven years of age, its replacement is signaled and a new dog is typically started through the training process. From 7.5 years of age onwards the dog is replaced according to logistical considerations. An individual dog may work longer if a suitable replacement is not yet available.

The aim of this study was to determine the causes of loss from active duty amongst GSDs in service with the NZ PDS.

Materials and methods

Police dog handlers identified from the staff database of the NZ PDS, Trentham, NZ, were sent a three-page questionnaire (see Appendix 1 [Available at the supplementary material to papers published in *Animal Welfare* section at the UFAW website; http://www.ufaw.org.uk/supplementarymaterial.php]), which was prepared after discussion with senior dog section staff and then sent to each handler by e-mail or post. Handlers were asked to complete a survey form for each of the dogs they had worked with during their career as a dog handler. For each dog, the handler was asked to complete demographic data (name, sex, date of birth, district), the date when the dog entered service, whether the dog was still in service or if it had been retired from service, been euthanased, died of a disease/illness or had been killed. For retired dogs, they were then asked to record the major and other reasons prompting retirement from a list: behavioural problem; loss of tracking ability; inability to meet the physical demands of the job; other (specify). For euthanased dogs, the handler was asked to identify a reason for euthanasia from a list of common medical and surgical conditions as well as behavioural problems, or specify the reason if the condition was not listed. Similarly, where a dog had died of an illness, the handler was given a list of medical and surgical problems or the option to specify the diagnosis. When a dog had been killed on active service the handler was asked to describe the circumstances. If arthritis was indicated as a cause of euthanasia or retirement then the handler was asked to specify the joint(s)/skeletal region affected from a list. If back pain/spinal problems were indicated as a cause of retirement or euthanasia the handler was asked to indicate the region/area of the spine affected.

Statistical analysis

In order to assess the spread of data across the time of the study, the median and mean (± SD) of the calendar year at the time of loss was determined. The overall mean and median age at loss was calculated for all dogs no longer in service. The dogs were then classified according to the category of loss (retired/euthanased/died/killed) and the mean/median and SD for each category were determined. A one-way analysis of variance was performed (R v2.8.1; R Foundation for Statistical Computing, Vienna, Austria) to compare age at loss, by loss category.

The null hypothesis was that there would be no relationship between the response (age of dog at the time of loss) and the factor (loss category). This model contains $K = 4$ regression parameters. If f_{obs} is the observed value of the test statistic and X is a random variable from an $F_{K-1,n-K}$ distribution then $P = P(X \geq f_{obs})$. A Kaplan-Meier product limit analysis was performed using the time from birth to loss from active service. From this curve, a 3-, 5- and 7-year 'still working' rate was calculated.

Results

One hundred and eighty-two surveys were returned completed by 149 current dog section staff that were, or had previously been, dog handlers. Of the 149 staff, 119 were currently working with an operational police dog, 13 were re-training a replacement dog and 17 were now supervisers who no longer actively worked a dog. The earliest records were from two dogs born in 1975. Data were collected in July 2011, restricting the analysis to dogs already in service prior to that date. The median year of loss for dogs in the survey was 2004, the mean (± SD) year of loss was 2002 (± 6.76) years. Only eight of 182 dogs were lost from the PDS prior to 1990. There were four entire females, the remaining dogs entered service as entire males though an undetermined number were castrated for medical reasons later in life.

Causes of loss were categorised as either retirement, euthanasia whilst still in active duty, death from illness/natural causes, or being killed whilst on duty. Of 182 dogs with complete surveys, 48 dogs were still in service leaving 134 that had been retired (94), been euthanased (24), had died (11) or had been killed (5), (see Table 1). Of the 134 dogs with a known cause of loss, ten records lacked sufficient information from which to calculate age at loss. These were gifted dogs, acquired from the public rather than bred by the PDS, and were approximately 9–24 months of

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Table 1 Causes of loss from active service of 134 NZ police dogs (1975–2011).

Cause	Number of dogs	(%) of loss	Major reason/cause	Number of dogs per subcategory
Retired	94	(70)	Inability to meet the physical demands of the job	61
			Planned retirement due to age	11
			Loss of tracking	7
			Other	6
			Behavioural problems	5
			Poor bite work	4
Euthanased	24	(18)	Medical problem prompting euthanasia	19
			Behavioural problem prompting euthanasia	4
			Unknown	1
Died	11	(8)	Gastric dilation/volvulus	4
			Neoplasia	3
			Other	4
Killed	5	(5)	Shot on duty	2
			Motor vehicle accident	2
			Drowned	1

age at acquisition; however they were discounted from the age analysis. The mean (± SD) age at loss for dogs no longer in service (n = 124) was 6.59 (± 2.75), (df = 120). The median age at loss for dogs no longer in service (n = 124) was 6.63 years. The mean and median for each of the categories of loss is shown in Table 2. The distribution of the age data is depicted in Figure 1. The Kaplan-Meier analysis is depicted in Figure 2. The curve is almost linear showing a steady loss of dogs at all ages rather than an anticipated skew towards loss in older dogs. The 3-year 'still working' rate was 91%, the 5-year rate was 82% and the 7-year rate was 52%. The nominal age for planned retirement (8 years) was only reached by 40% of dogs.

The one-way ANOVA showed there was a significant association between age at loss and loss category ($P = 0.038$), thus the null hypothesis is rejected (Multiple R-squared: 0.067, Adjusted R-squared: 0.044, F-statistic: 2.89). Euthanased dogs were lost from service at a significantly younger age than those dogs that retired ($P = 0.007$).

Reasons for retirement as stated in the survey.

The stated (primary) reasons for retirement are shown in Table 1. The single most important reason for retirement was inability to cope with the physical demands of the job (61/94 dogs or 65%). Of these, 25 were reported as having back/spinal problems affecting their ability to work and 24 had arthritis of one or more joints (seven dogs had concurrent arthritis and back/spinal problems prompting retirement). Overall, 42/61 dogs were retired due to inability to cope with the physical demands of the job as a result of degenerative musculoskeletal disease (69% of all retired dogs). The remaining 19 dogs were retired as the result of inability to work due to 'old age' without mention of any specific ailment.

Table 2 Mean (± SD) and median age at loss from service as a NZ police dog (n = 124).

	Mean (± SD) age (years)	Median
Retired (n = 87)	7.01 (± 2.56)*	7.42
Euthanased (n = 24)	5.40 (± 2.38)*	5.17
Died (n = 8)	6.49 (± 1.70)	6.33
Killed (n = 5)	5.52 (± 3.40)	6.00

* Significant difference between mean age by category of loss ($P = 0.007$).

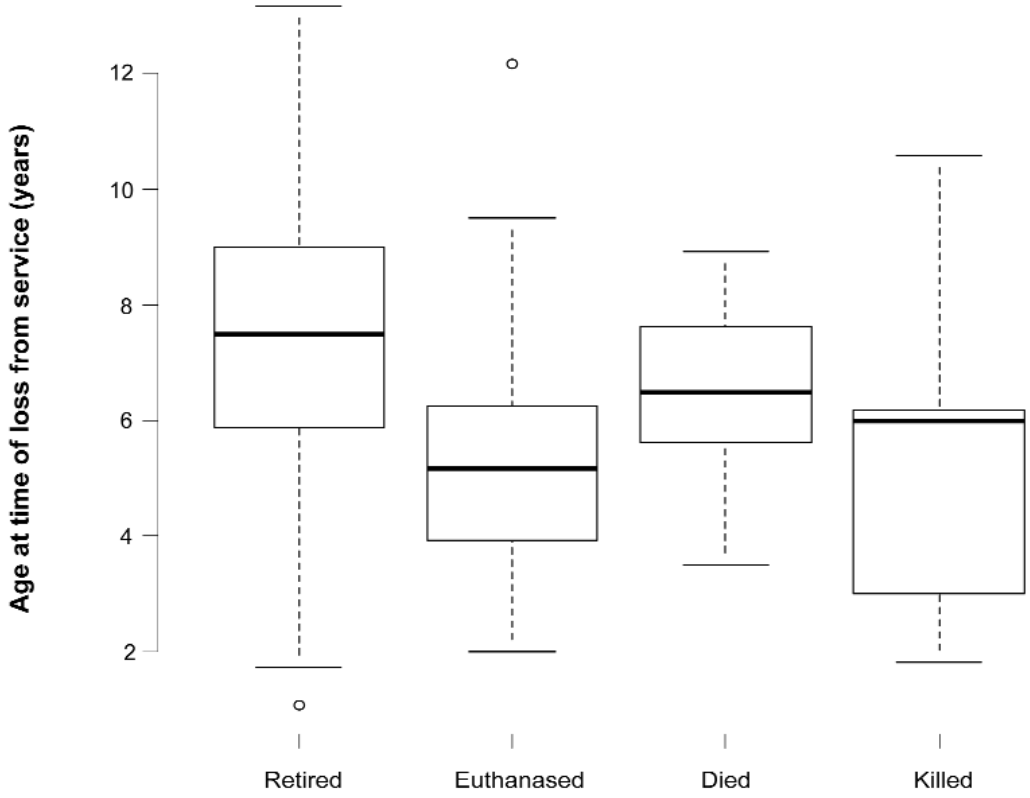
Behavioural problems were the reason for retirement in five dogs (5%): two dogs for problematic aggression, one 'scared dog', one dog with 'lack of aggression', and one dog 'lacking drive'. Loss of tracking ability sufficient to prompt retirement was reported in seven dogs. Loss of tracking ability and loss of ability in bite was cited as a secondary reason for retirement in three and eleven dogs, respectively.

Planned retirement due to age was the reason for retiring eleven dogs (12% of retirees), see *Discussion*.

Major causes prompting euthanasia

Of the 24 euthanased dogs, four (17%) were primarily euthanased due to behavioural issues (three dogs had aggression problems and one dog was reported to be 'environmentally inadequate'). A medical reason was given for 19 dogs. These included back/spinal problems in eight dogs (33%), cancer in five dogs (21%) and arthritis in two dogs (8%). One dog was euthanased due to each of the following: blindness, GDV, 'stomach and intestinal disease', and chronic inflammatory bowel disease. The reason prompting euthanasia was not reported for one dog.

Figure 1



Age at loss from service of 124 New Zealand police dogs, classified according to whether a dog was retired, euthanased, died, or was killed on duty. The bold line represents the median, the box shows the interquartile range (25th–75th percentile). The two 'whiskers' on either side of the box show the adjacent values where the upper value is the largest observation that is less than or equal to the upper quartile plus 1.5 times the length of the interquartile range. Outliers are represented by open circles. Loss due to euthanasia occurred at a significantly younger age than loss due to retirement ($P = 0.007$).

Minor causes contributing to euthanasia

Gastrointestinal disease and urinary tract disease were listed as secondary reasons prompting euthanasia in two separate dogs.

Natural causes of death

Of the eleven dogs that died on duty, four died as the result of GDV. Three died as the result of neoplasia (two from splenic haemangiosarcoma and one of multicentric lymphoma). One dog died of each of the following: cardiac disease, pneumonia, suspected poisoning, unspecified infectious disease.

Accidental and malicious causes of death

Of the five dogs killed in action, two were shot and killed on duty, two died as the result of a motor vehicle accident, and one dog was drowned whilst tracking a suspect (probable malicious death).

Thirty-three dogs that were retired or euthanased were reported to suffer from back or spinal problems (28%). Of these dogs, 24/33 (73%) were described as having a problem involving the lumbo-sacral joint. The remainder had lumbar spinal problems. The coxo-femoral joint was identified as the affected joint in 86% of dogs with arthritis prompting retirement or euthanasia.

Overall, the major primary causes of death (including euthanasia) or retirement, excluding planned retirement and death due to accident, (n = 96) were musculoskeletal disorders (52 or 54%), (including spinal disorders [33 or 34%] and coxo-femoral arthritis [22 or 23%]), behaviour (9 or 9%), loss of tracking (7 or 7%), GDV (5 or 5%) and neoplasia (5 or 5%).

Discussion

In this study, the average age of a NZ police German shepherd dog at the time of its death or retirement from service was 6.6 years. This is lower than the planned retirement age of eight years currently accepted by the NZ PDS, which was only reached by 40% of the study population. This represents a working career of 6.5 years assuming a dog enters service at approximately 18 months of age following training. Overall, 70% of the study population were retired from active duty however the analysis showed that the majority of dogs were lost from active duty prior to planned retirement.

A planned retirement policy confounds direct comparison of our data with other reports on working dog longevity in the literature, which use the date of death/euthanasia. In our study, retired dogs were recorded as the date of loss from

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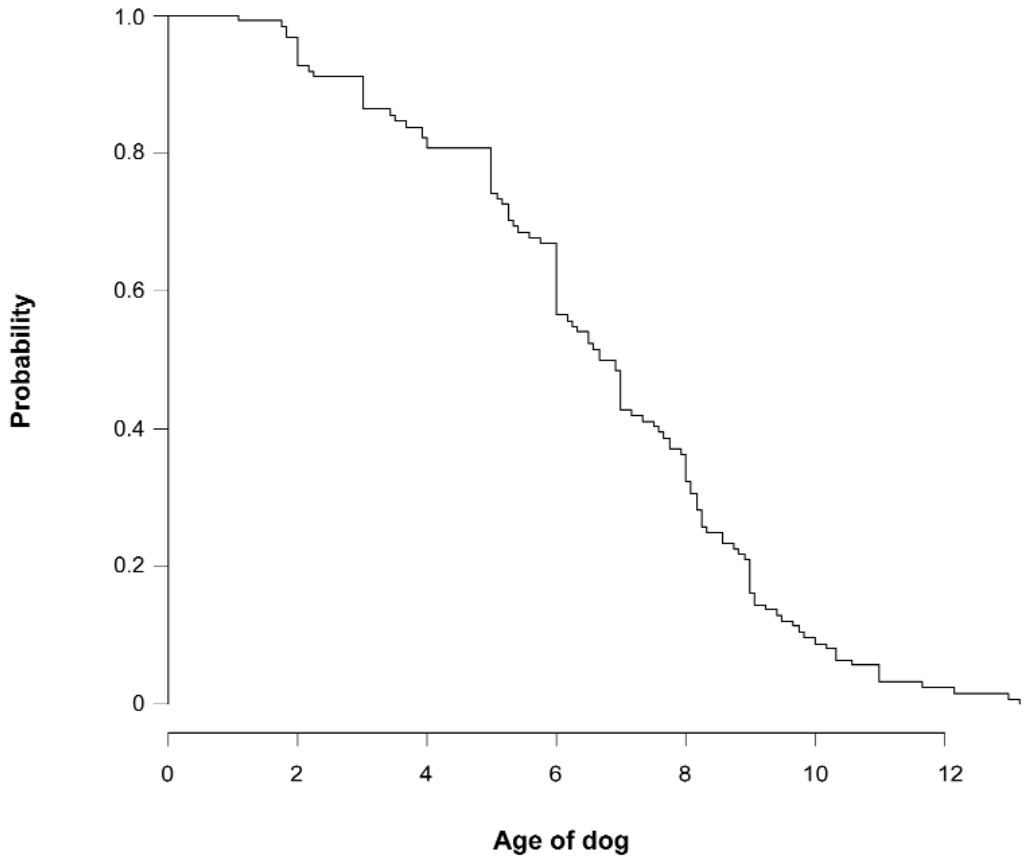
Figure 2



Kaplan-Meier analysis of 182 New Zealand police dogs from date of birth to date of loss from active duty. The survey was performed in July 2011. The earliest records were from two dogs born in 1975. Dogs still working on the survey date appear as censored observations on the 1.0 line at the top of the curve.

service, not the ultimate time of their death/euthanasia. Many dogs live considerable time-spans in retirement, usually with their old handlers, as a family pet. When retirements are excluded, the mean age a NZ PDS dog died or was euthanased was only 5.65 years. This is considerably lower than the ten years reported for a large cohort of military working dogs by Moore *et al* (2001). That study only considered dogs that were euthanased or died, dogs that retired were excluded. There are a number of reasons that could account for this difference between police dogs in the NZ environment and a US military dog. The US State Department maintains approximately thirty times the number of dogs worked by the NZ PDS (Evans *et al* 2007). Several breeds are used in addition to the GSD and Belgian Malinois. There are also hounds and sporting breeds which are generally trained for detection work. When only GSDs are considered, the mean age at death or euthanasia was still ten years. The causes of loss were very similar with appendicular degenerative joint disease, neoplasia and spinal cord disease being the most frequent (Moore *et al* 2001). There are a number of reasons that could account for this difference between police dogs in the NZ environment and a US military dog. A US military dog may be redeployed to a less strenuous role such as a training/demonstration dog. There could be differences in: thresholds for euthanasia (cost, willingness to pursue surgery), thresholds for selection into training, availability of dogs, access to veterinary care, genetic quality and breeding programme success. For instance, the NZ PDS has only recently been considering lumbosacral disease status as a criteria for breeding selection.

The majority of dogs were retired (70%) and the most common reason for retirement was inability to cope with the physical demands of the job. The majority of retired dogs left service as a result of degenerative musculoskeletal disease. This was primarily attributed to spinal disease (anatomically, lumbo-sacral disease was predominately identified) and arthritis. This outcome is similar to previous reports in military working dogs who share physically demanding roles. Canine hip dysplasia and secondary osteoarthritis of the coxo-femoral joints were reported to be the primary reason for procurement rejection and the most common reason for departure from active service in military working dogs (Olson 1971; Dutton & Moore 1987).

Of those dogs euthanased, 33% were euthanased as the result of spinal/back problems and the average age at euthanasia was significantly younger than the average age

of retirement. Spinal disease was the single most prevalent reason for euthanasia in this study, whereas it was the third most common cause for early elimination of dogs from the United States Military Dog Program between 1993 and 1996 (Moore *et al* 2001). A later study of US Department of Defense dogs between 2000–2004 showed that spinal cord disease was the most common cause for discharge (60%). This was followed by degenerative joint disease alone or in combination with spinal cord disease (26.3%) (Evans *et al* 2007). The general terms 'spinal cord disease' and 'spinal disease' used in these studies likely includes degenerative intervertebral disc disease, degenerative lumbo-sacral stenosis and degenerative (GSD) myelopathy. We used the term 'back/spinal disease' and selection of the anatomical region without further specification of diagnosis. Our study relies entirely on handler knowledge and recall rather than confirmation of diagnosis via veterinary records or post mortem analysis and therefore the results should be interpreted with caution. In addition, 49 of 134 dogs were retired or lost from service over ten years prior to the survey date, so it is reasonable to assume some inaccuracy of recall. Therefore, the results provided should be considered indicative rather than precise.

The authors' practice provides a referral service to the NZ PDS. In our experience, degenerative lumbo-sacral stenosis (DLSS) is the most prevalent spinal disorder of the lumbo-sacral spine in working NZ police GSDs. In contrast, we rarely clinically diagnose degenerative myelopathy in NZ police GSDs during their working life. However, the inability to confirm degenerative myelopathy ante mortem prevents accurate assessment of its prevalence within the population. DLSS is a multifactorial syndrome of degeneration of the lumbo-sacral articulation and subsequent compression on the *cauda equina* manifesting as pain and disability (Meij & Bergknut 2010). The GSD has the highest breed incidence for degeneration of the lumbo-sacral disc (Bergknut 2011). Many of the dogs in this present study underwent investigation for DLSS and several underwent successful surgical decompression and/or stabilisation procedures (Worth unpublished data).

Dogs with transitional vertebrae have a higher risk of developing *cauda equina* syndrome (Morgan *et al* 1993), putatively due to the abnormal rotational forces induced by malalignment and malarticulation of the asymmetrical lumbo-sacral junction. Lumbo-sacral transitional vertebrae occur more frequently in GSDs than in other breeds (Morgan *et al* 1993). Dogs with such vertebrae were eight times more likely to develop *cauda equina* syndrome than dogs without them, and GSDs were eight times more likely to develop *cauda equina* syndrome than other breeds, and at a significantly younger age (Fluckiger *et al* 2006). Those authors hypothesised that lumbo-sacral transitional vertebrae accelerate degeneration of the disc cranial to the transitional vertebrae, or that the disc itself is dysplastic and therefore prone to premature degeneration. The incidence of transitional vertebrae in GSDs has been reported to range from 3.5 to 29%, and have a varying incidence within populations from different countries (Scharf *et al* 2004; Damur-Djuric *et al* 2006; Wigger *et al* 2009). The incidence of transitional vertebrae amongst the dogs in the current study was not investigated. From approximately 2008, the NZ PDS began radiographic screening of breeding dogs for transitional vertebrae/osteochondrosis on our advice that such dogs should not be bred from. A lesion resembling osteochondrosis has been reported to affect the dorsal end-plate of the first sacral vertebra in the GSD (Lang *et al* 1992; Hanna 2001; Mathis *et al* 2009) and to occur with increased incidence in dogs with *cauda equina* syndrome compared with normal dogs (Hanna 2001). Affected dogs have ventral compression, and potential instability associated with dorsal displacement of the osteochondral fragment from the edge of the first sacral vertebra. Only one dog with an osteochondrosis-like lesion was identified in this study.

All breed-associated diseases with proven high incidence rates in comparison to other dog breeds are suspected to have a genetic basis (Patterson 2000). Other than the elimination of dogs with transitional vertebrae or sacral osteochondrosis, suitable recommendations have not been developed to enable selection of dogs with a lower risk of pathology of the lumbo-sacral region. Future studies should seek to determine anatomical or work-related factors that may influence the development of DLSS. Studies into the characteristic stance and gait of the GSD and their relationship to conformation of the lumbo-sacral and coxo-femoral joints have also not been performed.

Behavioural problems (mainly undesirable aggression) were the cited cause of loss in 7% of NZ PDS dogs. Undesirable aggression in an inappropriate situation may involve fear, or excessive (poorly controlled) aggression, whereas desirable aggression is seen as bold, non-fearful aggression shown in an appropriate operational situation. In comparison, other authors reported higher incidences of behavioural/aggression problems in working dogs as a cause of loss from service (Evans *et al* 2007; Haverbeke *et al* 2009). Behavioural problems were the most common cause of discharge for adult military working dogs < 4 years of age (Evans *et al* 2007). The low levels of undesirable aggression and behavioural problems seen in this study suggests effective breeding and operational selection of dogs and appropriate training methods within the NZ PDS.

Police dogs are also selected for tracking ability and operational bite work. The loss of tracking ability was cited as a reason (primary or secondary) for the retirement of 11% of the retired police dogs in this study. Successful tracking involves both innate and physical ability in addition to training and, as such, reluctance or apparent inability to track may in part be due to physical inability or behavioural issues. The loss of bite work ability was a secondary reason for the retirement of 12% of police dogs and this loss may also have been due to either motivational/behavioural causes or a physical problem such as fractured canine teeth. Future analysis of the causes of tracking loss, bite ability loss and aggression problems would be worthwhile to provide an opportunity to mitigate future losses.

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GDV was a significant cause of death/euthanasia in this study. Police dogs are large breed, generally male dogs and for logistical reasons are fed once a day, all factors that are recognised as increasing the risk of GDV (Glickman *et al* 1997). In addition, feeding a large breed dog prior to exercise is not recommended (empirically), however, such a situation is unavoidable in PDS dogs as they may be called upon at any time to respond to an emergency. Prophylactic gastropexy has been suggested as an effective means of preventing GDV and is cost effective in some at-risk breeds depending on the local price differentiation between treatment and preventative surgeries (Ward *et al* 2003). When the high cost of training a working dog is factored into the equation such programmes become cost-saving.

The NZ PDS does not have a searchable medical records system from which to generate data on loss from service. Therefore, contacting handlers and asking them to provide the detail on their current and previous dogs was undertaken and was the only way we could get the data required. There are numerous deficiencies in conducting a survey in this manner. Police records were used to contact those handlers with addresses on file but only a subset of the total number of current or ex-dog handlers were able to be contacted for this study.

The period which was retrospectively evaluated extended over 36 years. Thus, considerable reliance was placed on handler recall introducing the possibility of recall error. Our survey also relied upon handler understanding of the medical state of the dog at euthanasia/retirement or as a cause of death. For logistical reasons this data could not be cross-referenced against veterinary or police records. However, the handler/dog bond is strong and it is unlikely that each handler would be ill-informed or otherwise unaware of the condition(s) affecting his/her dog at the point of loss from service. Previous studies of military working dogs in the United States (Dutton & Moore 1987; Moore *et al* 2001) have published necropsy data and are therefore likely to be more pathologically accurate regarding diagnosis than information from the present study. Unlike the US Military Working Dog Program, the NZ PDS has no formal requirement for dogs lost to the programme to be necropsied.

Animal welfare implications and conclusion

The average age at which a NZ police dog is lost from service was lower than the planned age of retirement expected by the NZ police. Degenerative orthopaedic disease including lumbo-sacral joint degeneration and coxo-femoral arthritis was the most important cause of retirement/euthanasia of a NZ police dog in this study. Improvements in the ability to select superior genetic stock would be valuable to mitigate loss due to hip dysplasia. Greater research effort must be targeted at identification of the factors that lead to significant lumbo-sacral disease and identification of breeding and husbandry methods to lower its prevalence in the working population. Such research will improve welfare for the police dogs and should lengthen the average working life of a police GSD.

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References

Bergknut N 2011 *Intervertebral disc degeneration in dogs.* Doctoral Thesis No 2010:91, Faculty of Veterinary Medicine and Animal Science, Uppsala, Sweden and Faculty of Veterinary Medicine, Utrecht University, The Netherlands

Damur-Djuric N, Steffen F, Hassig M, Morgan JP and Fluckiger MA 2006 Lumbo-sacral transitional vertebrae in dogs: classification, prevalence, and association with sacroiliac morphology. *Veterinary Radiology & Ultrasound 47*: 32-38. http://dx.doi.org/10.1111/j.1740-8261.2005.00102.x

Dutton R and Moore GE 1987 Clinical review of death or euthanasia in 123 military working dog necropsies. *Military Medicine 152*: 489-493

Evans R, Herbold JR, Bradshaw BS and Moore GE 2007 Causes for discharge of military working dogs from service: 268 cases (2000–2004). *Journal of the American Veterinary Medical Association 231*: 1215-1220. http://dx.doi.org/10.2460/javma.231.8.1215

Fluckiger MA, Damur-Djuric N, Hassig M, Morgan JP and Steffen F 2006 A lumbo-sacral transitional vertebra in the dog predisposes to cauda equina syndrome. *Veterinary Radiology & Ultrasound 47*: 39-44. http://dx.doi.org/10.1111/j.1740-8261.2005.00103.x

Glickman LT, Glickman NW, Schellenberg DB and Lantz GC 1997 Multiple risk factors for gastric dilatation and dilatation-volvulus in dogs: a practitioner case/control study. *Journal of the American Animal Hospital Association 33*: 197-204

Hanna FY 2001 Lumbo-sacral osteochondrosis: radiological features and surgical management in 34 dogs. *Journal of Small Animal Practice 42*: 272-278. http://dx.doi.org/10.1111/j.1748-5827.2001.tb02040.x

Haverbeke A, De Smet A, Depiereux E, Giffroy J and Deiderich C 2009 Assessing undesired aggression in military working dogs. *Applied Animal Behaviour Science 117*: 55-62. http://dx.doi.org/10.1016/j.applanim.2008.12.002

Kippenes H and Gondalen J 1999 Helsetilstanden hos politiets patruljehunder og et utvalg schaferhunder. *Norsk Veterinartidsskrift 111*: 145-150. [Title translation: Health status of police patrol dogs and selected German shepherds]

Lang J, Hani H and Schwalder P 1992 A sacral lesion resembling osteochondrosis in the German Shepherd dog. *Veterinary Radiology 33*: 69-72. http://dx.doi.org/10.1111/j.1740-8261.1992.tb01962.x

Mathis KR, Havlicek M, Beck JB, Eaton-Wells RD and Park FM 2009 Sacral osteochondrosis in two German shepherd dogs. *Australian Veterinary Journal 87*: 249-252. http://dx.doi.org/10.1111/j.1751-0813.2009.00418.x

Meij BP and Bergknut N 2010 Degenerative lumbo-sacral stenosis in dogs. *Veterinary Clinics Small Animal 20*: 983-1009. http://dx.doi.org/10.1016/j.cvsm.2010.05.006

Moore GE, Burkman KD, Carter MN and Peterson MR 2001 Causes of death or reasons for euthanasia in military working dogs: 927 cases (1993-1996). *Journal of the American Veterinary Medical Association 219*: 209-214. http://dx.doi.org/10.2460/javma. 2001.219.209

Morgan JP, Bahr A, Franti CE and Bailey CS 1993 Lumbo-sacral transitional vertebrae as a predisposing cause of cauda equina syndrome in German Shepherd Dogs; 161 cases (1987-1990). *Journal of the American Veterinary Medical Association 202*: 1877-1882

Olson RC 1971 Physical evaluation and selection of military dogs. *Journal of the American Veterinary Medical Association 159*: 1444-1446

Patterson DF 2000 Companion animal medicine in the age of medical genetics. *Journal of Veterinary Internal Medicine 14*: 1-9. http://dx.doi.org/10.1111/j.1939-1676.2000.tb01492.x

Scharf G, Steffen F, Grunenfelder F, Morgan JP and Fluckiger M 2004 The lumbo-sacral junction in working German Shepherd dogs: neurological and radiological evaluation. *Journal of Veterinary Medicine. Series A51*: 27-32

Ward MP, Patronek GJ and Glickman LT 2003 Benefits of prophylactic gastropexy for dogs at risk of gastric dilatation-volvulus. *Preventative Veterinary Medicine 60*: 319-329. http://dx.doi.org/10.1016/S0167-5877(03)00142-9

Wigger A, Julier-Franz C, Tellhelm B and Kramer M 2009 Lumbo-sacral transitional vertebrae in the German shepherd dog: prevalence, classification, genetics, and association with canine hip dysplasia. *Tierärztliche Praxis Ausgabe Kleintiere Heimtiere 37*: 7-13

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