The influence of obligatory screening for patellar luxation in Chihuahua and the incidence trend of 10 other commonly canine breeds.

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One of the most common orthopedic conditions in small animal practice is the luxation of the patella. There are various predisposed breeds for patellar luxation (PL) including Kooiker, Flatcoated Retriever, Jack Russell Terrier and Chihuahua dogs but other breeds can be affected as well. Due to the genetic inheritance of the disease it is possible to reduce the incidence by breed guidelines. The purpose of this research is to show how important it is to test for PL before breeding. The outcome of this study could be used in breeding programs and etiology studies.

By using the historic Meutstege database and compare these results with the results of the last five years (till 2015) it is possible to evaluate the change in the trend of the appearance of this disease. In this study eleven different breeds are examined; Chihuahua, Flatcoated Retriever, Kooiker, Labradoodle, Markiesje, Jack Russell Terrier, Fox Terrier, Great Pyrenean, Shiba, Papillon and Havanese.

The incidence of PL (grade 1,2,3 and 4) is decreased in general, all breeds taken together, compared with the first PL examinations available in the historic database. The incidence of grade 1 was increased in Chihuahua with 4.7%, Papillon with 4.1%, Havanese with 2.7% and the Markiesje with 11% and grade 2 is grown in Markiesje with 6.9%, Shiba with 3.1% and Labradoodle with 8.7%. The average increase of the incidence of grade 1 PL of the Chihuahua, Papillon, Havanese and Markiesje is 5.63% and the total population average of grade 1 PL of all breeds is 16.0%. The percentage of the first results (Meutstege database) is 21.8%. For grade 2 the total population average of grade 2 PL of all breeds is 4.0%. The percentage of the first results (Meutstege database) is 3.1%. Concluding that the incidence of PL grade 1 in these breeds is reduced over the years, although 16.0% of the population of these breeds is still affected with PL grade 1. PL grade 2 shows a slight increase in the incidence over the years.

The incidence of grade 1 in the Chihuahua has grown since 2013 the breeding association obliged breeders to test on this disease, 26.9% to 31.6%. The incidence of PL grade 1 in 2015 is 31.6 % and PL grade 2 is 11.9%. Concluding that PL is a significant problem within the Chihuahua breed, 45% of the cohort is affected and a clear breeding selection program should be advocated for the Chihuahua and other breeds by the breeding association to decrease the incidence of PL.

Introduction

One of the most common orthopedic conditions in small animal practice is the luxation of the patella[1] Due to the genetic transmission, it is recommended to screen before breeding to minimize this disease.[2] The incentive to develop a strategy is because in some breeds PL is frequent and leads to an unacceptable high number of affected dogs.[3]
There are various predisposed breeds for patella luxation (PL) including Kooiker[1], Flatcoated Retrievers, Jack Russell Terriers and Chihuahua dogs but other breeds can be affected as well.[4] The main cause of patellar luxation in dog breeds is genetic but trauma may also result in patellar luxation. This disease can result in non-weight bearing lameness and can finally cause degenerative joint disease, which leads to pain and chronic lameness.[3]

The stifle joint

The patella is a part of the stifle joint. The stifle joint is a complicated joint involving two functional articulations. The articulation between the femoral and tibial condyles bear weight and the femoropatellar articulation amplifies the mechanical efficiency of the m. quadriceps and advance the extensor function. The patella is stabilized by two femoropatellar ligaments in the trochlear groove (see figure 1).[1] The patella has direct contact with the articular cartilage in the femoral trochlea, it forms a sesamoid bone within the patellar tendon. Because of its fit in the femoral trochlea it prevents tendon wear during extension and flexion of the stifle joint.[1] In certain dogs, the patella can dislocate out of the trochlear groove. This condition is known as patellar luxation.[5] Trauma due to femoral fracture or mal union, hip joint luxation with torsion of the femoral bone or rupture of the retinaculum can cause PL. Non-traumatic PL can evolve due to congenital factors or because of a developmental malalignment of the extensor mechanism of the stifle.[3]

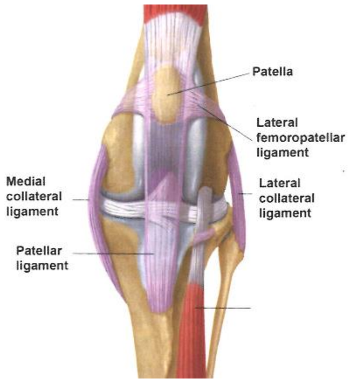


Figure 1. Normal of anatomy stifle joint. With the patella, medial and lateral collateral ligament, the patellar ligament and lateral femoropatellar ligament.[1]

Patella luxation

Patellar luxation can be present at birth (congenital) or can be acquired during life.[4] The main cause of PL in dog breeds is genetic, but trauma may also result in PL.[3,6] The assumption that PL could be heritable is made on the breed predisposition and the frequent bilateral involvement. PL has been suggested as a polygenetic, multifactorial disease.[7,8] Soontornvipart, K. *et al.* (2013) found that a region on chromosome seven that may be associated with PL.[2] Another recent study concludes that, the heritability in Flatcoated Retriever was 0.03 ± 0.17. Indicating that environmental factors may play an important role in the development of PL. Breeding with one positive parent increases the prevalence with 45% in the offspring of that litter compared to a litter with two unaffected parents.[9] Therefor it is recommended not to breed with dogs that have a positive PL screening result.[6]

The only well-researched study about the causes of patellar luxation, concluded that occurrence of medial PL is distinctive by coxa vara (a decreased angle of the gradient of the femoral neck) and a decrease in femoral neck relative retroversion (rearward facing position of the femoral neck). These skeletal deformities were considered to be the cause of the development of PL (medial) in this research.[10] Female dogs have a higher chance to develop PL.[11] A study concluded that females are 1.5 times more likely to be affected than males.[4]

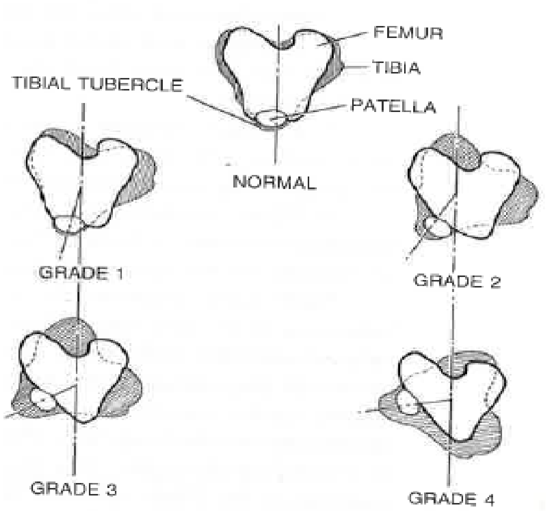


Figure 2: Position of the tibia pertaining to the femur and shape of femoral trochlea in different grades. From normal to grade 4 (medial). The femoral cross section in the trochlear sulcus region is shown in dark outline, the proximal tibial cross section is shaded.[10]

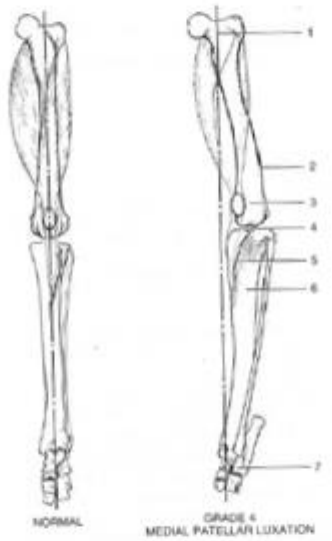


Figure 3: normal and grade 4.[10]

There are different stages of PL, from grade 1 to grade 4 (figure 2). Table 1. shows a more extensive explanation for each form. Figure 3 shows the difference between a normal patella and a patella luxation grade 4.[10] Clinical signs can vary from asymptomatic mild (grade 1), moderate weight-bearing lameness (grade 2 and 3) to severe non-weight-bearing lameness (grade 4) with severe hind limb abnormalities and deformities. The lameness may be intermittent or continuous and some dogs will mostly carry their leg. Dogs with lateral PL often have more problems than those with medial PL. PL can result in non-weight bearing lameness and finally can cause degenerative joint disease, which leads to pain and chronic lameness.[1] Medial luxation is far more common than lateral PL[10] The clinical symptoms will increase as a dog gains weight. When articular cartilage erosion occurs or when the cranial cruciate ligament ruptures the luxation becomes constant.[1] In case of low grade PL, movement of the patella can disturb the articular cartilage of the trochlear groove. When the cartilage is damaged, the subchondral bone is exposed to inflammatory mediators and osteoarthritis may develop. In this situation dogs will not only walk with lameness but are also painful.[3]

Table 1. Putam's system adapted by Meutstege [3]

scoring	**Characteristics during investigation**
grade 0	The patella is moving inside the trochlear groove and cannot be manually luxated.
loose patella	The patella can be manually positioned on the ridges of the trochlear groove, but cannot be luxated out of the groove completely.
grade 1	The patella can be manually luxated and will reposition spontaneously without any additional movements.
grade 2	The patella can be manually luxated and will reposition upon active extension (with or without concurrent rotation of the tibia).
grade 3	The patella is found luxated and can be manually reduced, but when loosened it will luxate again.
grade 4	The patella is found luxated and cannot be manually reduced.

History of patellar screening in the Netherlands

Because PL is essentially a hereditary disease, dogs are screened for more than 20 years for PL. The screening is a manual test developed and standardized by Prof. Meutstege and the results are documented in The Meutstege database in the Netherlands. This database contains more than 4000 dogs with identification (breed, date of birth, gender, and pedigree number) and results of the screening. Specialists in surgery (with interest in orthopedic surgery) perform the screening and this has resulted in a patellar screening panel that includes approximately fifteen surgical specialists distributed over the Netherlands. The accuracy of the test increases due to small selection of surgeons. After clinical examination, according to a strict protocol (Appendix 2) the patellar screening result is registered on a document for the owner and for central registration in the database (formerly sent to Prof. Meutstege but since Jan 2013 sent to the UKG (Prof. B. Meij) Appendix 1). The patella screening record carries a code to grade PL developed by Prof. Meutstege and is still in use today (Table 2).

The most common breeds that are tested in the Netherlands are the Flatcoated Retriever, the Kooiker dog, Jack Russell Terrier and the Chihuahua. The Chihuahua dog club made the patellar screening test obligatory (1 January 2013) for the breeders within their association, similar to the Flatcoated Retriever, Kooiker and Markiesje kennel clubs.[13]

The breeds who are included in this thesis are Flatcoated Retriever, Jack Russell Terrier, Great Pyrenees, Kooiker, Markiesje, Labradoodle, Shiba, Fox terrier, Epagneul Papillon (Papillon) and Havanese. Because of the growing number of tested Chihuahua's during the last years, this thesis will especially focus on the incidence of patellar luxation in screened Chihuahua cohorts in the database and compare that with earlier database results.

The patella screening test

Dogs younger than 249 days are excluded from this test because young dogs still have open physeal growth plates in the proximal tibia and distal femur until the age of 249 to 330 days (variability between breeds exists. Therefore most dogs are tested at a minimal age of 1 year when growth plates are closed and bony development is complete. A PL screening is in most cases at voluntary basis, but some breed associations decided to make the test obligatory for their members. The screening is performed by board-certified companion animal orthopedic surgeons that participate in this program. The score is subdivided in several categories: i.e. normal, and grade 1 to grade 4 PL.

The score depends on the positioning of the patella in the trochlea or the possibility and direction to luxate the patella.

Sceened dogs are identified by their breed, age, sex, chip number, NHSB number and name of the owner.[3] The screening is only performed when a copy of the pedigree is available to check the chip number. The examination of the patella can be performed in standing position and (left and right) lateral recumbency.

Standing (figure 4): The veterinarian stands behind the dog and palpates the symmetry of both patellae. The stability is checked by thrusting the patella medially and pulling laterally with the forefinger and thumb while the stifle is held extended (stifle is pushed toward the examiner). Each leg should be held extended and flexed permitting the examiner to palpate whether the patella luxates or repositions. In a dog without PL it is not possible to induce the patella in or over the edge of the trochlea, there is no crepitation and/or spontaneous or induced luxation.[14]

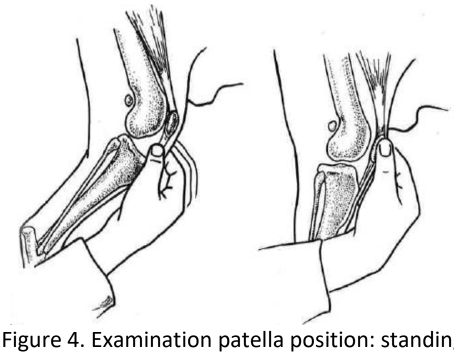


Figure 4. Examination patella position: standing.[14]

Lateral recumbency (figure 5): This is the best position to examine PL. The dog is held in lateral recumbency, to permit the upper limb to be manipulated and assessed for complete range of motion. The stifle should be extended and flexed in the same way as during the standing procedure. The examiner holds the metatarsus and uses it as a heaver to rotate first the tibia internally and next externally. During the rotation, the stifle should be flexed and extended to feel for the ability to luxate the patella with the other hand. Moving the patella over the edge of the trochlea is abnormal.[1]

Figure 5. Examination Patella position: Lateral recumbency.[14]

Treatment

Patellar luxation can be treated conservatively of surgically. The choice depends on the clinical history, physical findings and age of the patient. For asymptomatic PL (grade1) patients and some older dogs (grade 2) conservative treatment is recommended, although some of these older dogs may still respond positively to late surgical repair. In young dogs with grade 2, 3 or 4 it is recommended to consider early operation (3 – 4 months) before irreversible quadriceps contracture occurs. In adult dogs with grade 2, 3 or 4 it could be recommended to operate before erosion and deformity of the trochlea occurs. Some other treatment possibilities are underwater treadmill or water therapy.

Surgical treatment is advised in every dog who suffers from lameness and dogs with active growth plates.[1] In small breeds with grade 4 and severe femoral and tibial bone torsional deformities, the surgical techniques below will not suffice. In these clinical cases euthanasia is often considered since simple surgical corrections will not be sufficient to repair PL and restore the normal function of the patella. In addition to these techniques, complex corrective osteotomies or femur and/or tibia are necessary to correct PL in severe cases.

The most common surgical techniques

Several surgical techniques are described for the revision of PL. These techniques increase limb use in patients with lameness. Surgery may improve patellofemoral articulation, which prevents progression of osteoarthritis. Osteoarthritis can also be the result of imperfect techniques.[15]
Arthurs et al. (2006) declared that post-operative complications occur in 18% of all dogs. This is significantly higher in dogs weighing more than 20 kg. One of the most common complications is reluxation of the patella (8%).[16]
Surgical repair of PL by an experienced surgeon should have a 90 to 95 % success rate in reading active and pain-free use of the limb. This success rate is not as high (poor prognosis) with grade 4 patients with severe bone deformity and flexure contracture of the hamstring muscles.[10]

Soft tissue reconstruction

The aim of tissue reconstruction is to normalize the distance between the fabella and the patella on the opposite site of the luxation (shortening the extended retinaculum). The distance between patella and fabella at the other site of the luxation also become shorter because of the reconstruction.

Medial desmotomy

The medial retinaculum is incised for 3 to 5 mm parallel to the patella what relieves tension on the medial site. Which prevents to no more luxation of the patella.[1]

Overlap of the lateral or medial retinaculum

Surgery for both medial and lateral PL. The superficial layers of fascia and capsule are sutured to the fascia that remains attached to the patella and sometimes will be extended beyond the cranial midline of the joint and continues the length of the facial incision.

Lateral reinforcement

Is used to reinforce the lateral retinaculum to help restrain the patella within the trochlear groove.

Patellar and tibial antirotational suture ligaments

This technique creates a synthetic lateral patellar ligament by anchoring the lateral fabella to the patella with non-absorbable suture. Medial tibial rotation can be prevented by another suture passing from the lateral fabella to the tibial tubercle or distal patellar ligament.[10]

Other ways to operate PL is by bone reconstruction.[1] These surgeries start with an arthrotomy. First a craniolateral skin incision is made four centimeters proximal to the patella. Extend this incision two centimeters below the tibial tuberosity. The incision for the subcutaneous tissue is along the same line. After that the lateral retinaculum and joint capsule is accused, which will expose the joint.[17] (Figure 6A)

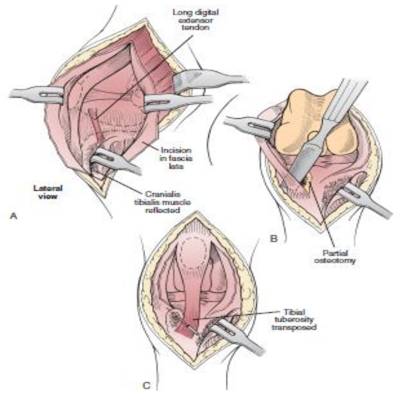


Figure 6. Transposition of the tibial tuberosity by medial PL. A; a craniolateral skin incision is made proximal to the patella. And will expose the joint. B; Partly osteotomize the tibial crest beneath the patellar ligament. C; Stabilizing the tibial tuberosity in its new site.[17]

Transposition of the tibial tuberosity

This surgery will move a part of the tibial tuberosity with patellar ligament which will be fixated after relocation to facilitate a stable seating of the tuberosity. The tuberosity position is caudal compared with its original position. Figure 6. shows this transposition of the tibial tuberosity by medial patella luxation.[3] (Figure 16)

Patella groove trochleoplasty

Patella groove trochleoplasty (wedge recession) is a surgery where the specialist will deepen the trochlea to restrain the patella and maintain the integrity of the patellofemoral articulation. After the exposure of the joint a surgeon will cut into the articular cartilage of the trochlea with a diamond shaped outline. Remove the diamond shaped part (osteochondral wedge) and deepen the recession in the trochlea by taking away the additional bone from one or both sides of the created femoral groove. If the patella fits for 50% in the newly groove the osteochondral wedge can be replaced. To keep the osteochondral wedge in place the joint uses the force of the patella and friction between the cancellous surfaces of the two cut edges.

Patella groove replacement

This treatment is used in dogs with chronic PL grade 4 or failed trochleoplasty which had led to a severe degenerative joint with condyle deformation, massive osteophytosis or chondromalacia. A prosthesis can be used to substitute the damaged condylar trochlea with a less invasive surgical technique. It is a titanium prosthesis (Kyon) which is shaped like a natural trochlea groove. This prosthesis is connected to the condyle with a perforated grade 4 titanium base plate.[3]

Hypothesis and research questions

Question (general):

What is the incidence and gradation of PL in Flatcoated Retriever, Jack Russell Terrier, Great Pyrenees, Kooiker, Markiesje, Labradoodle, Shiba, Fox terrier, Papillon and Havanese in the Netherlands till 2015? How does it compare with the historical database of Prof. Meutstege (1980-2011)?

Hypothesis (Chihuahua)

H0: There will be a decreased incidence of patella luxation in Chihuahua dogs than in the years before.

H1: There will be an increased incidence of patella luxation in Chihuahua dogs than in the years before.

H0: the incidence of patella luxation (grade 1 to 4) in Chihuahua dogs is smaller than 10% of the screened cohort.

H1: the incidence of patella luxation (grade 1 to 4) in Chihuahua dogs is higher than 10% of the screened cohort.

Materials and methods

For this analysis different breeds were selected, breeds that have been for a long time in the database but also breeds that recently increased the number of PL screenings. For example, the Chihuahua breeding organization obliged testing for PL since 2013 before breeding.[13] The results from 2011 unto 2015 were added to the large data base from 1975 to 2011 (Prof. Meutstege) which was available by the UKG (Prof. Meij, B).

The animals used in this research should fulfil certain criteria. The following selection criteria were used: every five years had N>10 and that operated dogs and dogs without age / sex / code are not included in this research. The tested dogs are 12 months or older. An overview of the total number of dogs and the dogs used in this thesis is shown in table 3.

Examination

Both patella were palpated to check possible mobility of the patella (using the standing or lateral recumbency position) and for arthritis. Each stifle was classified free (loose or normal), grade 1, grade 2, grade 3 or operated/grade 4.

The screening result is coded with a code system developed by Prof. Meutstege (Table 2). This code contains two letters, one letter for each leg. (Table 2). The code stands for the condition of the patella, from patella free, loose patella, and grade 1 PL to grade 4 PL and whether the PL is lateral, medial or bidirectional. There are also sub codes for PL that register whether PL occurs with or without rotation of the knee but rotation is excluded from this thesis.

Analysis

To calculate the incidence of PL, the percentage of each gradation (only calculated with the usable animals) was calculated for every five years. For Labradoodle and Markiesje the data are selected for every year, due to the small number of screened animals. The incidence can be used as a parameter to see if PL is decreased, increased or remained the same.

Table 2. The schedule of Meutstege. Coding scheme for PL screening results

	Left	Right
normal	**A**	**B**
loose to lateral	**P**	**Q**
loose to medial	**R**	**S**
loose to lateral and medial	**T**	**U**
luxated to lateral grade 1	**C**	**D**
luxated lateral torsion grade 1	**G**	**H**
luxated lateral and medial grade 1	**O**	**Z**
luxated lateral and medial torsion grade 1	**I**	**J**
luxated medial grade 1	**E**	**F**
luxabted medial torsion grade 1	**V**	**W**
luxated to lateral grade 2	**K**	**L**
luxated to medial grade 2	**M**	**N**
operated (of grade 3, 4)	**X**	**Y**

The code is determined on the outcome of the PL examination form. (Appendix 1: form patella examination)[3]

Results

Table 3. Total/total usable for each breed in database since 1975 to 2015. Percentage of male/female and for free/grade1/grade2/grade3/4

	Total in database 10-12-15	Total animals used in the research	Male (%) (total)	Female (%) (total)	Free (%) (total)	GR.1 (%) (total)	GR.2 (%) (total)	GR.3/4 (%) (total)
Chihuahua	876	862	31.1(268)	68.9 (594)	54.7 (472)	30.9 (267)	12.8 (110)	1.6 (14)
Flatcoated Retriever	4729	3387	48 (1627)	52 (1760)	80.1 (2712)	18.4 (625)	1.1 (38)	0.4 (12)
Kooiker	1313	1135	42.4 (482)	57.6 (653)	79.7 (905)	17.0 (193)	2.5 (28)	0.8 (9)
Labradoodle	98	93	19.4 (18)	80.6 (75)	84.9 (79)	12.9 (12)	2.2 (2)	0.0 (0)
Markiesje	285	273	49.8 (136)	50.2 (137)	73.6 (201)	25.3 (66)	21 (6)	0.0 (0)
Jack Russell Terrier	556	547	29.1 (159)	70.9 (388)	89.9 (492)	9.4 (51)	0.7 (4)	0.0 (0)
Fox Terrier	175	169	29.0 (49)	71.0 (120)	90.5 (153)	9.5 (16)	0.0 (0)	0.0 (0)
Great Pyrenees	125	90	41.1 (37)	58.9 (53)	92.2 (83)	7.8 (7)	0.0 (0)	0.0 (0)
Shiba	299	274	38.0 (104)	62.0 (170)	71.9 (197)	24.1 (66)	4.0 (11)	0.0 (0)
Papillon	171	156	33.3 (52)	66.7 (104)	78.8 (123)	15.4 (24)	5.8 (9)	0 (0)
Havanese	158	136	27.9 (38)	72.1 (98)	72.1 (98)	27.9 (38)	0.0 (0)	0 (0)
Total	8785	7109	2970	4152	5515	1361	208	35

Table 4. Incidence of all breeds, from the first Meutstege database to the results from 2010 to 2015

		Meutstege 1975 - 2010 (%)				Results 2015 (%)			
	Started	Free	GR. 1	GR.2	GR. 3/4	Free	GR.1	GR.2	GR. 3/4
Chihuahua	2005	53.1	26.9	17.7	2.3	55.0 +	31.6 +	11.9	1.5
Flatcoated Retriever	1980	63.5	36.5	N.A.	N.A.	86.7 +	11.4	1.9 +	N.A.
Kooiker	1990	69.2	19.2	3.9	7.7	84.4 +	12.1	3.0	0.5
Labradoodle	2011	66.7	33.3	N.A.	N.A.	78.3 +	13.0	8.7 +	N.A.
Markiesje	2009	80.0	20.0	N.A.	N.A.	61.1	30.0 +	6.9 +	N.A.
Jack Russel terrier	2000	83.6	13.9	2.5	N.A.	92.2	7.3	0.5	N.A.
Fox Terrier	2000	76.2	23.8	N.A.	N.A.	92.1	7.9	N.A.	N.A.
Great Pyrenees	2000	91.7	8.3	N.A.	N.A.	100	N.A.	N.A.	N.A.
Shiba	2000	72.4	25.9	1.7	N.A.	72.4	22.8	4.8	N.A.
Papillon	2000	82.6	8.7	8.7	N.A.	80.8	12.8 +	6.4	N.A.
Havanese	2000	77.1	22.9	N.A.	N.A.	74.4	25.6 +	N.A.	N.A.
N.A.: Not available + : increased incidence									

Table 5. Gender predisposition of all eleven breeds of this research till 2015 of the whole population

	Grade 1 (%)		Grade 2 (%)		Grade 3/4 (%)	
	male	female	male	female	male	female
Chihuahua	8.9	21.9	3.9	8.8	0.6	1.0
Flatcoated Retriever	6.7	12.0	0.4	0.7	0.2	0.1
Kooiker	5.9	11.1	0.9	1.6	0.6	0.2
Labradoodle	1.1	11.8	-	2.2	-	-
Markiesje	10.6	13.6	0.7	1.5	-	-
Jack Russell Terrier	1.1	2.8	0.2	0.5	-	-
Fox Terrier	1.8	7.7	-	-	-	-
Great Pyrenees	3.3	5.6	-	-	-	-
Shiba	7.7	16.4	1.5	2.6	-	-
Papillon	4.5	10.9	0.6	5.1	-	-
Havanese	4.4	23.5	-	-	-	-

Chihuahua

Table 6. Male Chihuahua, results between 2005 to 2015

	05-10	10-15	Total
VRIJ	23	129	152
GR.1	10	67	77
GR.2	10	24	34
GR. 3/4	0	5	5
Total	43	225	268

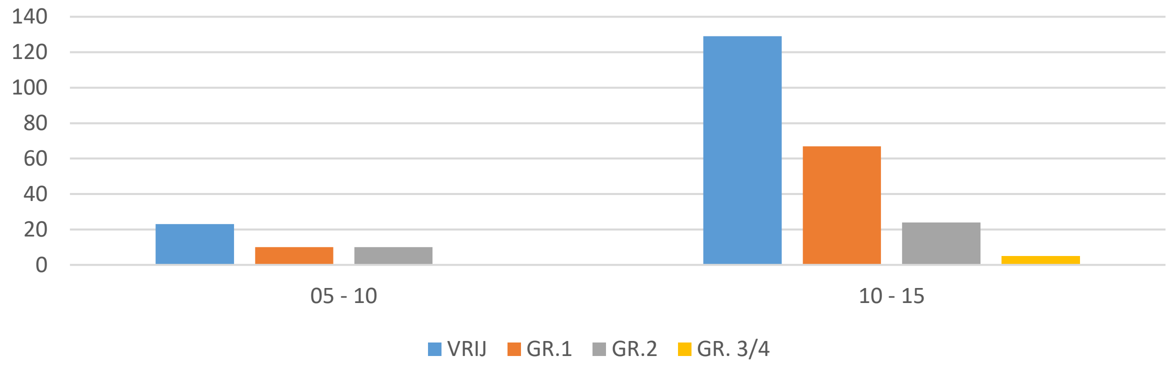


Figure 7: Male Chihuahua, results from 2005 to 2015

Table 7. Female Chihuahua, results from 2005 to 2015

	05 - 10	10 - 15	Total
VRIJ	46	274	320
GR.1	25	164	189
GR.2	13	63	76
GR. 3/4	3	6	9
Total	87	507	594

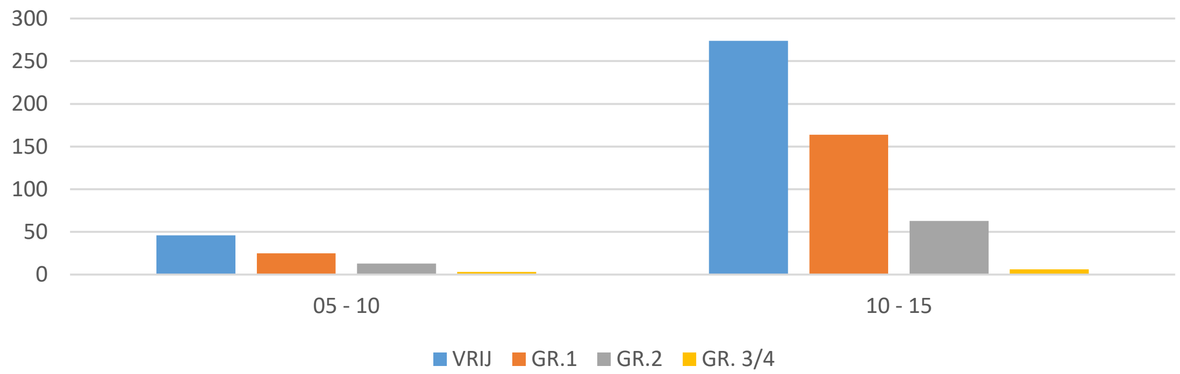


Figure 8. Female Chihuahua, results from 2005 to 2015

Table 8. Total results Chihuahua from 2005 to 2015

	05 - 10	10 - 15	Total
VRIJ	69	403	472
GR.1	35	231	266
GR.2	23	87	110
GR. 3/4	3	11	14
Total	130	732	862

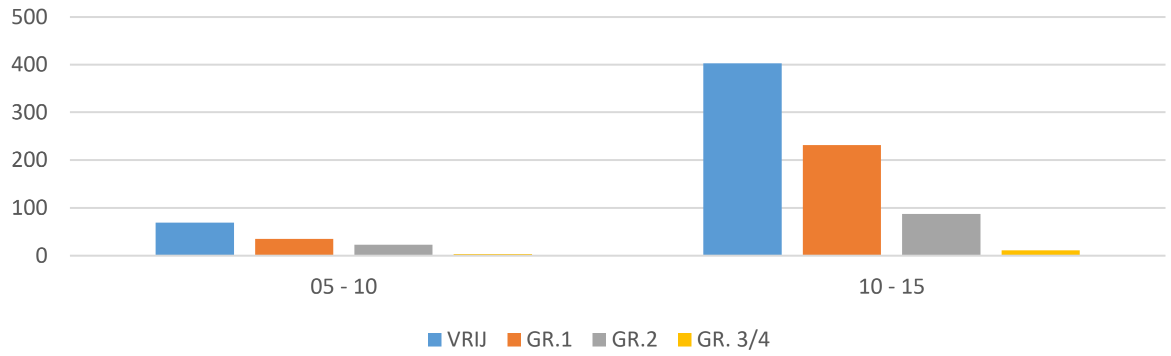


Figure 9. Total results Chihuahua, from 2005 to 2015

Table 9. Incidence Chihuahua from 2005 to 2015 in percent (%)

	05 – 10 (%)	10 – 15 (%)
VRIJ	53.1	55.0
GR.1	26.9	31.6
GR.2	17.7	11.9
GR. 3/4	2.3	1.5
Total	100	100

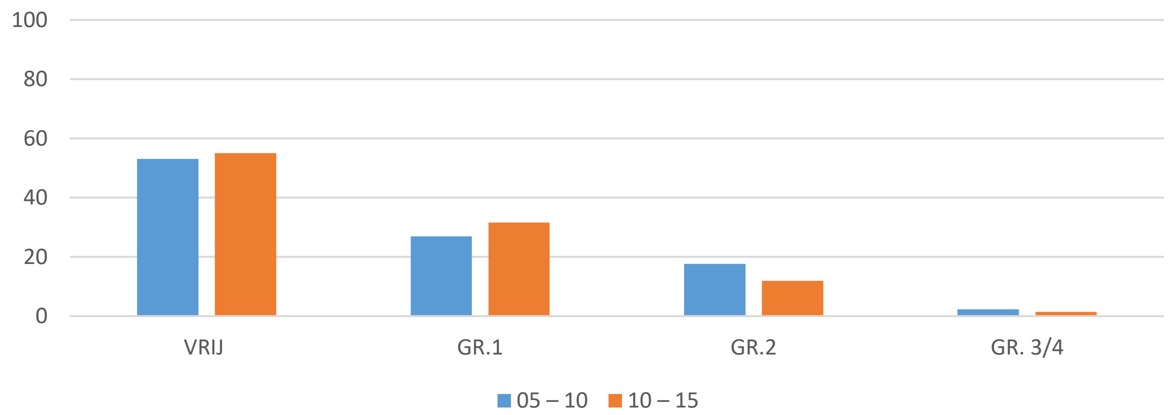


Figure 10. Incidence Chihuahua from 2005 to 2015 in percent (%)

Flatcoated Retriever

Table 10. Male Flatcoated Retriever, results from 1980 to 2015

	80 - 85	85 - 90	90 - 95	95 - 00	00 - 05	05 - 10	10 - 15	Total
VRIJ	21	113	8	212	451	338	238	1381
GR.1	14	34	3	28	56	59	30	224
GR.2	0	0	2	1	5	3	4	15
GR.3/4	0	0	0	3	3	1	0	7
Total	35	147	13	244	515	401	272	1627

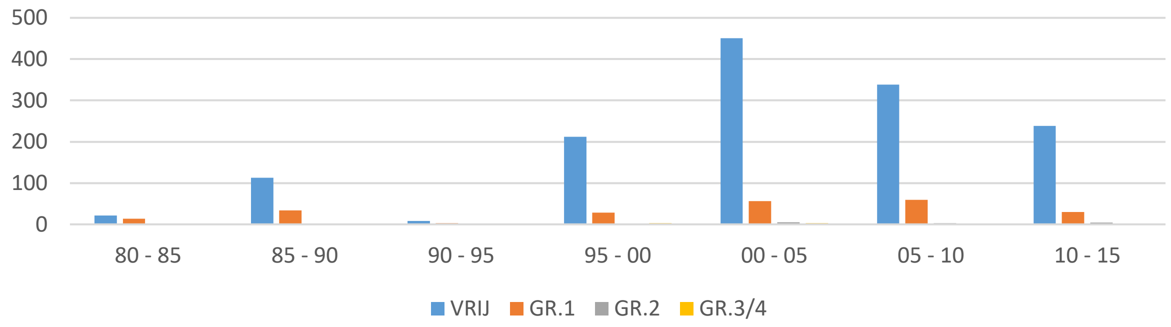


Figure 11. Male Flatcoated Retriever, results from 1975 to 2015

Table 11. Female Flatcoated Retriever, results from 1980 to 2015

	80 - 85	85 - 90	90 - 95	95 - 00	00 - 05	05 - 10	10 - 15	Total
VRIJ	33	101	9	191	397	335	265	1331
GR.1	17	68	16	59	124	81	36	401
GR.2	0	1	1	7	5	2	7	23
GR.3/4	0	0	0	0	1	4	0	5
Total	50	170	26	257	527	422	308	1760

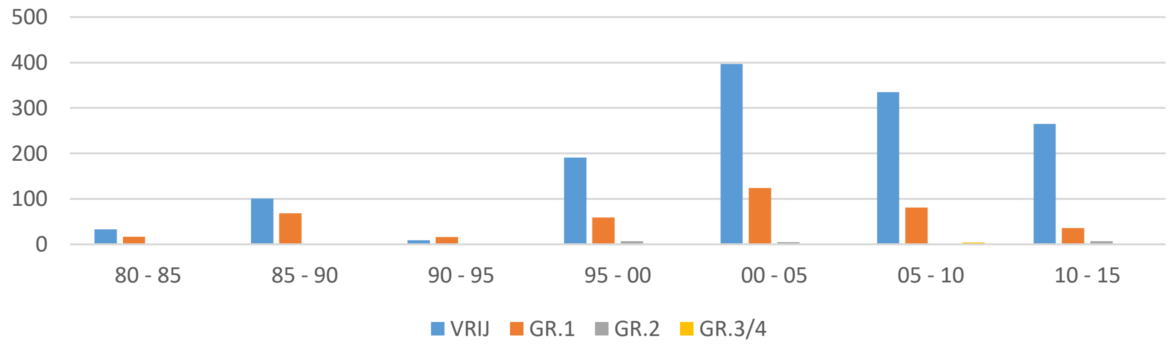


Figure 12. Female Flatcoated Retriever, results from 1980 to 2015

Table 12. Total Flatcoated Retriever, results from 1980 to 2015

	80 - 85	85 - 90	90 - 95	95 - 00	00 - 05	05 - 10	10 - 15	Total
VRIJ	54	214	17	403	848	673	503	2712
GR.1	31	102	19	87	180	140	66	625
GR.2	0	1	3	8	10	5	11	38
GR3/4	0	0	0	3	4	5	0	12
Total	85	317	39	501	1042	823	580	3387

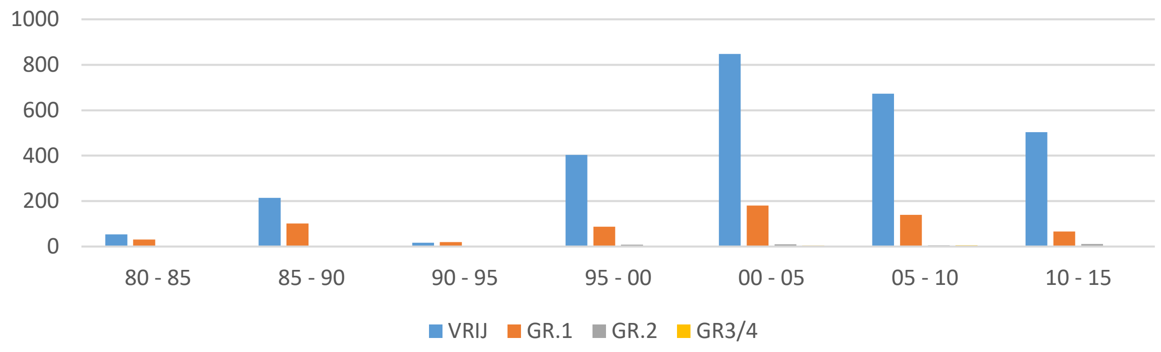


Figure 13. Total Flatcoated Retriever, results from 1980 to 2015

Table 13. Incidence Flatcoated Retriever, results from 1980 to 2015

	80 – 85 (%)	85 – 90(%)	90 – 95 (%)	95 – 00(%)	00 – 05(%)	05 – 10(%)	10 – 15(%)
VRIJ	63.5	67.5	43.6	80.4	81.4	81.8	86.7
GR.1	36.5	32.2	48.7	17.4	17.3	17.0	11.4
GR.2	0.0	0.3	7.7	1.6	1.0	0.6	1.9
GR.3/4	0.0	0.0	0.0	0.6	0.3	0.6	0.0
total	100	100	100	100	100	100	100

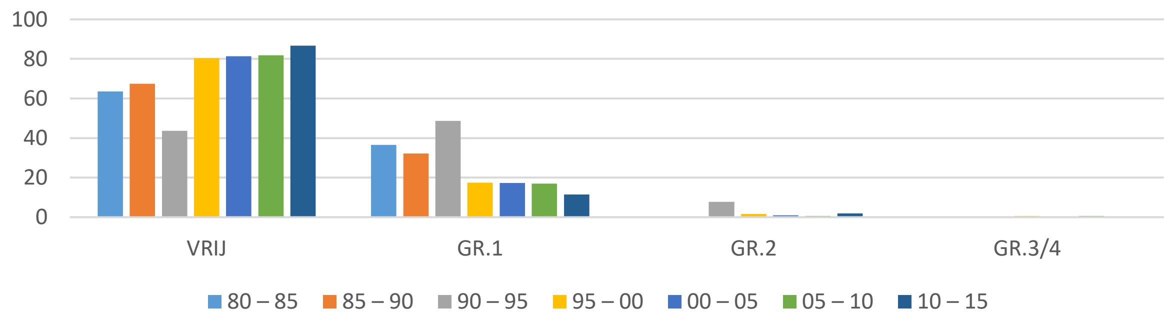


Figure 14. Incidence Flatcoated Retriever, results from 1980 to 2015 in percent (%)

Kooiker

Table 14. Male Kooiker, results from 1990 to 2015

	90 - 95	95 - 00	00 - 05	05 - 10	10 - 15	Total
VRIJ	8	37	81	126	146	398
GR.1	4	5	20	24	14	67
GR.2	0	2	4	1	3	10
GR.3/4	2	1	2	0	2	7
Total	14	45	107	151	165	482

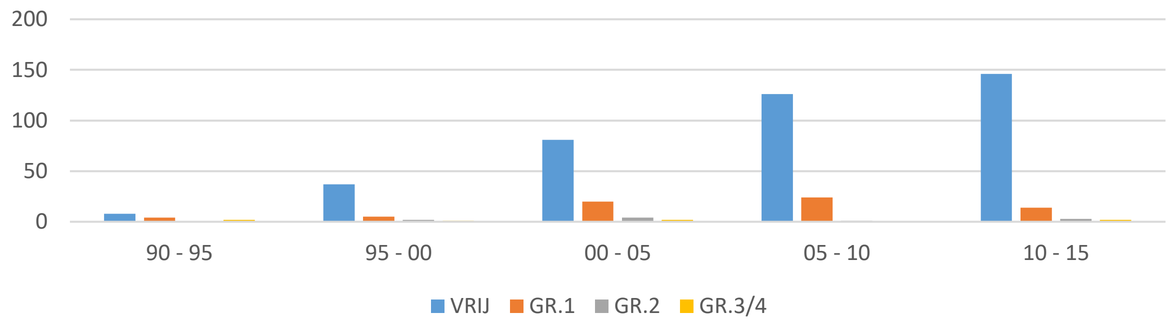


Figure 15. Male Kooiker, results from 1990 to 2015

Table 15. Female Kooiker, results from 1990 to 2015

	90 - 95	95 - 00	00 - 05	05 - 10	10 - 15	Total
VRIJ	10	52	120	158	167	507
GR.1	1	20	28	46	31	126
GR.2	1	3	5	1	8	18
GR.3/4	0	1	1	0	0	2
Total	12	76	154	205	206	653

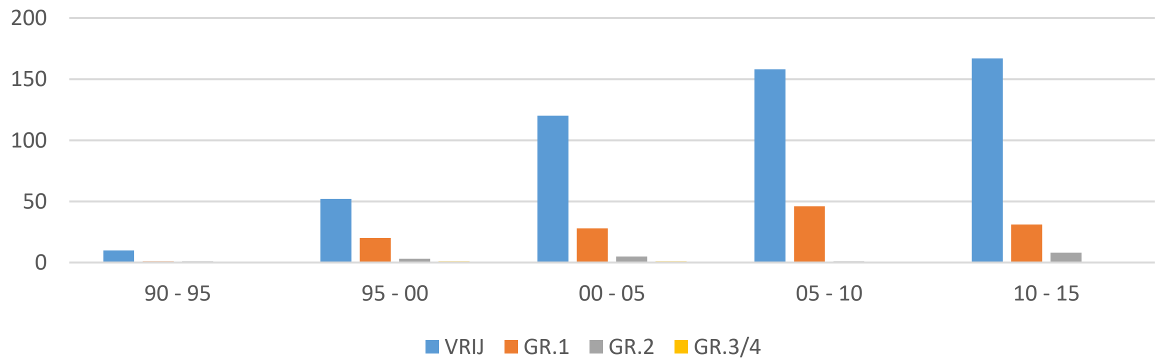


Figure 16. Female Kooiker, results from 1990 to 2015

Table 16. Total Kooiker, results from 1990 to 2015

	90 - 95	95 - 00	00 - 05	05 - 10	10 - 15	Total
VRIJ	18	89	201	284	313	905
GR.1	5	25	48	70	45	193
GR.2	1	5	9	2	11	28
GR.3/4	2	2	3	0	2	9
Total	26	121	261	356	371	1135

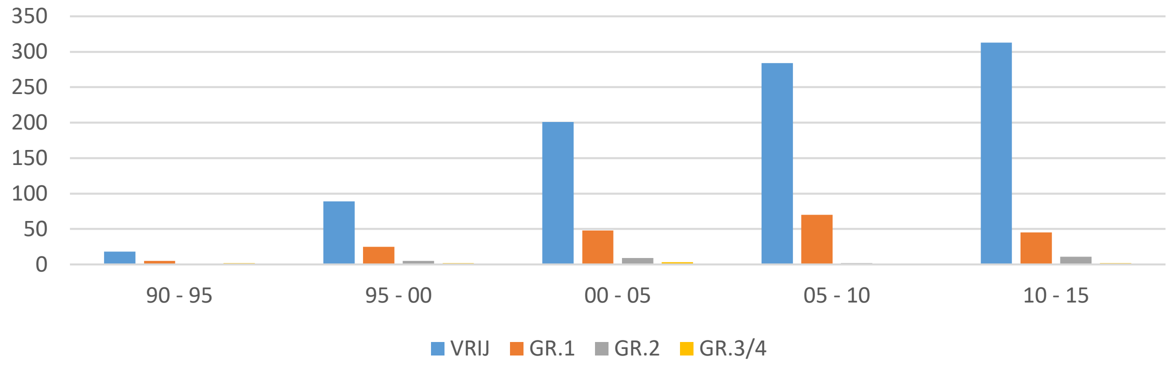


Figure 17. Total Kooiker, results from 1990 to 2015

Table 17. Incidence Kooiker, results from 1990 to 2015

	90 – 95 (%)	95 – 00 (%)	00 – 05 (%)	05 – 10 (%)	10 – 15 (%)
VRIJ	69.2	73.5	77.0	79.8	84.4
GR.1	19.2	20.7	18.4	19.7	12.1
GR.2	3.9	4.1	3.4	0.5	3.0
GR.3/4	7.7	1.7	1.2	0.0	0.5
Total	100	100	100	100	100

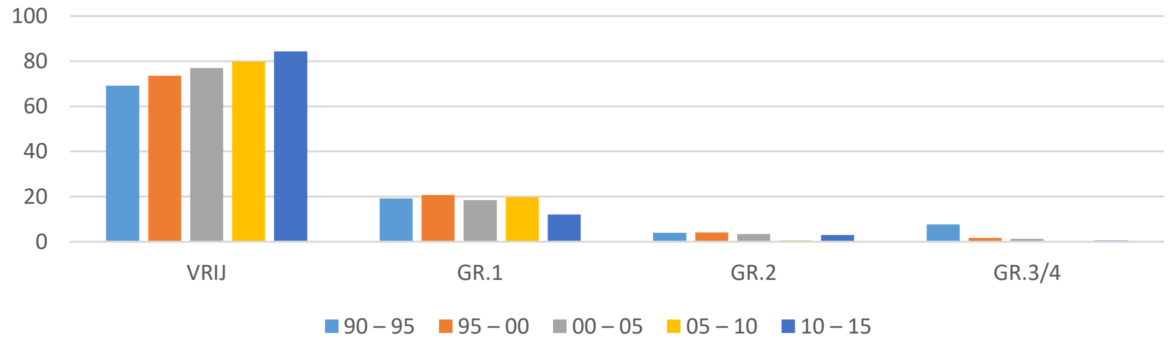


Figure 18. Incidence Kooiker, results from 1990 to 2015

Labradoodle

Table 18. Male Labradoodle, results from 2011 to 2015

	2011	2012	2013	2014	Total
VRIJ	0	4	8	5	17
GR.1	0	0	1	0	1
GR.2	0	0	0	0	0
Total	0	4	9	5	18

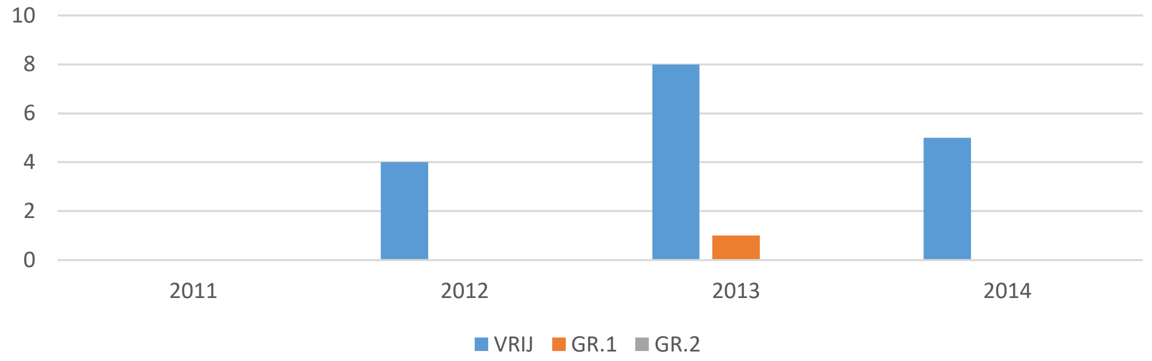


Figure 19. Male Labradoodle, results from 2011 to 2015

Table 19. Female Labradoodle, results from 2011 to 2015

	2011	2012	2013	2014	Total
VRIJ	2	18	29	13	62
GR.1	1	3	4	3	11
GR.2	0	0	0	2	2
Total	3	21	33	18	75

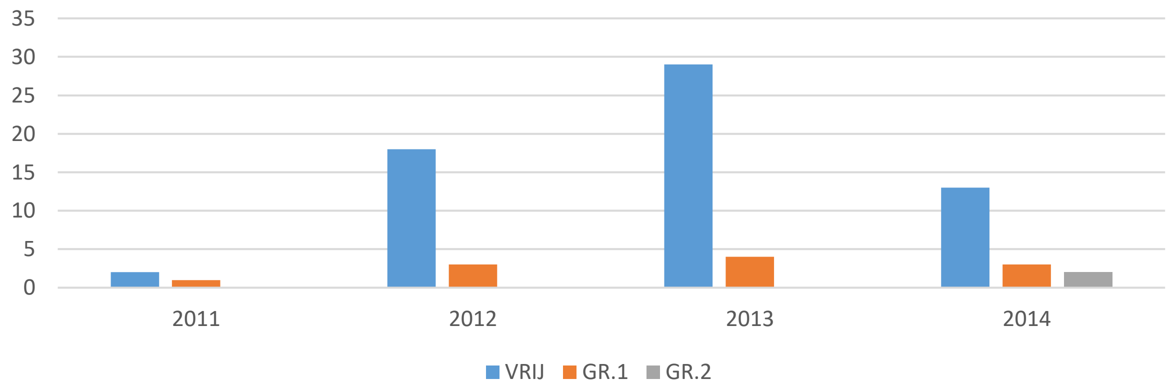


Figure 20. Female Labradoodle, results from 2011 to 2015

Table 20. Total Labradoodle, results from 2011 to 2015

	2011	2012	2013	2014	Total
VRIJ	2	22	37	18	79
GR.1	1	3	5	3	12
GR.2	0	0	0	2	2
Total	3	25	42	23	93

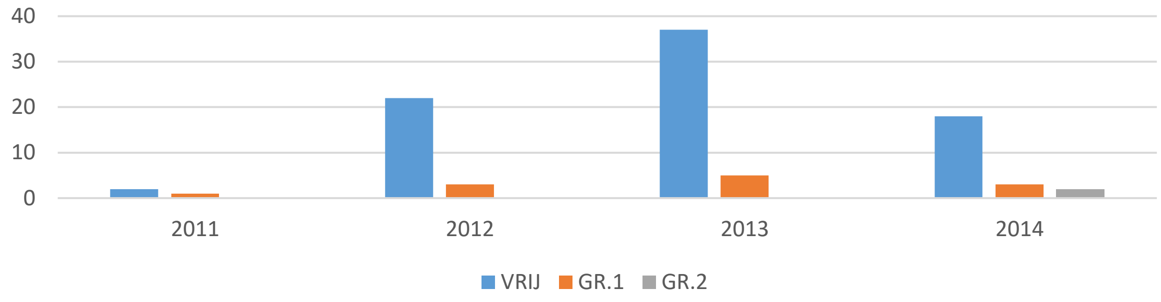


Figure 21. Total Labradoodle, results from 2011 to 2015

Table 21. Incidence Labradoodle, results from 2011 t0 2015

	2011	2012	2013	2014
VRIJ	66.7	88.0	88.1	78.3
GR.1	33.3	12.0	11.9	13.0
GR.2	0.0	0.0	0.0	8.7
Total	100	100	100	100

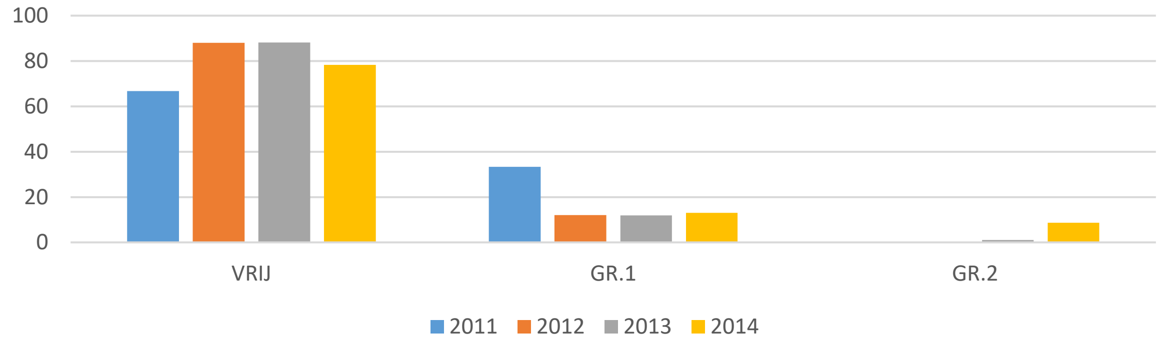


Figure 22. Incidence Labradoodle, results from 2011 to 2015

Markiesje

Table 22. Male Markiesje, results from 2009 to 2015

	2009	2010	2011	2012	2013	2014	Total
VRIJ	3	18	18	34	19	13	105
GR.1	0	4	2	11	9	3	29
GR.2	0	0	0	0	1	1	2
Total	3	22	20	45	29	17	136

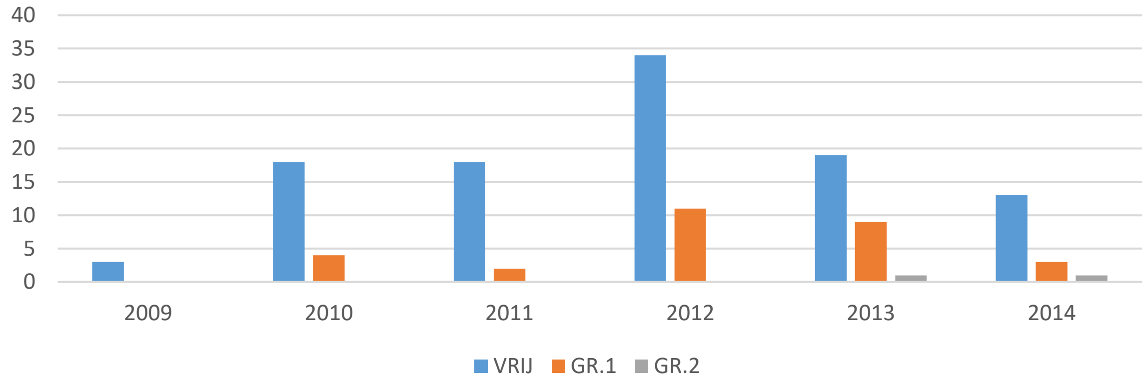


Figure 23. Male Markiesje, results from 2009 to 2015

Table 23. Female Markiesje, results from 2009 to 2015

	2009	2010	2011	2012	2013	2014	Total
VRIJ	5	17	25	22	22	5	96
GR.1	2	9	5	5	10	6	37
GR.2	0	1	0	0	2	1	4
Total	7	27	30	27	34	12	137

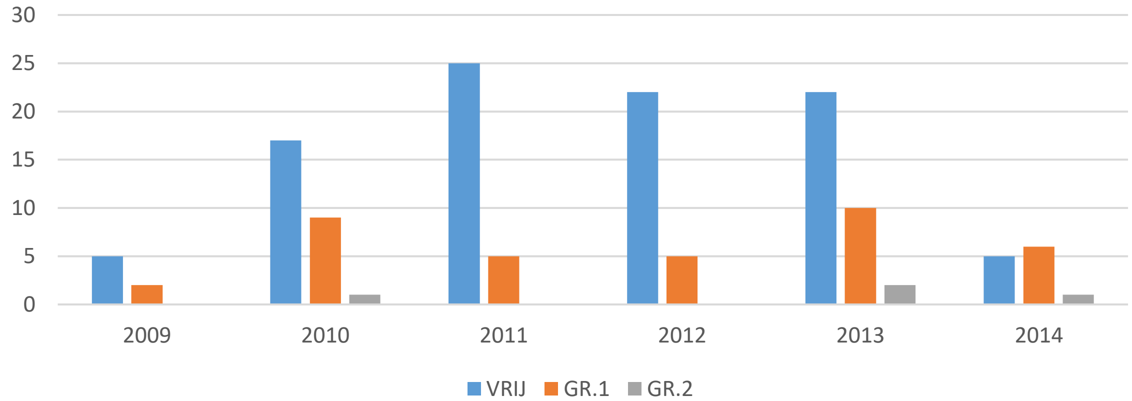


Figure 24. Female Markiesje, results from 2009 to 2015

Table 24. Total Markiesje, results from 2009 to 2015

	2009	2010	2011	2012	2013	2014	Total
VRIJ	8	35	43	56	41	18	201
GR.1	2	13	7	16	19	9	66
GR.2	0	1	0	0	3	2	6
Total	10	49	50	72	63	29	273

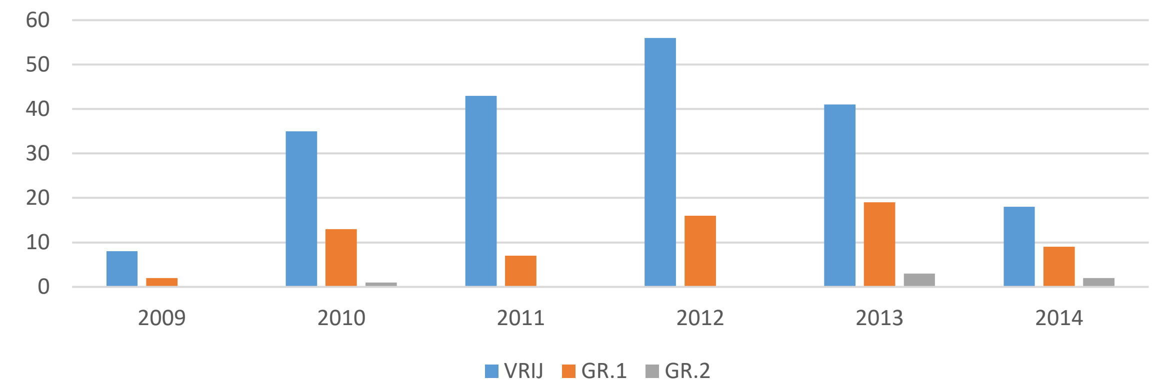


Figure 25. Total Markiesje, results from 2009 to 2015

Table 25. Incidence Markiesje, results from 2009 to 2015

	2009 (%)	2010 (%)	2011 (%)	2012 (%)	2013 (%)	2014 (%)
VRIJ	80.0	71.4	86.0	77.8	65.1	61.1
GR.1	20.0	26.5	14.0	22.2	30.1	31.0
GR.2	0.0	2.1	0.0	0.0	4.8	6.9
Total	100	100	100	100	100	100

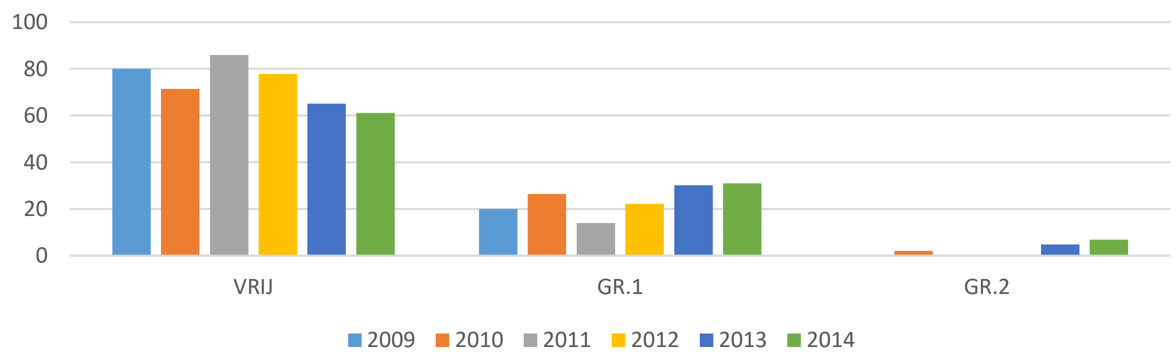


Figure 26. Incidence Markiesje, results from 2005 to 2015

Jack Russell Terrier

Table 26. Male Jack Russell Terrier, results from 2000 to 2015

	00 - 05	05 - 10	10 - 15	Total
VRIJ	24	77	51	152
GR.1	0	4	2	6
GR.2	1	0	0	1
Total	25	81	53	159

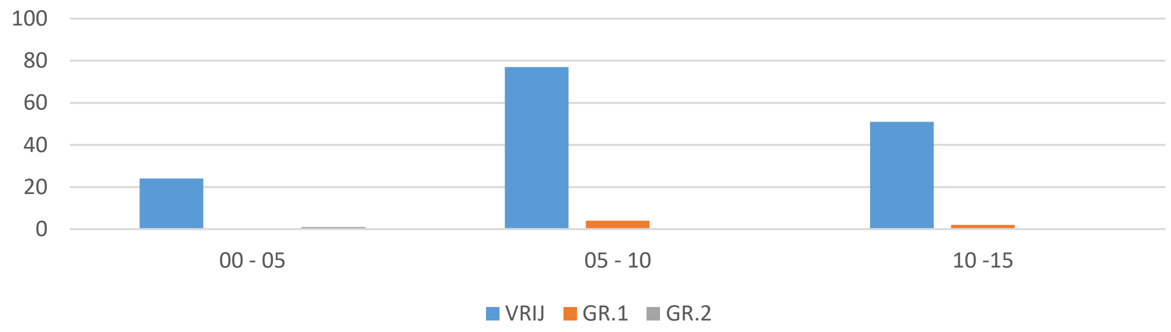


Figure 27. Male Jack Russell Terrier, results from 2000 to 2015

Table 27. Female Jack Russell Terrier, results from 2000 to 2015

	00 - 05	05 - 10	10 - 15	Total
VRIJ	42	172	126	340
GR.1	11	22	12	45
GR.2	1	1	1	3
Total	54	195	139	388

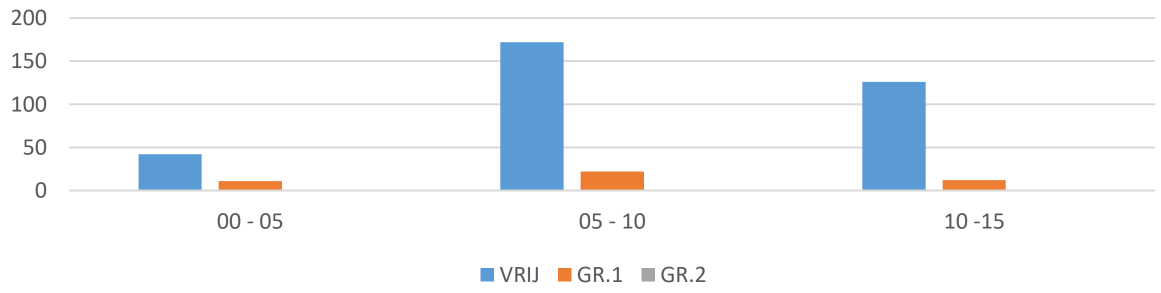


Figure 28. Female Jack Russell Terrier, results from 2000 to 2015

Table 28. Total Jack Russell Terrier, results from 2000 to 2015

	00 - 05	05 - 10	10 - 15	Total
VRIJ	66	249	177	492
GR.1	11	26	14	51
GR.2	2	1	1	4
Total	79	276	192	547

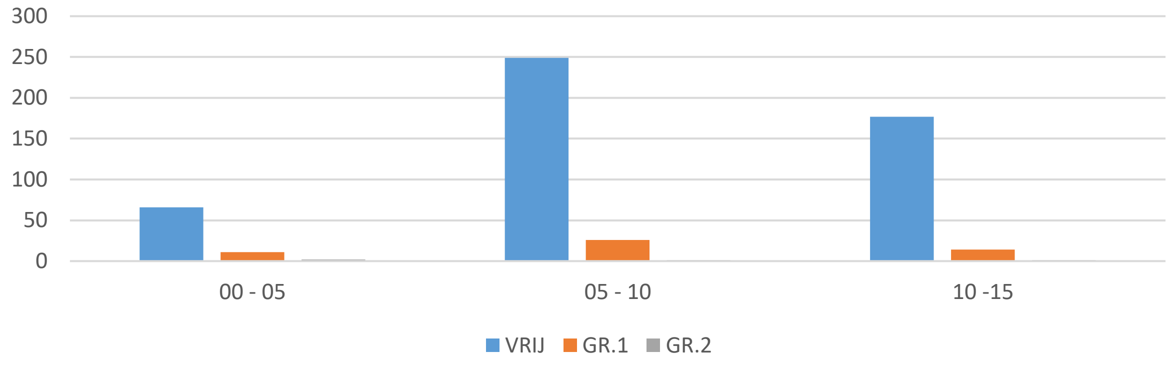


Figure 29. Total Jack Russell Terrier, results from 2000 to 2015

Table 29. Incidence Jack Russell Terrier, results from 2000 to 2015

	00 – 05 (%)	05 – 10 (%)	10 – 15 (%)
VRIJ	83.5	90.2	92.2
GR.1	13.9	9.4	7.3
GR.2	2.5	0.4	0.5
Total	100	100	100

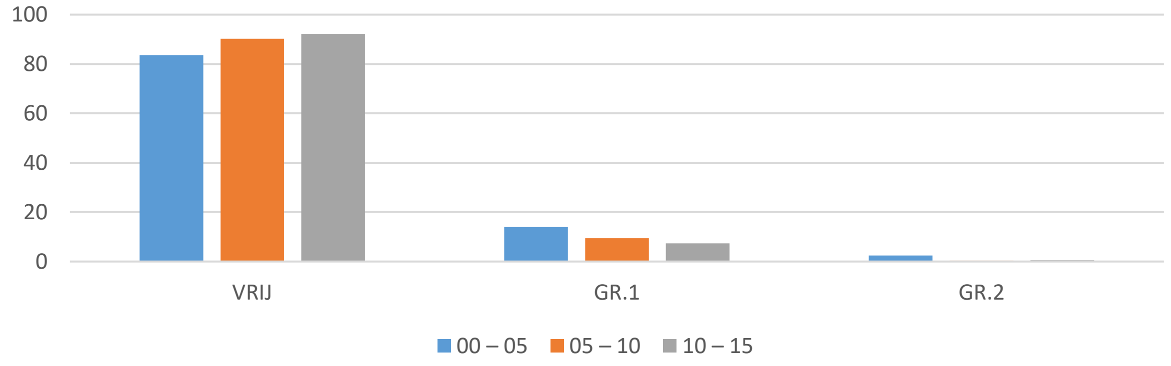


Figure 30. Incidence Jack Russell Terrier, results from 2000 to 2015

Fox terrier

Table 30. Male Fox Terrier, results from 2000 to 2015

	00 - 05	05 - 10	10 - 15	Total
VRIJ	10	29	7	46
GR.1	1	0	2	3
Total	11	29	9	49

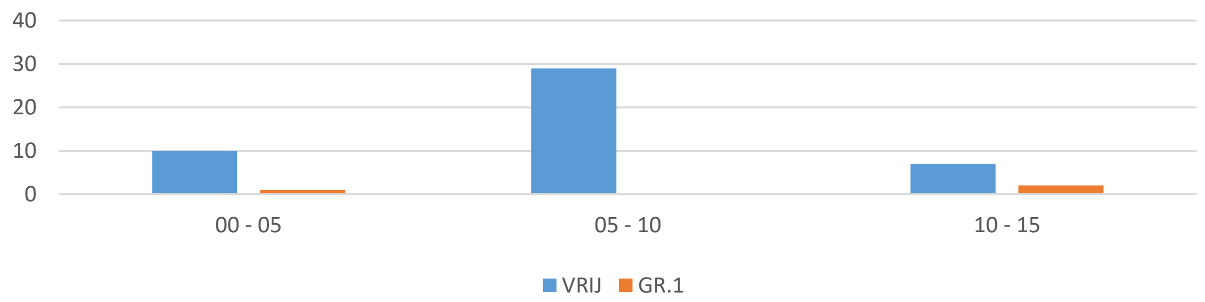


Figure 31. Male Fox Terrier, results from 2000 to 2015

Table 31. Female Fox Terrier, results from 2000 to 2015

	00 - 05	05 - 10	10 - 15	Total
VRIJ	22	57	28	107
GR.1	9	3	1	13
Total	31	60	29	120

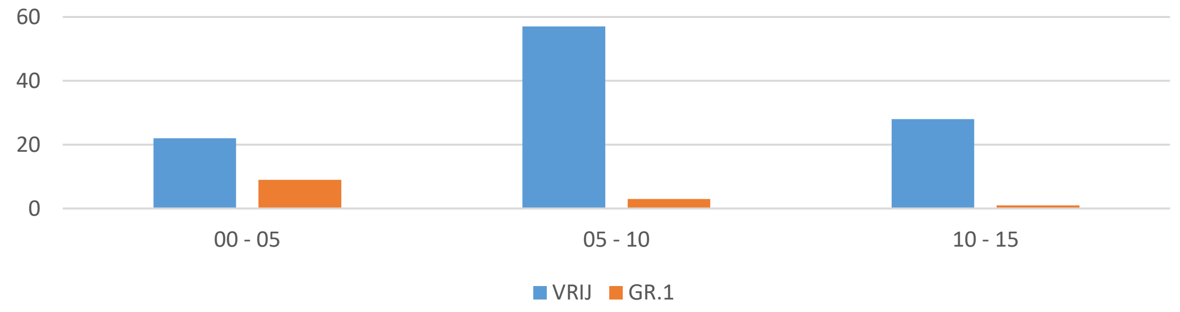


Figure 32. Female Fox Terrier, results from 2000 to 2015

Table 32. Total Fox Terrier, results from 2000 to 2015

	00 - 05	05 - 10	10 - 15	total
VRIJ	32	86	35	153
GR.1	10	3	3	16
Total	42	89	38	169

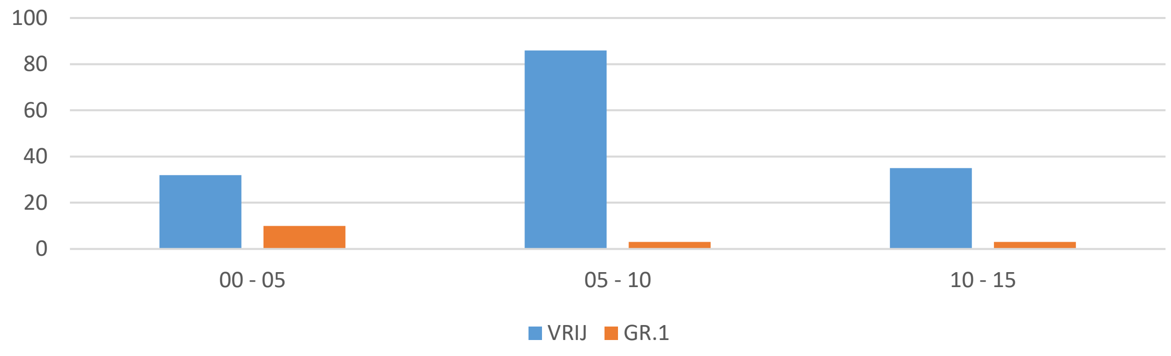


Figure 33. Total Fox Terrier, results from 2000 to 2015

Table 33. Incidence Fox Terrier, results from 2000 to 2015

	00 – 05 (%)	05 – 10 (%)	10 – 15 (%)
VRIJ	76.2	96.6	92.1
GR.1	23.8	3.4	7.9
Total	100	100	100

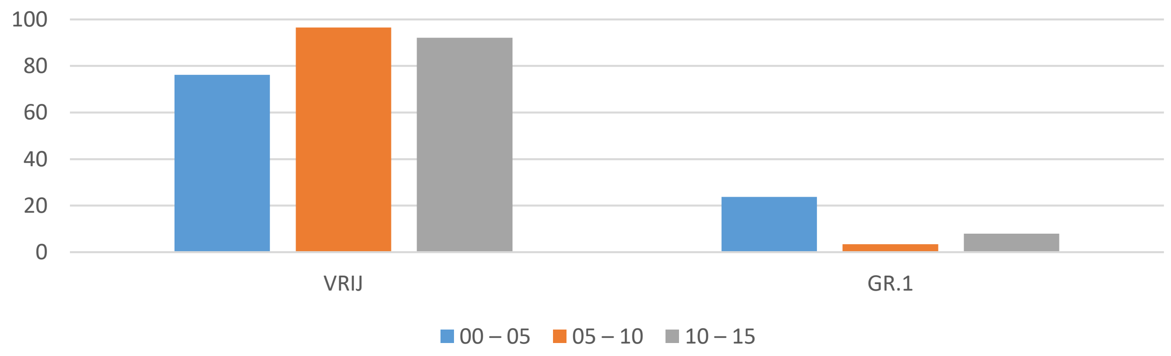


Figure 34. Incidence Fox Terrier, results from 2000 to 2015

Great Pyrenees

Table 34. Male Great Pyrenees, results from 2000 to 2015

	00 - 05	05 - 10	10 - 15	Total
VRIJ	8	21	5	34
GR.1	1	2	0	3
Total	9	23	5	37

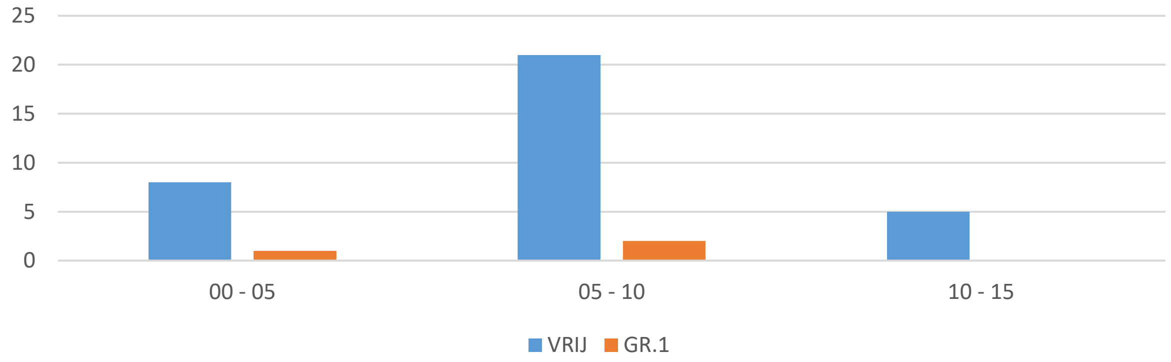


Figure 35. Male Great Pyrenees, results from 2000 to 2015

Table 35. Female Great Pyrenees, results from 2000 to 2015

	00 - 05	05 - 10	10 - 15	Total
VRIJ	14	24	11	49
GR.1	1	3	0	4
Total	15	27	11	53

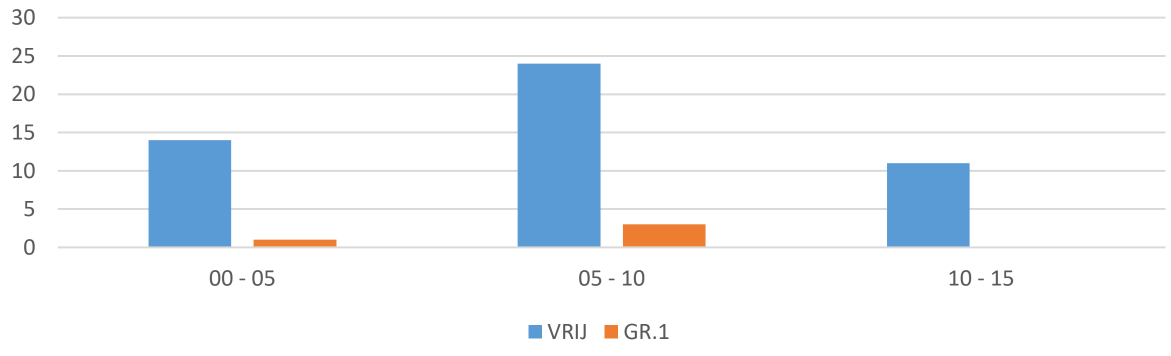


Figure 36. Female Great Pyrenees, results 2000 to 2015

Table 36. Total Great Pyrenees, results from 2000 to 2015

	00 - 05	05 - 10	10 - 15	Total
VRIJ	22	45	16	83
GR.1	2	5	0	7
Total	24	50	16	90

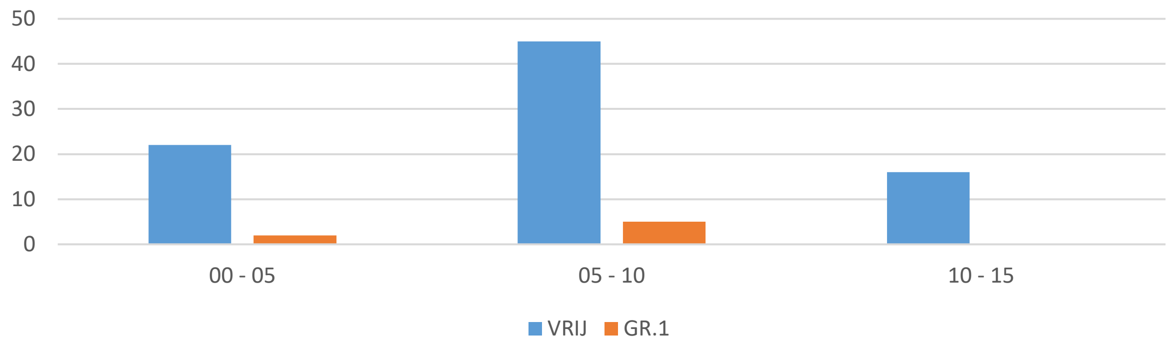
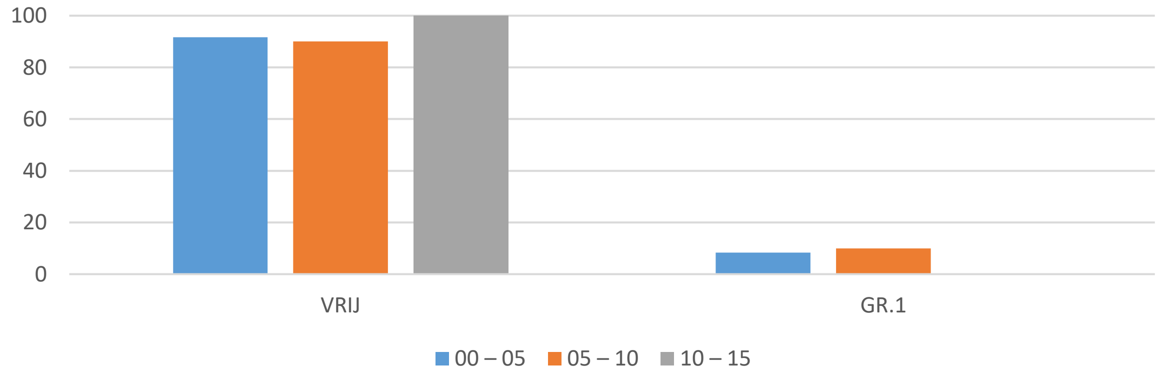


Figure 37. Total Great Pyrenees, results from 2000 to 2015

Table 37. Incidence Great Pyrenees, results from 2000 to 2015

	00 – 05 (%)	05 – 10 (%)	10 – 15 (%)
VRIJ	91.7	90.0	100.0
GR.1	8.3	10.0	0.0
Total	100	100	100



Incidence 37. Incidence Great Pyrenees, results from 2000 to 2010

Shiba

Table 38. Male Shiba, results from 2000 to 2015

	00 - 05	05 - 10	10 - 15	Total
VRIJ	18	31	30	79
GR.1	3	11	7	21
GR.2	0	3	1	4
Total	21	45	38	104

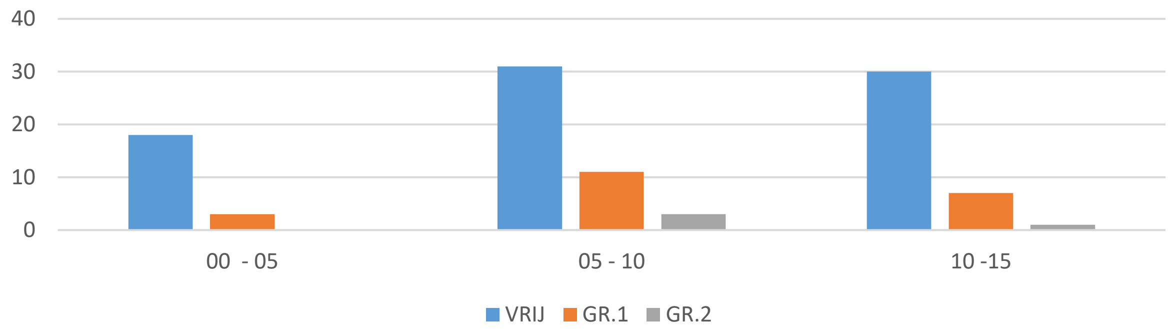


Figure 39. Male results from 2000 to 2015

Table 39. Female Shiba, results from 2000 to 2015

	00 - 05	05 - 10	10 - 15	Total
VRIJ	24	48	46	118
GR.1	12	16	17	45
GR.2	1	2	4	7
Total	37	66	67	170

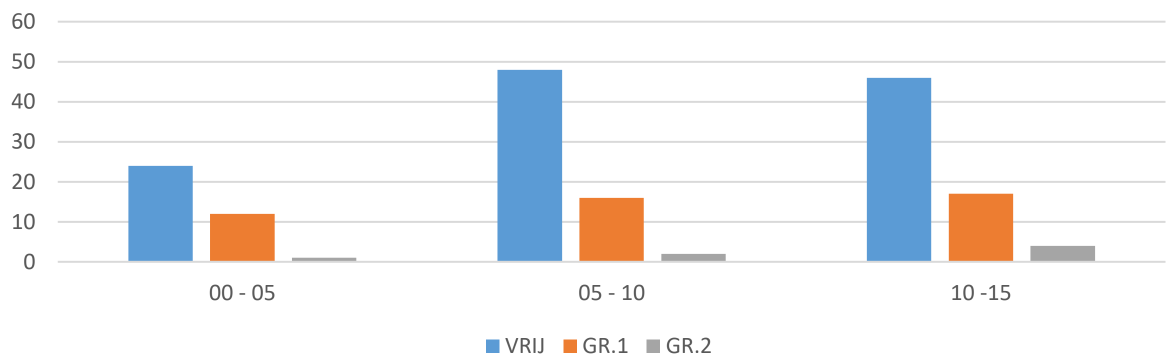


Figure 40. Female Shiba, results from 2000 to 2015

Table 40. Total Shiba, results from 2000 to 2015

	00 - 05	05 - 10	10 - 15	Total
VRIJ	42	79	76	197
GR.1	15	27	24	66
GR.2	1	5	5	11
Total	58	111	105	274

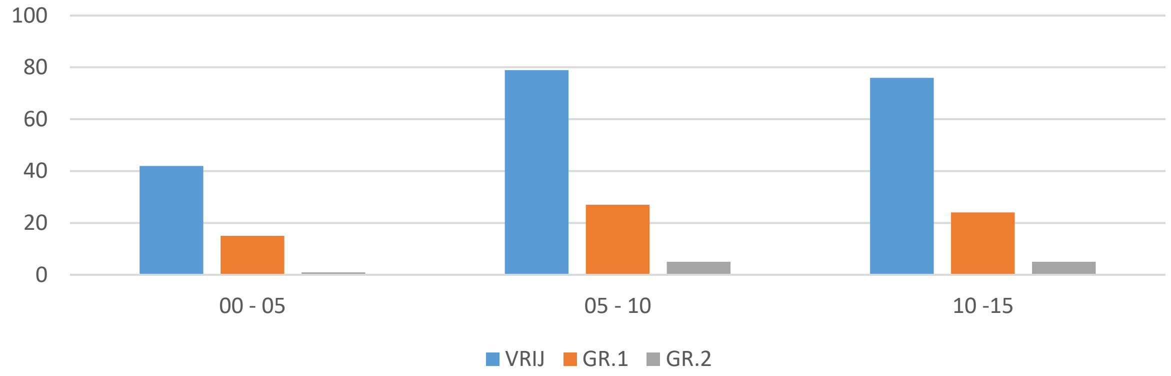


Figure 41. Total Shiba, results from 2000 to 2015

Table 41. Incidence Shiba, results from 2000 to 2015

	00 – 05 (%)	05 – 10 (%)	10 – 15 (%)
VRIJ	72.4	71.2	72.4
GR.1	25.9	24.3	22.8
GR.2	1.7	4.5	4.8
Total	100	100	100

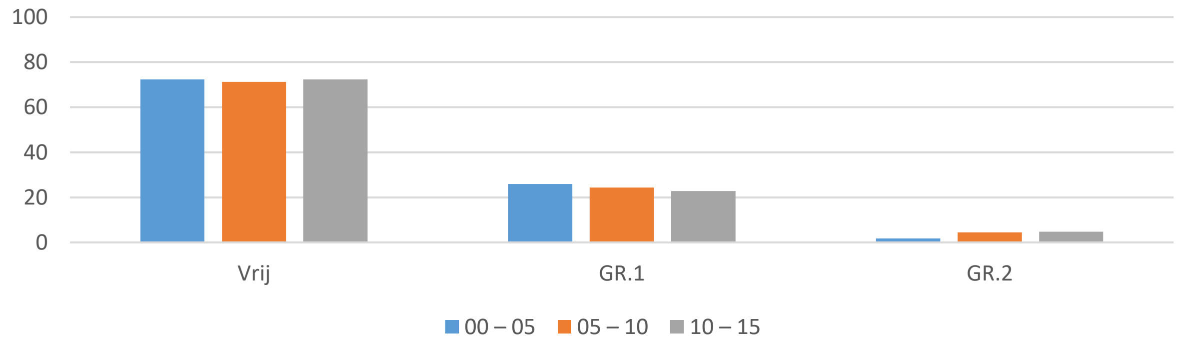


Figure 42. Incidence Shiba, results from 2000 to 2015

Papillon

Table 42. Male Papillon, results from 2000 to 2015

	00 - 05	05 - 10	10 - 15	Total
VRIJ	11	21	12	44
GR.1	2	2	3	7
GR.2	1	0	0	1
Total	14	23	15	52

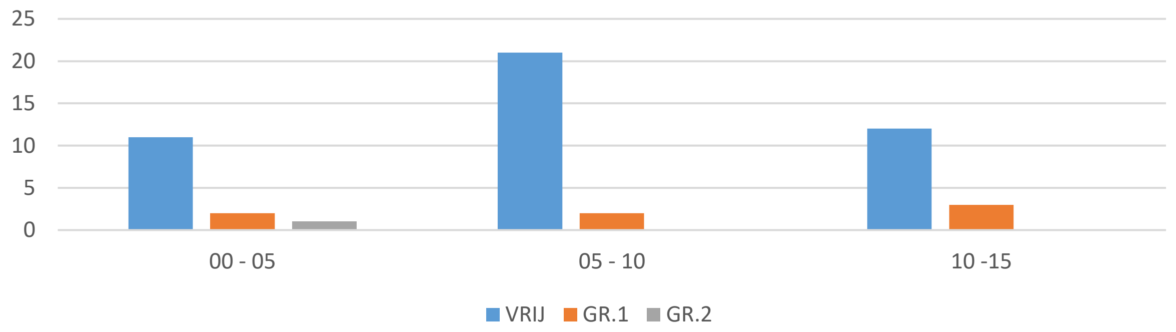


Figure 43. Male Papillon, results from 2000 to 2015

Table 43. Female Papillon, results from 2000 to 2015

	00 - 05	05 - 10	10 - 15	Total
VRIJ	8	45	26	79
GR.1	0	14	3	17
GR.2	1	4	3	8
Total	9	63	32	104

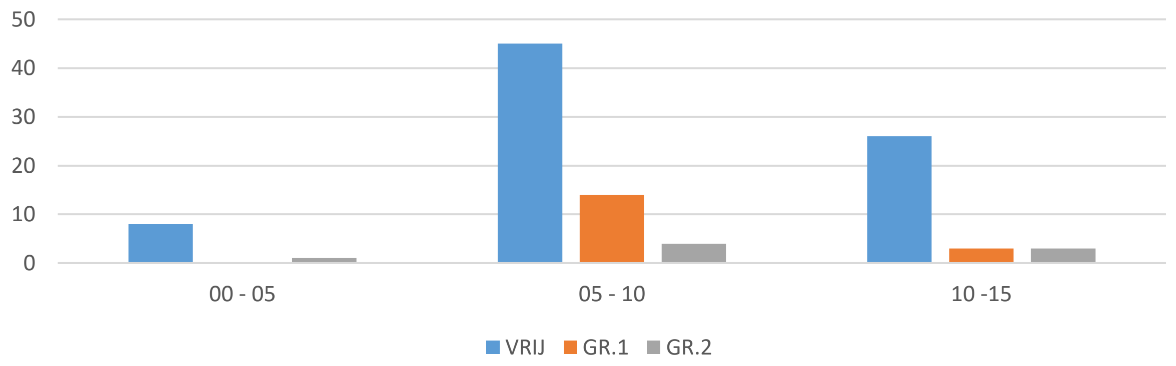


Figure 44. Female Papillon, results from 2000 to 2015

Table 44. Total Papillon, results from 2000 to 2015

	00 - 05	05 - 10	10 - 15	Total
VRIJ	19	66	38	123
GR.1	2	16	6	24
GR.2	2	4	3	9
Total	23	86	47	156

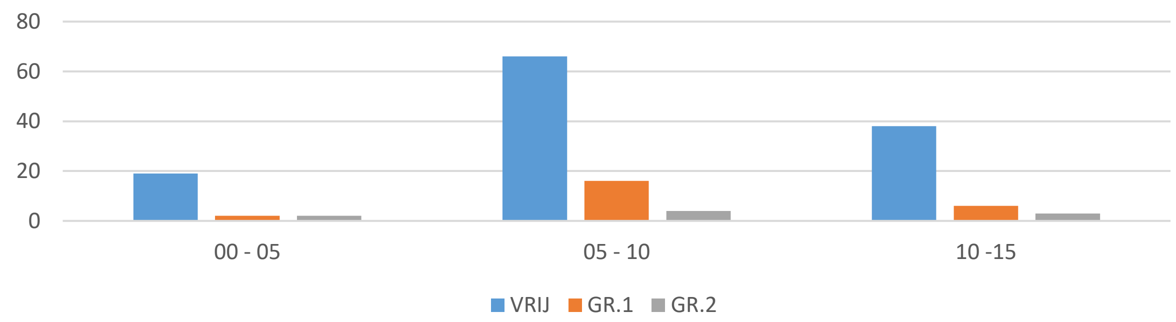


Figure 45. Total Papillon, results from 2000 to 2015

Table 45. Incidence Papillon, results from 2000 to 2015

	00 – 05 (%)	05 – 10 (%)	10 – 15 (%)
VRIJ	82.6	76.7	80.8
GR.1	8.7	18.6	12.8
GR.2	8.7	4.7	6.4
Total	100	100	100

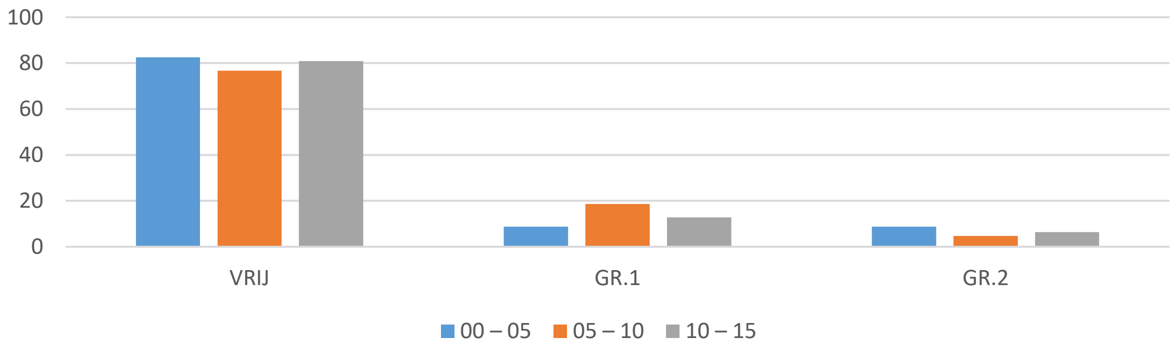


Figure 46. Incidence Papillon, results from 2000 to 2015

Havanese

Table 46. Male Havanese, results from 2000 to 2015

	00 - 05	05 - 10	10 - 15	Total
VRIJ	11	12	9	32
GR1	2	3	1	6
Total	13	15	10	38

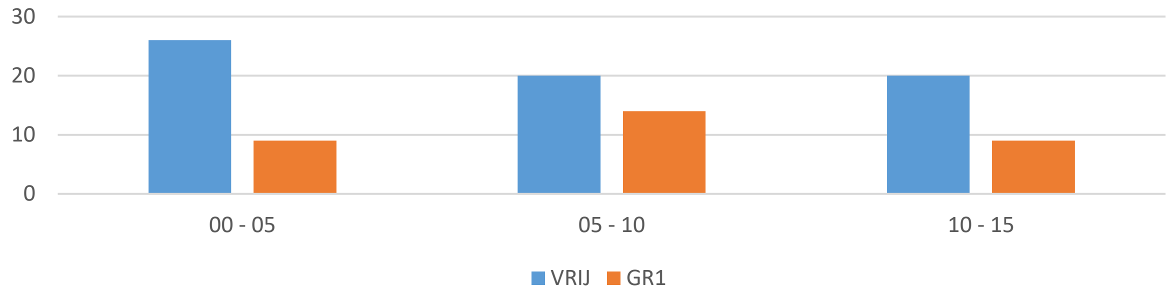


Figure 47. Male Havanese, results from 2000 to 2015

Table 47. Female Havanese, results from 2000 to 2015

	00 - 05	05 - 10	10 - 15	Total
VRIJ	26	20	20	66
GR1	9	14	9	32
Total	35	34	29	98

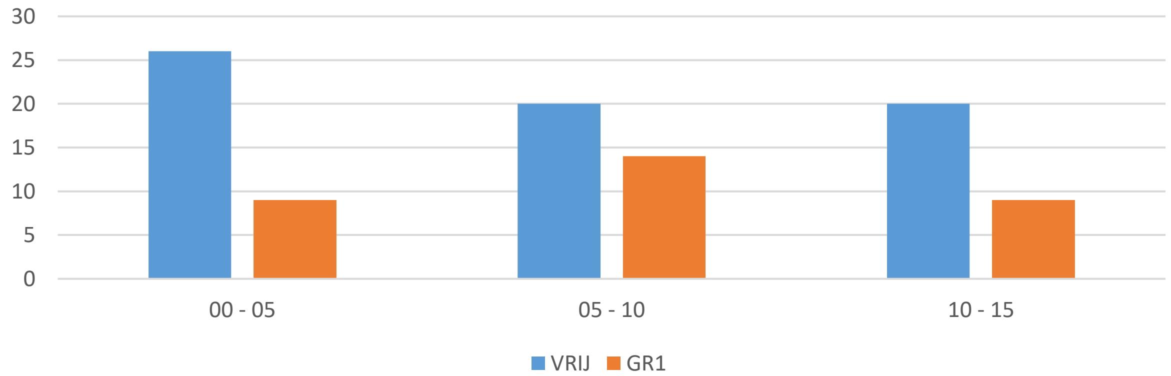


Figure 48. Female Havanese, results from 2000 to 2015

Table 48. Total Havanese, results from 2000 to 2015

	00 - 05	05 - 10	10 - 15	Total
VRIJ	37	32	29	98
GR1	11	17	10	38
Total	48	49	39	136

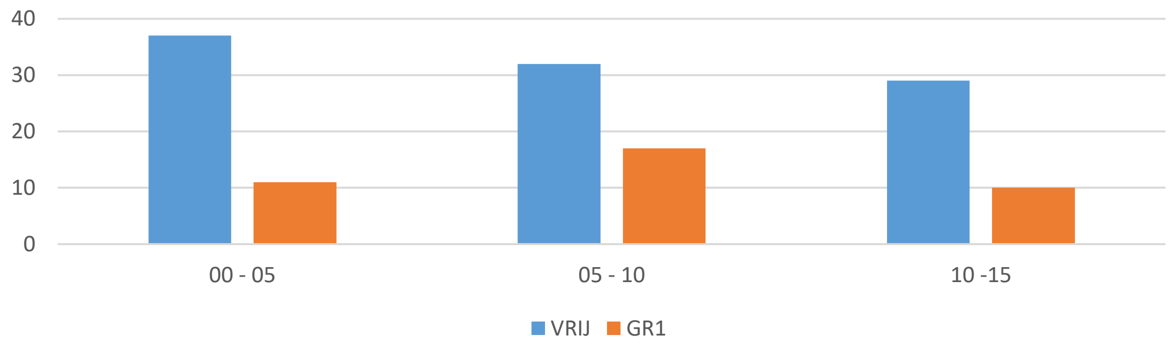


Figure 49. Total Havanese, results from 2000 to 2015

Table 49. Incidence Havanese, results from 2000 to 2015

	00 – 05 (%)	05 – 10 (%)	10 – 15 (%)
VRIJ	77.1	65.3	74.4
GR.1	22.9	34.7	25.6
Total	100	100	100

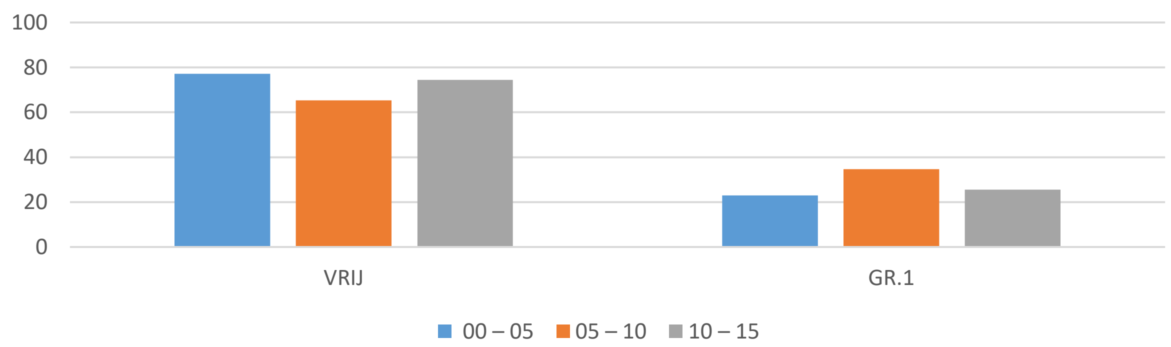


Figure 50. Incidence Havanese results from 2000 to 2015

Discussion
In this thesis the data of PL examinations are collected of different breeds. Despite the large number of tested dogs, the screened cohort is not a reflection of the total dog population. This may be due to the choice of owners not to screen their dogs, because of financial reasons or due to a previous PL diagnosis.

This is a screening bias study, which means that the tested animals are not reprehensive for the larger population. Some explanations are the lack of information of the tested animal or parents, the number of tested animals for each breed, some breeds have more results, for example the Flatcoated Retriever. Because of this screening bias the accuracy is lower, but the error is smaller due to the few certified orthopedic specialists.

The database of Meutstege has data of the examination for PL for predisposed dog breeds. Some breeds have results originating from 1980 but other only have data of the last ten years. For example, the increase of grade 1 PL in Labradoodle (4 years) and Markiesje (9 years) is less reliable than results since 1980 (35 years). In the data of the Labradoodle there is one year N<10. This year is used because of the small number of data, which ensures more progress within the trend.

Especially in the early years of patella screening some of the identification data were incomplete and dogs without birthdate, gender or PL examination are excluded.
Some of the test results are not completely accurate because the number of dogs is too small; for this reason, we only reported the results with a minimum of ten dogs in an interval of 5 years. Except for Labradoodle and Markiesje, these are reported for every year, because of the small number of screened animals.

The results Flatcoated Retriever shows that between 1990 and 1995 there is a decrease of PL screening results. This downfall is due to the startup of a second breeder organization. This organization did not oblige to test for PL what resulted in a decrease of the results. These results are thereby not used in this thesis.

Female dogs have 1.5 times more chance to be affected than male dogs.[4] This might be related to hormonal or to non-hormonal influences of an X-linked inheritance.[11] The development of PL is possibly influenced by hormonal factors, which is also seen in spayed dogs or neutered dogs.[18] For example, estradiol effects the growth of the cartilages of the condyles. Dogs who are injected with estradiol benzoate for a longer period have lower condyles.[19] These dogs have a higher risk to develop PL.[18] Human research has shown, there is a connection between female hormones and an injury to the anterior cruciate ligament. (4 to 6-fold increased incidence) Hormones that control the menstrual cycle influences effects the laxity of the ligament as well.[20] Another study suggested that the problem is more muscle-related, because the muscles of male dogs are better developed.[5,21]

This female predisposition is a possible explanation for the fact that there are more female dogs in this database than male dogs. Another reason that female dogs are tested more than male dogs, is due to the higher chance of developing PL when a dog is on heat. Therefore, it might be necessary to test the same female dog several times in her life due to the possibility of the development of PL after every litter.[19] In this study the female dogs in all breeds are generally more affected in comparison with male dogs, these results are shown in table 5.
However other studies show that in large breeds males are more often affected. This might conclude that PL may be more common in small breed female dogs and large breed male dogs.[12]

The differences between breeds can be explained by their predisposition, length of implementation of the breeding rule and organization policy.

The incidence of grade 1 in Chihuahua has increased with 4.7% (26.9% to 31.6%) since the breeding association obliged breeders to test on this disease. Grade 2 (17.7% to 11.9%) and grade 3/4 (2.3% to 1.5%) are decreased between 2005 and 2015. In the tested population 45% of the dogs is affected with PL.

The incidence of grade 1 PL is increased for several breeds, (Papillon with 4.1%, Havanese with 1%, Markiesje with 11.0% and Flatcoated Retriever with 12.6% in comparison with the first submitted examinations. Which variate between different breeds. The average elevation of the incidence of grade 1 PL in these breeds is 5.63%.

In the other breeds the grade 2 PL is increased compared with the first examination results in (Flatcoated retriever with 1.9%, Markiesje with 6.9%, Shiba with 3.1% and Labradoodle with 8.7%. For Flatcoated retrievers the incidence of PL has been higher than 1.9% between 1980 and 2015, therefore the incidence of grade 2 PL in this breed has not increased over the years. The average incidence in GR 2 PL is increased from 3.1% to 4.0%.

A decreased incidence of grade 1 PL is seen in the following dog breeds (Flatcoated Retriever, Kooiker, Jack Russell Terrier, Shiba, Fox Terrier, Labradoodle and Great Pyrenees). Additionally, the quantity of the free dogs in the population increased. These results show that the obligation to test for PL and use these results to breed with only healthy leads to a decrease in the incidence of PL.

The H1 hypotheses is partly accepted because the incidence of grade 1 PL is increased within the last years, whereas the grade 2 and 3/4 are mildly decreased.

The second H1 hypotheses is accepted. It is concluded that PL is a significant problem within the Chihuahua breed. 45% (GR 1. + GR 2. + Gr 3/4) of the cohort is affected and a clear breeding selection program should be advocated for the Chihuahua by the breeding association to decrease the incidence of PL. For example, it can be advised not to breed with dogs that are affected with PL grade 1,2 or worse and continue to screen to decrease the incidence of PL in Chihuahua dogs over the years.

Conclusion

The average incidence of PL grade 1 till 2015 is decreased from (Database Meutstege) 21.8% to 16.0%. For grade 2 the average is increased from 3.1% to 4.0%. The incidence of grade 1 is increased in Chihuahua with 4.7%, Papillon with 4.1%, Havanese with 2.7% and the Markiesje with 11% and in grade 2 is grown in Markiesje with 6.9% and Shiba with 3.1% and Labradoodle with 8.7%. Concluding that the incidence of grade 1 in these breeds is reduced over the years, although 20.2% (grade 1+2+3/4) of the population of these breeds is still affected with PL. PL grade 2 shows a little increase in the incidence over the years (0.9%).
The incidence of grade 1 in Chihuahua has grown since the breeding association obliged breeders to test on this disease, from 26.9% to 31.6%. The incidence of PL grade 1 in 2015 is 31.6 % and PL grade 2 is 11.9%. It is concluded that PL is a significant problem within the Chihuahua breed, 45% of the cohort is affected and a clear breeding selection program should be advocated for the Chihuahua by breeding association to decrease the incidence of PL.

It is recommended to breed with PL free parents due to breeding with one positive parent increases the prevalence with 45% in the offspring of that litter compared to two unaffected parents.[9]

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Appendix 1

Uitslag formlier patella onderzoek

naam hond : ....
ras : ....
geslacht : reu / teef
geboortedatum : ....
NHSB-nummer : ....
tatoeage-/chipnummer : ....
eigenaar : ....
te : ....
Bij klinisch onderzoek van bovenstaande hond op .... (datum) werd:
( ) geen aanwijzing gevonden voor bestaan van een patella-luxatie (<u>patella "vrij"</u>)
( )* vastgesteld dat de horizontale verschuifbaarheid van de patella (links en/of rechts) vrij groot is (naar binnen [en] buiten), deze is echter niet uit de groef te disloceren
( ) vastgesteld dat de patella (links en/of rechts) niet voldoende stabiel in haar groef op het dijbeen zit – zij is door draaien aan het scheenbeen en/of door zijwaartse druk te disloceren naar buiten en/of naar binnen
<u>er is sprake van een patella-luxatie Graad 1</u>
( ) vastgesteld dat de patella (links en/of rechts) bij beweging, tijdens het staan of lopen spontaan (af en toe / regelmatig) van haar plaats schiet naar binnen / buiten
<u>er is sprake van een patella-luxatie Graad 2</u>
( ) bijzonderheden (o.a. Graad 3 of 4 of evt. operatie):
...
...
Opgemerkt dient te worden dat het bovenstaande dier werd onderzocht in het kader van een inventarisatie binnen het ras en dat vooralsnog over de wijze van vererving onvoldoende bekend is om te kunnen zeggen dat er bij het fokken met normale ("vrije") dieren geen patella-luxatie kan optreden bij de nakomelingen.
handtekening : ....
naam dierenarts : ....
specialist Chirurgie van Gezelschapsdieren
datum : ....
te Utrecht
*** vermelding gebeurt alleen ter documentatie, heeft geen betekenis voor fokadvies**

Appendix 2

BEVINDINGEN PATELLA-ONDERZOEK

Onderzoek verricht door Dr.B.P.Meij te Utrecht. Hij verklaart het tatoeage-/chipnummer van de hond gecontroleerd te hebben en: in orde bevonden - dit nummer was niet leesbaar/chip niet gevonden

handtekening : ....
datum : ....
te Utrecht
naam hond : ....
ras : ....
geslacht : reu / teef
geboortedatum : ....
NHSB-nummer : ....
tatoeage-/chipnummer : ....
eigenaar : ....
te : ....
uitslag code : ....

Anamnese (vraag aan de eigenaar):

ooit klachten gehad bij het lopen		**nee / ja**
heeft u aanmerking op het gangwerk (gehad)?		**nee / ja**

Staand onderzoek:

patella op haar plaats?	**links**	**ja / nee**
	rechts	**ja / nee**
patella te luxeren?	**links**	**nee / ja -> lateraal/mediaal**
	rechts	**nee / ja -> lateraal/mediaal**

Liggend onderzoek:

<u>linkerknie</u>: hond is .... gespannen

patella in de trochlea?	**ja / nee -> lateraal/mediaal**
patella over rand te drukken	**nee / ja -> lateraal/mediaal; met/zonder rotatie**
patella alleen door torsie van de tibia al luxabel?	**nee / ja -> lateraal/mediaal**
crepitatie	**nee / ja**
crista midden voor?	**ja / nee**

<u>rechterknie</u>: hond is .... gespannen

patella in de trochlea?	**ja / nee -> lateraal/mediaal**
patella over rand te drukken	**nee / ja -> lateraal/mediaal; met/zonder rotatie**
patella alleen door torsie van de tibia al luxabel?	**nee / ja -> lateraal/mediaal**
crepitatie	**nee / ja**
crista midden voor?	**ja / nee**

Overige bijzonderheden: ....
Conclusie: ....

Ondergetekende – eigenaar/hoeder van bovenstaande hond verklaart dat de voor onderzoek aangeboden hond de hierboven beschreven hond is en dat hij/zij bekend is met de door de rasvereniging gestelde regels en toestemming geeft om de resultaten van het onderzoek te gebruiken voor het officiële fokprogramma.

handtekening : ....
naam eigenaar : ....
datum : ....