



A RESEARCH REVIEW™  
SPEAKER SERIES

# Desexing – making sense of the literature and conversations with clients



Making Education Easy

2023

## About the expert



**Dr Abbie Tipler**  
ATCL BVSc MANZCVS FANZCVS  
(Surgery)

Dr Abbie Tipler graduated from Massey University in 2005 and soon after graduation discovered her passion for surgery. This took her to London where she worked for several years in a combined general practice/orthopaedic referral practice. During her time overseas, Dr Tipler spent time at some of the top veterinary universities including UC Davis and Bristol University. In 2011 she moved to Sydney and sat her ANZCVS Memberships in Small Animal Surgery and in 2016 was chosen as head examiner for Memberships in surgery. In 2022 she was the only candidate to pass ANZCVS Specialist Small Animal Surgery examinations. She is now President of the ANZCVS Surgery Chapter and is a regular attendee and speaker at surgical conferences world-wide, including ACVS, ANZCVS Science Week, AVA Conference and BVOA. She is a member of AO VET.

## ABOUT RESEARCH REVIEW

Research Review is an independent animal health and medical publishing organisation producing electronic publications in a wide variety of specialist and therapeutic areas.

## SUBSCRIBE AT NO COST TO ANY RESEARCH REVIEW

NZ animal health professionals will soon be able to subscribe to or download previous editions of Research Review publications at [www.animalhealthreview.co.nz](http://www.animalhealthreview.co.nz)

Privacy Policy: Research Review will record your email details on a secure database and will not release them to anyone without your prior approval. Research Review and you have the right to inspect, update or delete your details at any time.

Disclaimer: This publication is not intended as a replacement for regular animal health education but to assist in the process. The reviews are a summarised interpretation of published studies and reflect the opinion of the writer rather than those of the research group or scientific journal. It is suggested readers review the full trial data before forming a final conclusion on its merits.

This publication summarises a webinar presented by Dr Abbie Tipler, a Specialist Small Animal Surgeon working at Veterinary Specialist Services (VSS) in Brisbane, Australia. The webinar covers recent literature relating to desexing in dogs, as well as case examples to help guide recommendations in clinical practice. Sponsorship for the webinar was provided by Virbac Animal Health Australia.

## Ethics surrounding desexing

Ethics is a complicated subject, and one in which you can obtain a university degree. Dr Tipler gave a very brief overview to highlight complexities of the topic.

A utilitarian may argue that it is right to desex all dogs because the benefit (potentially fewer dogs being euthanised) outweighs the harm (increased incidence of disease in some dogs). However, according to ethical rules that veterinarians are expected to follow, in particular the Hippocratic oath, vets have an obligation to the specific animal under their care to not knowingly endanger or hurt them, regardless of the wider consequences for society. A published survey has shown that many veterinarians in the Australian Capital Territory don't support mandatory prepubertal desexing of dogs.<sup>1</sup>

## Desexing and population control

There is a lack of evidence to show that desexing reduces euthanasia rates or the population of shelter dogs, although it does seem to reduce the number of free roaming, wild dogs.<sup>2</sup> Overall, two-thirds of puppy litters are intentionally bred, and most dogs are surrendered to shelters because of behavioural issues. Interestingly, countries with lower rates of dog desexing also have lower rates of surrender to animal shelters.

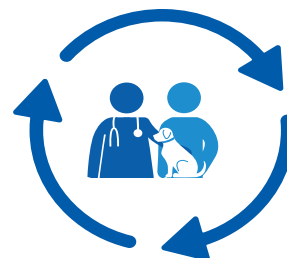
Currently, desexing decisions in Australia lie with the owner. However, studies show high rates of non-compliance with desexing contracts when dogs are adopted from shelters. It is Dr Tipler's belief that it is unethical for breeders to desex dogs prior to new ownership, if this is not in the dog's best interest.

## Desexing and the role of the primary care veterinarian

*"Whether or not you think desexing dogs is the right thing to do, we as professionals, who are in a position of power because we hold greater knowledge, have a duty to explain the risks, pros and cons to our pet owners and offer all the options"* said Dr Tipler.

The primary care veterinarian should educate pet owners on the pros and cons before they can give informed consent for desexing. In a large survey of Australian pet owners, 61% of male dog owners and 47% of female dog owners would not make the same decision, if given the choice again to desex.<sup>3</sup> Dr Tipler suggests that rather than simply charging owners for a desexing procedure, they could be charged for a consultation to explain the pros and cons of desexing for the specific pet, based on their age, breed and owner situation.

PROS



CONS

INDIVIDUAL

## How do we decide what to recommend?

While there are limitations in the veterinary literature, generally accepted trends include:

- Desexing at greater than 12-18 months of age will have less influence on developmental diseases, for example orthopaedic disease.
- Desexing at a later age can still have effects on degenerative diseases. Preserving hormones for longer may reduce the incidence of these diseases.
- Hormones have an effect on growth plate closure, ligament and muscle formation, relaxin, luteinizing hormone (LH) and osteoporosis.



It should be noted that there is likely to be significant bias in the literature on the effects of desexing. For example, desexing is often associated with better general husbandry and more compliant owners, which may confound reported outcomes. In addition, screening for degenerative disease is more likely to occur in breeding dogs, who won't be desexed.

When discussing disease risk associated with intact and desexed dogs, it is important to consider disease prevalence. For example, while there is an increased risk of prostate carcinoma in desexed dogs, the prevalence of this disease is low, and it is a minor contributor to overall dog mortality. A recent study from Japan found the most common cause of death amongst companion dogs was senility.<sup>4</sup>

## Pros and cons of desexing

The pros and cons of desexing can be discussed in a dedicated consultation with pet owners, covering both disease risk and possible effects on behaviour.

### Desexing pros in females

#### Reduced risk of mammary gland neoplasia

Mammary gland neoplasia is a common disease in female dogs and there is some evidence to show that desexing reduces risk. In particular, desexing dogs with benign mammary tumours reduces the risk of further tumours.

However, a recent review noted that the risk of mammary neoplasia associated with not desexing dogs may be overstated.<sup>5</sup> For example, a 5% absolute risk of mammary neoplasia in desexed dogs and a 26% increased risk in intact dogs equals a 6.3% absolute risk in intact dogs, a small increase in absolute terms. It is important to note that the prevalence of mammary neoplasia in intact dogs varies widely by breed, from 0% to approximately 6%. Furthermore, this disease can be detected early via palpation, and is generally treatable.

#### Reduced risk of ovarian tumours, uterine neoplasia, vaginal and vulval tumours

Desexing reduces the risk of ovarian tumours, uterine neoplasia, vaginal tumours and vulval tumours in dogs. However, ovarian tumours are rare with low mortality, while uterine neoplasia is also rare and often benign. Vaginal and vulval tumours have a prevalence of 2.4-3%; leiomyomas are the most common. Desexing is recommended in conjunction with surgery for dogs with confirmed leiomyoma.

#### Reduced risk of pyometra, metritis and ovarian cysts

Ovariectomy, ovariohysterectomy and ovary-sparing hysterectomy can prevent and treat pyometra and metritis, and prevent problems associated with pregnancy and parturition. Ovariectomy and ovariohysterectomy also prevent ovarian cysts. The incidence of pyometra in intact dogs is up to 25% by 10 years, but varies by breed. It can result in septic shock and renal failure, and is associated with a 4-17% mortality rate.

### Desexing pros in males

Testicular tumours are common in intact dogs but have a low rate of metastasis. Castration is preventative and often curative. Cryptorchid testicles may be more prone to tumours.

Castration also reduces the risk of androgen-related diseases such as benign prostatic hyperplasia, chronic prostatitis, perianal adenomas and perianal hernias. Benign prostatic hyperplasia affects around 50% of intact dogs by 5 years of age and 95-100% by 9 years, which makes them prone to prostatic cysts, prostatitis and prostatic abscesses.

### Desexing pros in males and females

Transmissible venereal tumours are common in regions with many intact dogs, particularly roaming dogs. These tumours are sexually transmitted and metastasis occurs in 5-17% of cases.

The evidence for an increased lifespan in desexed dogs is dubious, and studies may be subject to significant bias. One study found an increased risk of death from neoplasia in desexed dogs, but a decreased risk of death by trauma and infectious disease.<sup>6</sup> Lifespan studies are conducted on deceased dogs and don't take age of desexing into account.<sup>2</sup> They also do not consider the quality of life of the dog during its lifespan.

### Desexing cons in females

Urinary incontinence (UI) occurs in 2-20% of desexed female dogs, and larger breeds are more at risk, particularly dogs weighing over 30kg. Desexing earlier than 3 months of age appears to have the highest risk of urinary incontinence. No difference in risk is evident between dogs desexed at 6 months of age and those desexed after the first oestrus. UI responds to medical management, and gonadotropin-releasing hormone (GnRH) agonists have been successfully used.<sup>2</sup> However, medical treatment can be expensive and the condition can be bothersome for both dogs and owners.

There is an increased risk of recessed vulva when dogs are desexed before sexual maturity.

### Desexing cons in males

The risk of prostatic carcinoma is increased approximately 8 times in desexed dogs, however, the overall prevalence is low. Prostatic carcinoma is an aggressive cancer with a high metastatic rate. Risk varies according to breed.

### Desexing cons in males and females

#### Cancer

In addition to prostatic carcinoma, there is trending evidence to show that desexing increases the risk of other cancers in some breeds of dogs, including transitional cell carcinoma, lymphoma, mast cell tumours, hemangiosarcoma and osteosarcoma.<sup>7</sup> However, no increased risk has been found in mixed breed dogs.<sup>8</sup>

Transitional cell carcinomas account for approximately 2% of all neoplasia. Desexing is associated with an approximate 2-fold increase in risk. This is an aggressive cancer, with only 16% of affected dogs surviving >1 year. The risk varies with breed.

Lymphoma is common, but risk varies by breed. It has a high remission rate with chemotherapy. Mast cell tumours are also common, accounting for approximately 20% of all cutaneous tumours. Prognosis is variable depending on the grade and stage of the tumour, and the risk varies with breed. One study suggested a 4-fold increased risk of mast cell tumours in desexed female dogs.<sup>9</sup>

Hemangiosarcoma accounts for 5-7% of non-cutaneous neoplasia in dogs. It has a poor prognosis and only 10% of those affected survive >1 year, even with surgery and chemotherapy. There is a 2-fold increased risk in desexed females, and the risk of cardiac hemangiosarcoma is also increased.

Osteosarcoma is the most common malignant bone tumour and has a high metastatic rate. Risk is increased approximately 2-fold in desexed dogs; those desexed at <12 months of age have a higher risk. Risk varies by breed, with 25% of desexed Rottweilers developing osteosarcoma.

#### Joint disease

A number of studies have shown that the risk of joint disease is increased for some breeds of dogs when they are desexed prior to skeletal maturity. Risk is related more strongly to breed than to dog size or sex. Breeds at increased risk include Golden Retrievers, Labrador Retrievers, German Shepherds, Rottweilers, male Beagles and female Australian cattle dogs. Breeds with no increased risk of joint disease include Boxers, Border Collies, Great Danes and Pugs.

Cruciate ligament disease occurs in 2-4% of dogs, and is more common in larger breeds. Desexing is a risk factor for some breeds including larger mixed breeds. In one study, dogs desexed prior to skeletal maturity had a 3-fold increase in tibial plateau angle.<sup>10</sup>

The risk of hip dysplasia varies by breed. Mixed breed dogs weighing ≥20kg and male Golden Retrievers desexed at <12 months of age have an increased risk, as do Boxers desexed ≥6 months prior to diagnosis.<sup>7,8</sup>

### Other cons in males and females

Desexing is associated with an increased risk of obesity due to increased appetite and slowed metabolism, as well as an increased risk of diabetes. There is also a possible increased risk of immune-mediated disease, Addison's disease, hypothyroidism, inflammatory bowel disease, Cushing's disease and epilepsy.

The risk of intervertebral disc disease is increased in desexed female Dachshunds, and in male Dachshunds when desexed at <12 months of age.

Surgical complications with desexing occur in approximately 10% of cases, including haemorrhage, wound infections, stump pyometra, ovarian remnant, seroma, iatrogenic ureteral or urethral damage or ligation, pain and splenic laceration. Older, larger dogs may have an increased risk of complications.

### Behaviour pros and cons

The effects of desexing on behaviour is a complex topic with conflicting information.

A 2022 owner questionnaire study from Poland found that desexing reduced aggressive behaviours towards other dogs, roaming, mounting and urine marking, as well as decreasing overall activity.<sup>11</sup> A systematic review found that desexing reduced the incidence of dog bites.<sup>12</sup> However, this latter finding could also be a result of better husbandry and owner compliance in the desexed population.

In contrast, a 2023 questionnaire study of over 6000 dog owners, predominantly from the US and Canada, found an increase in behavioural problems in desexed dogs, including aggression, anxiety-based behaviours and extreme fears, as well as nuisance behaviours such as urine marking and mounting.<sup>13</sup> There were less behavioural problems the longer dogs were exposed to hormones.<sup>13</sup>

Veterinarians should be wary of promising to owners that desexing will fix behavioural problems. Even if behaviour is improved, there may only be a 20-40% reduction in problem behaviours.



## Guidelines for age of desexing dogs based on risk of cancer and joint disorders

Hart et al. provides breed-specific recommendations for the age of desexing based on risk of cancer and joint disorders (see **Table 1**).<sup>7</sup> Where there is no noticeably increased risk of joint disorders or cancers with desexing, recommendations state that those wishing to desex should decide on the appropriate age (briefly stated as “choice” in Table 1). When desexing before 6 months of age is associated with an increased disease risk but no increased risk is evident with desexing after 6 months, the default recommendation is desexing after 6 months of age.<sup>7</sup> It is recommended that some breeds are not desexed until after the age of 23 months, including Boxers, German Shepherds, male Golden Retrievers, and male Poodles.<sup>7</sup> It is also suggested that male Doberman Pinschers and female Golden Retrievers be left intact.<sup>7</sup>

## Communicating with dog owners

A link to a printable handout on desexing for owners can be found at <https://www.vss.net.au/desexing-your-dog.html>. The handout describes the pros and cons of desexing, however it is important to advise owners that information changes over time. It also gives owners links to recent breed-specific articles. A separate page discusses the options for desexing, which veterinarians can decide whether to give to dog owners based on what they offer in their practice. Veterinarians are entitled to offer their recommendation, and dog owners often want this guidance.

## Desexing procedure options

The procedure options for desexing female and male dogs are listed in **Table 2**.

For females, there is no difference in outcome between an ovariectomy (traditional spay, both ovaries and uterus removed) and an ovariohysterectomy (spay leaving the uterus). An ovariohysterectomy is typically the procedure performed when undergoing laparoscopic desexing. An ovary-sparing hysterectomy, in which one or both ovaries are retained, and a salpingectomy (fallopian tube ligation) are both hormone-sparing techniques.

Dr Tipler prefers to perform an ovary-sparing hysterectomy for hormone-sparing desexing. Dogs will still have a heat cycle after this technique and will be attractive to male dogs. They may have a small amount of bloody discharge. They may also exhibit behaviours associated with being on heat such as yowling. So long as the uterus is removed beyond the cervix, dogs should not experience a pyometra.

For males, orchietomy (castration) removes sex hormones while vasectomy preserves them, and also preserves the testicles.

The previously-mentioned 2023 owner questionnaire study examined the outcomes of dogs after ovary-sparing hysterectomy, vasectomy or no desexing (i.e., keeping the dog entire) vs traditional spay or castration, and found both health and behavioural benefits with the hormone-sparing techniques.<sup>13</sup> Problem behaviours (aggression, anxiety-based behaviour and extreme fears) were more likely to occur in castrated males than in all other groups.<sup>13</sup> “Our findings emphasize the importance of gonadal hormone exposure to canine health and behavior” the authors stated.<sup>13</sup>

Breed	Males					Females				
	Leave intact	Choice	>6 mos	>11 mos	>23 mos	Leave intact	Choice	>6 mos	>11 mos	>23 mos
Australian cattle dog		✓						✓		
Australian shepherd		✓					✓			
Beagle				✓			✓			
Bernese Mt. Dog					✓		✓			
Border Collie				✓					✓	
Boston Terrier				✓			✓			
Boxer					✓					✓
Bulldog		✓					✓			
Cavalier King Charles Spaniel		✓					✓			
Chihuahua		✓					✓			
Cocker Spaniel			✓							✓
Collie		✓							✓	
Corgi			✓				✓			
Dachshund		✓					✓			
Doberman Pinscher	✓									✓
English Springer Spaniel		✓							✓	
German Shepherd					✓					✓
Golden Retriever				✓		✓				
Great Dane		✓					✓			
Irish Wolfhound					✓		✓			
Jack Russell Terrier		✓					✓			
Labrador Retriever			✓						✓	
Maltese		✓					✓			
Miniature Schnauzer		✓					✓			
Pomeranian		✓					✓			
Poodle (Toy)		✓					✓			
Poodle (Miniature)				✓			✓			
Poodle (Standard)					✓		✓			
Pug		✓					✓			
Rottweiler				✓				✓		
Saint Bernard		✓						✓		
Shetland Sheepdog		✓								✓
Shih Tzu		✓								✓
West Highland White Terrier		✓					✓			
Yorkshire Terrier		✓					✓			

**Table 1.** Suggested guidelines for age of desexing dogs based on cancer and orthopaedic risk (reproduced from Hart BL, et al. Front. Vet. Sci. 2020 Jul 7;7:388).<sup>7</sup>

Females	Males
Ovariectomy or ovariohysterectomy	Orchietomy – castration
Ovary-sparing hysterectomy	Vasectomy
Salpingectomy – fallopian tube ligation	Intra-testicular injection
Medical desexing	Medical desexing

**Table 2.** Desexing procedure options in female and male dogs.



Another option for male dogs is the GnRH agonist Suprelorin® (deslorelin), which provides temporary, non-surgical infertility by suppressing testosterone production and spermatogenesis.<sup>14</sup> Suprelorin® 4.7mg is an injectable implant which lasts for 6 months.<sup>14</sup> It can be useful for owners who are undecided on permanent desexing, or as a trial for the effects of castration on behaviour.<sup>14</sup>

The Australian Veterinary Association states that “Veterinarians should make recommendations about the type of sterilisation procedure and the age of sterilisation on a case-by-case basis, in consultation with the client, based on the risks and benefits to the individual animal and current scientific evidence. Relevant regulations and registration requirements should be taken into account.”<sup>15</sup>

## Facebook poll of veterinarian recommendations regarding desexing

A poll conducted on Dr Tipler’s Small Animal Surgery Facebook page, which attracted 725 votes, asked veterinarians whether they recommend early desexing, desexing at 6 months for all dogs, desexing at 6 months for small breeds and skeletal maturity for large breeds, or whether they make differing recommendations based on individual breed and owner. The most common response to the poll was to provide differing recommendations (66%), followed by desexing at 6 months for small breeds and skeletal maturity for large breeds (28%).

## Conclusion

Many of the traditional perceived pros of desexing are based on little evidence of benefit or relatively small benefits. There is a lack of evidence to show that desexing reduces euthanasia rates or the population of shelter dogs, although it does seem to reduce the number of free roaming, wild dogs. For most breeds, no increased risk of disease has been found with desexing. However in some breeds, consideration should be given to delaying desexing until after 23 months of age, to reduce the risk of joint disorders.

All dog owners should be educated on the pros and cons of desexing to allow them to provide informed consent, along with a warning that the research will change over time. As stated by Hart et al., “the new paradigm is for the veterinarian and pet owner, or the pet owner alone, to use the available data-based information to decide on the best age for neutering” and to “take each puppy as a separate case and consider all the relevant factors of the living context.”<sup>15</sup>

## Questions and answers

### 1. How common are transmissible venereal tumours in Australia?

Dr Tipler believes these tumours are uncommon in both Australia and New Zealand, which may be related to the fact that traditionally, most dogs are desexed. If desexing is delayed, owners should be counselled to keep their dogs confined. Transmissible venereal tumours tend to be more of a problem in roaming, wild dogs which is of lesser importance in Australia and New Zealand.

### 2. What is your recommendation for large breed male dogs with cryptorchidism?

Dr Tipler recommends desexing as cryptorchidism is a heritable condition, and also because these dogs are more prone to testicular tumours. She would advise waiting for skeletal maturity if the owners are able to keep the dog confined until that time. Another option could be to remove the cryptorchid testicle and perform vasectomy to the other testicle as a hormone-sparing sterilisation in breeds where this may be indicated.

## Desexing decisions: case examples

### 1. Confined full-size female Groodle, expected adult weight >40kg

Dr Tipler would spend time talking to the owner about the pros and cons of desexing. She would recommend delaying desexing until 18-24 months, if the owner was aware of the cons of this.

### 2. Border Collie that will become an agility or farm dog

Athletic ability is a priority for this dog, therefore it should not be put at risk of joint disease. Working dogs are often of high value, and therefore tend to be kept confined. Breed-specific studies advise owners to wait until 11 months before desexing. This evidence should be discussed with the owner so they can make an informed decision.

### 3. Small mixed-breed female dog from a busy household, that likes to escape

Dr Tipler would discuss the pros and cons of desexing to the owner. She would advise that the risks of desexing are less for small dogs, and that the dog coming into heat may be troublesome for the owner. The owner has also advised the dog has a tendency to escape. Therefore, in this situation, it may be advisable to desex at the more traditional age of around 6 months.

### 4. Female Golden Retriever

The breed-specific study recommends that female Golden Retrievers are left sexually intact. Dr Tipler would discuss the pros and cons, however would consider a hormone-sparing option in this case. An example of this could be an ovary-sparing spay. At the very least, she would discuss a delay in desexing as long as possible, and possible Suprelorin® implantation if ovariohysterectomy is indicated, to restore low levels of luteinising hormone.

## Commentary by Dr Becky Murphy, Director and Senior Clinical Veterinarian at TCI GlenBred

There is a growing body of evidence to support delaying gonadectomy dependent on both size, and breed, of dog. From a New Zealand perspective, ovary-sparing spay is not routinely performed. Anecdotally, we are seeing increasing cases of juvenile- and adult-onset vaginitis in bitches who were gonadectomised at an early age, with the treatment of choice including oestrogen replacement therapy. Transmissible venereal tumours are not endemic in New Zealand, with the only reported case in 2004 in an imported dog who was isolated and subsequently euthanised. There are international studies in the pipeline looking at the effects of gonadectomy and subsequent supra-physiological release of LH and follicle-stimulating hormone from the pituitary gland. It is possible that this unregulated production of LH is responsible for some of the negative effects of gonadectomy. Suprelorin® down-regulates pituitary receptors and prevents the unregulated production of LH. This will be an interesting space to watch. The New Zealand Veterinary Association (NZVA) supports surgically de-sexing all cats and dogs that can safely undergo anaesthesia and are not intended for breeding.

## REFERENCES:

- Orr B, Jones B. A Survey of Veterinarian Attitudes Toward Prepubertal Desexing of Dogs and Cats in the Australian Capital Territory. *Front Vet Sci.* 2019 Aug 21;6:272.
- Urfer SR, Kaerberlein M. Desexing Dogs: A Review of the Current Literature. *Animals (Basel).* 2019 Dec 5;9(12):1086.
- Blackshaw JK, Day C. Attitudes of dog owners to neutering pets: demographic data and effects of owner attitudes. *Aust Vet J.* 1994 Apr;71(4):113-6.
- Inoue M, Sugiura K. Identifying causes of death of companion dogs in Japan using data from pet cemeteries. *J Vet Med Sci.* 2021 Jul 2;83(7):1039-1043.
- Hart LA, Hart BL. An Ancient Practice but a New Paradigm: Personal Choice for the Age to Spay or Neuter a Dog. *Front Vet Sci.* 2021 Mar 19;8:603257.
- Hoffman JM, Creedy KE, Promislow DE. Reproductive capability is associated with lifespan and cause of death in companion dogs. *PLoS One.* 2013 Apr 17;8(4):e61082.
- Hart BL, Hart LA, Thigpen AP, Willits NH. Assisting Decision-Making on Age of Neutering for 35 Breeds of Dogs: Associated Joint Disorders, Cancers, and Urinary Incontinence. *Front Vet Sci.* 2020 Jul 7;7:388.
- Hart BL, Hart LA, Thigpen AP, Willits NH. Assisting Decision-Making on Age of Neutering for Mixed Breed Dogs of Five Weight Categories: Associated Joint Disorders and Cancers. *Front Vet Sci.* 2020 Jul 31;7:472.
- White CR, Hohenhaus AE, Kelsey J, Procter-Gray E. Cutaneous MCTs: associations with spay/neuter status, breed, body size, and phylogenetic cluster. *J Am Anim Hosp Assoc.* 2011 May-Jun;47(3):210-6.
- Duerr FM, Duncan CG, Savicky RS, Park RD, Egger EL, Palmer RH. Risk factors for excessive tibial plateau angle in large-breed dogs with cranial cruciate ligament disease. *J Am Vet Med Assoc.* 2007 Dec 1;231(11):1688-91.
- Kriese M, Kuźniewska E, Gugolek A, Strychalski J. Reasons for and Behavioral Consequences of Male Dog Castration-A Questionnaire Study in Poland. *Animals (Basel).* 2022 Jul 23;12(15):1883.
- D’Onise K, Hazel S, Caraguel C. Mandatory desexing of dogs: one step in the right direction to reduce the risk of dog bite? A systematic review. *Inj Prev.* 2017 Jun;23(3):212-218.
- Zink C, Delgado MM, Stella JL. Vasectomy and ovary-sparing spay in dogs: comparison of health and behavior outcomes with gonadectomized and sexually intact dogs. *J Am Vet Med Assoc.* 2023 Jan 19;261(3):366-374.
- Virbac. Suprelorin® 4.7mg. Available at: <https://nz.virbac.com/products/reproduction-and-contraception/suprelorin-47mg> [Accessed July 2023].
- Australian Veterinary Association. Surgical sterilisation of dogs and cats. 15 Jul 2022. Available at: <https://www.ava.com.au/policy-advocacy/policies/companion-animals-health/desexing-surgical-sterilisation-of-companion-animals/> [Accessed July 2023].



Production of this publication was supported by an educational grant from Virbac. The content and opinions expressed in this publication do not necessarily reflect the views of Virbac unless so specified. Treatment decisions based on these data are the full responsibility of the user. Suprelorin® 4.7mg is a restricted Veterinary Medicine. Available only under Veterinary Authorisation. Registered pursuant to the ACVM Act 1997, No. A009158.