

# Analysis of the biomechanics of dogs in New Zealand using the flygility box, resultant injuries, and recommendations to improve dog safety in flygility.

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## ***Abstract***



As a competitor in a variety of canine sports I carried out the following research and analysis based on concerns about the safety of equipment in flygility and the potential for injury in canine athletes in New Zealand.

Currently there are no available studies of the New Zealand design of fly box, or biomechanics of dogs using the box contributing to injuries.

Overseas literature suggests that common injuries diagnosed in competitive sports dogs (specifically flygility) include shoulder injuries, carpal injuries, hindlimb muscle injury, arthritis, ligament rupture, joint damage, soft tissue injuries and fractures resulting from collisions. Whilst in New Zealand we have significant differences in equipment and course design from overseas fly ball sports, it is expected to have similarities in common injuries.

The investigation of the biomechanics suggests that the NZ flygility box has many potential injury causing hazards, and the survey conducted suggests that despite assurance from the NZ Flygility committee that there are no injuries to date on the flybox, of the survey respondents 37% had observed injuries occurring, and many different injuries were observed. Not only were injuries noted, but significant concerns on physical stress on the dogs was expressed.

There are four main recommendations to the NZ Fly committee. Firstly, and of most importance, is the recommendation to change the fly box to the cam or boomerang style of box, as seen overseas. This is vastly superior in terms of biomechanics and would greatly reduce the chances of injuries occurring. Secondly, change the fly jumps to be wider, with breakaway slats in the middle. In injuries observed this was the second greatest source of injuries after the box itself. Thirdly regulate the size of the hoop placed on the end of ramps – regulate this to be a standard size somewhat bigger than current hoops (perhaps based on the measurement of the tallest competing dog). Finally consider releasing recommendations to competitors on training, surface, warm-up, and age of dogs beginning training and competing.

Recommendations to NZ clubs training in flygility and running competitions include training members to include adequate warmup for dogs, train in strength and conditioning of canine athletes, train fly specific skills in small modules not only full fly courses repetitively, critically examine the surface that dogs are running and training on, and consider using the overseas cam / boomerang style box for training exclusively.

Recommendations to flygility competitors focus on those outside above. Competitors must consider your dogs condition prior to training and competing in flygility. Dogs that are overweight have a significant increase of force when hitting the box, therefore a greater chance of injury. Also consider using time and runs during flygility competitions sensibly, considering the cumulative effect of runs.

In conclusion, with the increase in technical knowledge, and interest in the health and longevity of our canine athletes it is time to evaluate and modernise aspects of flygility in New Zealand.

## ***Introduction***

In 2013 / 2014 in the New Zealand dog agility community there was an emphasis on evaluation and modification of equipment and regulations with an aim to make agility safer for the canine athletes. This has been demonstrated with numerous NZ Dog agility committee surveys, height and jump revisions, and also in private equipment manufacture prototype development and testing.

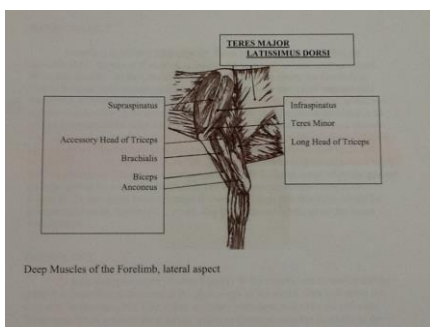
Flygility is a closely related sport to agility, however it is lacking the safety analysis and equipment development. The equipment and specifications have remained essentially unchanged since its development around 30 years ago.

NZ flygility competition consists of dogs competing in a race against another dog. Courses are 30 metres long and advance from a simple straight line of jumps and tunnels in beginners to complex twisting courses that can include 6 weaves or small contact ramps in the higher divisions. Dogs compete in two grades at one time, graduating up to higher classes with a specific number of points from winning races. There are currently 776 dogs in total with points registered in the NZ Flygility Association. It is not possible with this register to see which of these dogs are currently competing.

Overseas fly competitions consist of fly ball, and flygility. Race specifications are different, with the majority competing in a set straight course rather than NZ's varying courses. Every country with an established fly association has a vastly different fly box design from the current NZ design. Other aspects of equipment also vary, such as every jump being a fly jump, the majority of competitions being held indoors on a specifically designed non-slip and even surface, and allowed dog equipment including harnesses, collars with handles, carpal support devices, and wrist wrapping.

## Overseas information review

### • Common injuries in canine athletes relevant to flygility



Some of the most common injuries in dogs participating in sports such as agility and flygility involve the shoulder. The shoulder is a complex modified ball and socket joint that performs a wide range of movement including flexion, extension, abduction, adduction and rotation (5). There are a large number of muscles attaching around this joint and contributing to movement. Given that the shoulder joint has no boney attachments to the axial skeleton (like humans clavicle) and 60-65% of the dogs weight (2) is carried on the front limb injuries can greatly affect the movement, comfort and performance of the dog.

Figure 1. Diagram showing the muscles of the canine shoulder (2).

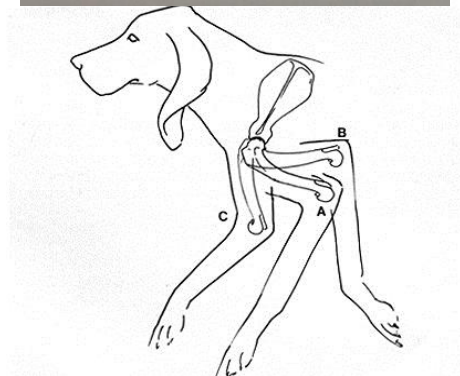


FIG. B-1 Flexion-extension of the shoulder (A) Zero starting position: With the dog or cat in lateral recumbency, the brachium is placed perpendicular to a line running along the scapular spine. The brachium should also be parallel to the thoracic wall. (B) Flexion is measured in degrees away from the zero starting position (A-B). (C) Extension is measured in degrees away from the zero starting position (A-C).

The biceps brachii muscle crosses across the shoulder joint down the arm to the elbow, and functions to flex and supinate the elbow, extend and stabilise the shoulder (5,1). The supraspinatus muscle originates on the scapula and crosses the shoulder to end at either humerus. This muscle extends and stabilises the shoulder (1). Smaller muscles such as the infraspinatus and teres minor also contribute to shoulder flexion,

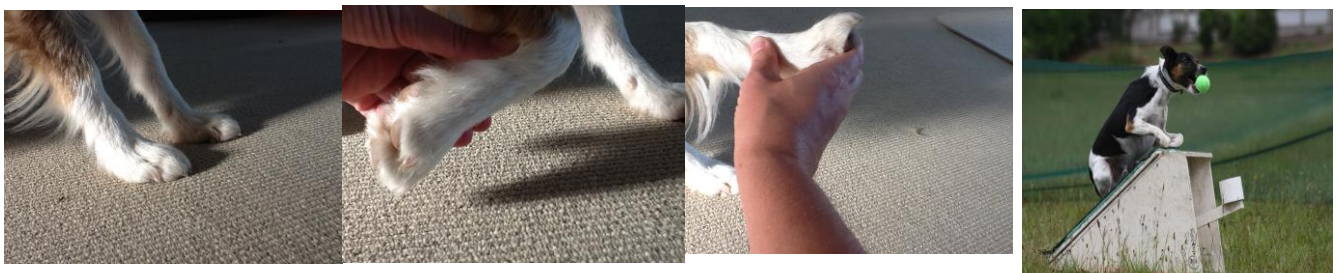
extension and rotation (1). Extension of the shoulder involves the forearm moving forwards towards the dogs head. As this movement is performed at the extreme (hyperextension) when most dogs launch towards the box, however this is not weight bearing. At the point where the dogs trigger the box the shoulder in most is relatively neutral, instead the carpals are at extreme angles. Often when dogs need to clear or launch over the box the shoulder is at extreme flexion to tuck paws away. The point at which dogs are langing on the ground is also a concern, as the shoulder is often hyper extended while weight bearing.

*Figure 2. A neutral shoulder position, and the shoulder in flexion and extension.*



*Figure 3. Photos of NZ dogs competing in 2013 showing a variety of shoulder extreme extension and flexion. from left to right: a. Dogs front right is in extension, left in extreme flexion. b. Both front legs in extreme flexion to clear the box. c. Front right in significant flexion whilst weight bearing, left appears extended and also weight bearing, d. Front left in hyper extension and left hyper flexed to clear box.*

The carpus joint is the 'wrist' joint in the forearm of the dog. Flexion occurs when the foot is folded back towards the dogs tummy, and extension is when the toes are pushed up towards the dogs face.



*Figure 4. Pictures showing the wrist in neutral, flexion and extension, and dogs competing in NZ with pressure on carpals.*

Carpal injuries are one of the most prevalent amongst flygility dogs. When you consider that dogs may be moving up to 7.61m/s when they hit the fly box,

and they trigger the box with front limbs pushing the wrist into hyperextension this is not surprising (6). Specific carpal injuries include superficial digital flexor tendon elongation, ligament rupture, tendinitis, luxation of bones and joints, and palmar ligament hyperextension injury (1). These injuries are caused by hyper extension which is clearly seen during the high speed triggering of the fly box with forelimbs. It is thought that these types of injuries would not be seen resulting from one fly run along, more likely to be from repetition after initial sprains (6).

Closely related to toe injuries are injuries to the soft pads and dew claws. During hyperextension of the wrist the carpal pad and dew claws may come in direct contact with the fly box surface, causing damage (6). With the NZ flygility box these injuries are likely to be more common due to the pegs, handle and other structural components dogs are likely to catch on. It is also thought that force and trauma applied to the forelimb may be transferred up the limb to the shoulder and neck (6).

The dogs hindlimb includes the hip, knee, stifle and hind toes. The hip is a ball and socket joint that performs a wide range of movements including flexion, extension, adduction, abduction and rotation (5). The iliopsoas muscle originates at the lumbar vertebrae, extends across the pelvis to join the iliacus muscle and attaching on the femur (1). The function of this muscle is to push the hind limb forward (6). Strain of the iliopsoas muscle may be caused by uneven push off the box or ground, slipping off the box, or turning constantly one way (6). Strain presents as decreased performance, difficulty rising, and a shortened stiff gait in the hindlimb (1).



Figure 5. L: Picture of a NZ border collie demonstrating the uneven weight distribution on landing that may cause injury to the iliopsoas muscle. R: Another border collie catching on the ball cup and hitting it hard enough to break it.

The gastrocnemius muscle flexes the stifle, and covers the hind limb from hip to knee (1). This muscle flexes the stifle and can present in non weight bearing lameness (1).

Particularly common in collies is the lateral luxation of the superficial digital flexor tendon. This crosses the stifle to the heel. Luxation is very painful and the dog will show hindlimb lameness and may elevate the toes off the floor (1).

When dogs have to transfer their weight from fore to hind limbs, and simultaneously change direction the motion of the turn may cause problems in the back and neck. Degenerative diseases such as Spondylosis have been noted in fly dogs (6). This motion is demonstrated frequently in the smaller NZ fly dogs, because of the differences in the way the box throws small balls.

Other less common injuries that may occur include friction burns, scrapes, fractures and soft tissue damage from collisions, and arthritis from the repetitive nature of flygility (6). Whilst cruciate and other knee injuries are common in sporting dogs it is more probable that this is the result of wear and tear from jumping rather than the motion of hitting the fly box (6).

#### • **Biomechanics of movement relating to injury**

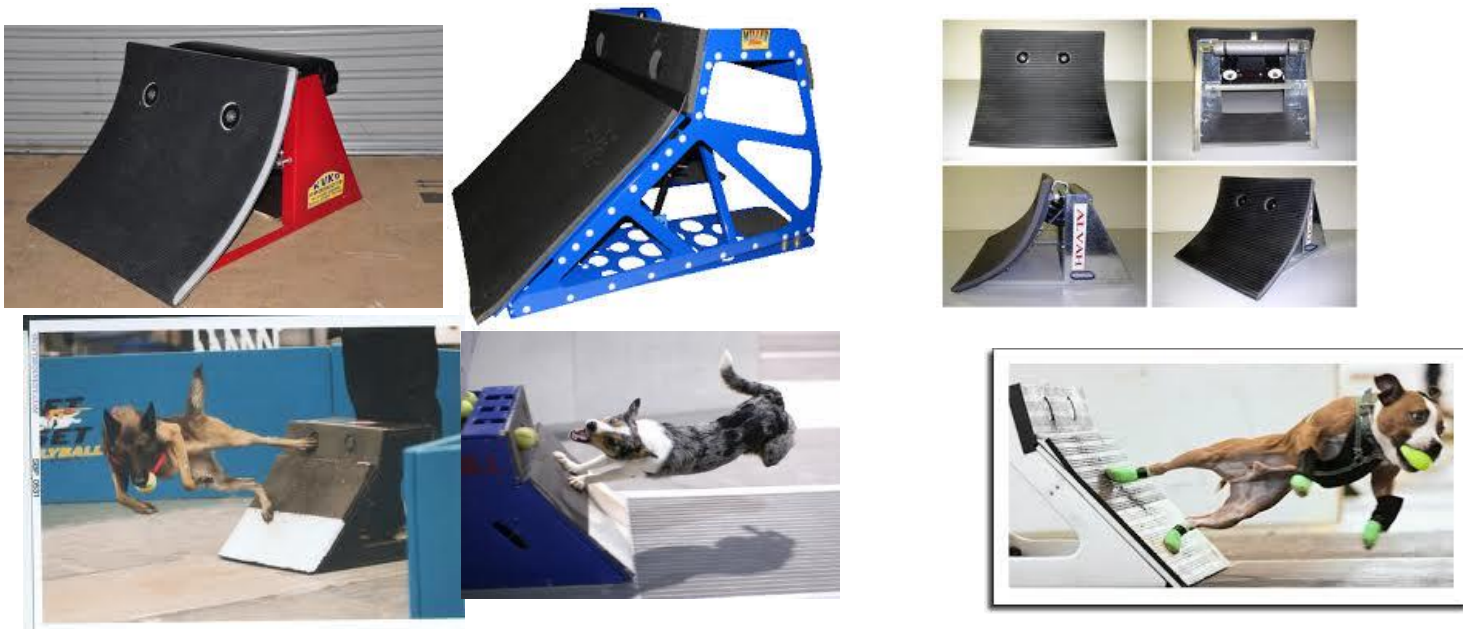


Currently there is no analysis of the biomechanics involved with the NZ fly box in published literature. Therefore although there are aspects relevant from overseas analysis, more important to this report is the analysis of biomechanics.

The generally style of turn being classed as biomechanically ideal is the "swimmers turn" (6). This means that the dog triggers the box evenly with the front legs, catches the ball, and turns to launch off the box with rear legs, again evenly. The dog is evenly distributing weight and not launching over the box. This looks similar to how swimmers turn at the end of a lane against the wall, hence the name 'swimmers turn'.

### • **Overseas fly box analysis**

There are three commonly used styles of fly box in most competing overseas countries. Every one of these designs is vastly different from the New Zealand design. Each design has similarities - each are wider, have a steeper angle of the trigger surface, have a ball visible to the dog on approach, and fire the ball in a straight more consistent pattern an the NZ box.



*Figure 6. L-R, Two of the common overseas designs: the boomerang box, the upright cam box. Image showing other views of the boomerang box. Bottom row: images of dogs overseas using these style of boxes.*

Overalls figures from the UK indicate that the incidence rate of injury is as low as 0.04% per fly run (6). This does not seem like a lot, but when you consider that injuries may be cumulative, and when most fly dogs also compete in agility, it is relevant. Frequency of injuries on each of the overseas styles of boxes varies with the style of box, and there seems no clear difference between the similar styles.

### • **Other factors relevant to injuries in canine athletes**

Muscle injuries are more prevalent in faster, and heavier dogs (6). This is because both faster, and heavier dogs have more force when they hit the box, therefore produce more pressure. This puts more strain on their body.

There is debate about the effectiveness of wrist protection devices, with some literature suggestion the use of such devices will reduce the chance of muscle strain and arthritis (6). However, the research on the effectiveness of such devices is not conclusive.

Effective strengthening, conditioning and fitness exercises can also reduce the chance of injuries in sporting dogs. Suggested suitable exercises include hydrotherapy, exercise balls and wobble cushions (6). \*

An efficient warm up increases the elasticity of muscles, increases blood flow, and increases performance. Athletes that have not warmed up have a 7% slower performance (6). Suitable warm up routines suggested included dynamic stretching consisting of short on lead sprints and retrieving a ball from a short distance approximately 15 minutes prior to competition. \*

Training and competition frequency has a significant impact on many types of common sporting injuries. It is suggested that to decrease the chance of repetitive type injuries vary training with training specific skills or issues in small parts, and whole runs (6).

There has been much emphasis overseas in examining the surface on which dogs compete. Because many of their competitions are held indoors, this is extremely important in the UK and US. However, due to all of our NZ competitions being held outside, it is less relevant. It is important to try to have a even non-slippery surface, as best as possible, to reduce the chance of injuries occurring.

- *\* Please see the appendix for details on appropriate warm ups and strength / conditioning programs.*

## **Biomechanics analysis of the NZ flygility box**

The aim of this investigation is to evaluate competitors current perceptions of hazards and stress on flygility dogs, document observed injuries, and to analyse the biomechanics of dogs using the current box.

### **• Analysis of biomechanics on the current box**

Video analysis of a randomly chosen representative of each style of catch on the NZ fly box were analysed using the Coach's eye application, as well as real time analysis during competitive shows. This application was used to analyse body movements previously identified from the literature review as having the potential to cause injury. Photographs were also used in analysis of angles. Most dogs competing in NZ tend to favour one of the following styles of box triggering / catch, but also have some variation in catching style.

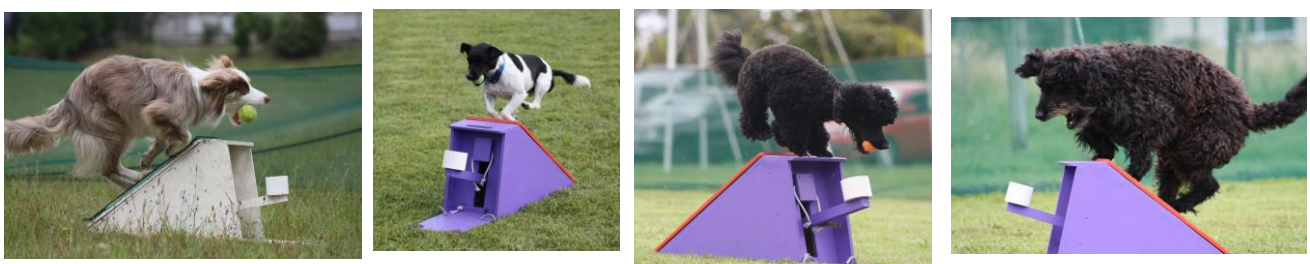
Style of catch	General description of the dogs movements	Hyperextension or flexion of the carpal (wrist)	Hyperextension or flexion of the shoulder	Significant twisting of the neck / back	Hyperflexion of the hind limbs	Uneven landing on the hindlimbs	Other injury concerns
<b>1. Speed</b>	Dog hits the box whilst in the air, clears the top of the box whilst catching the ball. The dog lands, then turns. <i>Common in very fast and agile dogs such as border collies / heading dogs.</i>	Some carpal extension with force	Flexion on launch over box, extension on landing			At times	The majority of dogs doing this swing their hind limbs to one side of the box to clear it. They also tend to skim the top near the handle with front limbs tucked under their body.
<b>2. Speed turn</b>	Dog hits the box whilst in the air, clears the top of the box whilst catching the ball. The dog twists in the air, and lands facing the startline. <i>Common in fast and agile dogs such as border collies / heading dogs.</i>	Some carpal extension with force	Flexion on launch over box, extension on landing and turn	Yes		At times	
<b>3. Launch</b>	This is the closest style to the 'swimmers turn' favoured overseas. The dog hits the box with the front feet, whilst transferring weight to the hind limbs (moving up onto the box slightly after the front limbs) which it then uses to push off the box and turn back towards the startline.	Some carpal extension with force					This style of jump is the least consistent due to the NZ style or flybox, so dogs that launch also tend to miscatch as well as do 'speed turns'.
<b>4. Stand and catch</b>	The dog approaches the box, slows down and triggers the box with the front feet whilst the hind legs are still on the ground. The dog waits for the ball to be thrown, and jumps up to catch, then lands and turns. <i>Common in the smaller dogs catching small balls.</i>			Yes	At times	Yes	
<b>5. Miscatch</b>	This occurs with almost all the above mentioned catch styles, though is most common with the small dogs because of the inconsistency in the throw of the small ball. This is when the dog either fails to catch the ball, or fumbles the ball and drops it or hits it in another direction. The dog then follows the ball.	At times all above issues can occur. Because a miscatch is not expected and difficult to train this can be potentially very dangerous for the dog.					



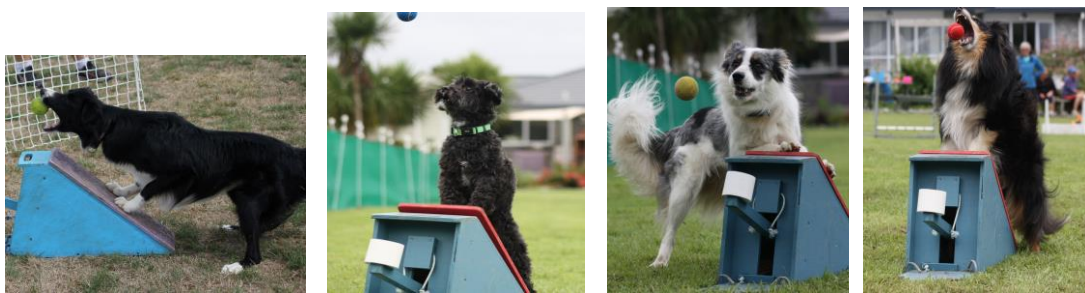
*Figure 7. The 'speed' style of box triggering and catch*



*Figure 8. The 'speed turn' style of box triggering and catch*



*Figure 9. The 'launch' style of box triggering and catch*





*Figure 8. The 'stand and catch' style of box triggering and catch*

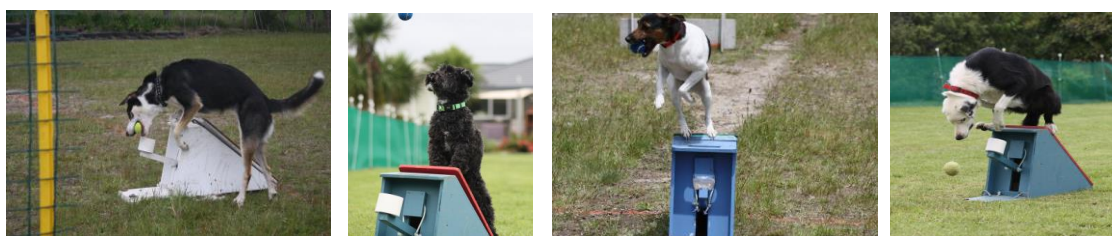


*Figure 8. The 'miscatch' style of box triggering and*

*catch*



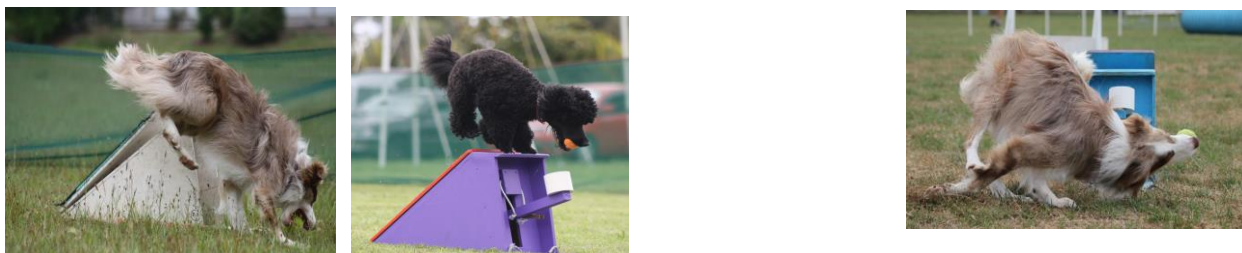
*Figure 9. Potential for catching toes / limbs on the fly box particularly the top flat section, the handle, the ball cup and also the pegs (not shown). Note in all pictures the dogs have one leg tucked up under the body that is only just clearing the box top.*



*Figure 10.*

*Potential for twisting / back / neck injury. Each of these pictures the dog is over twisting the neck or back.*





*Figure 11. Potential for front limb / shoulder injury. Extreme weight distribution and turning on front limbs.*



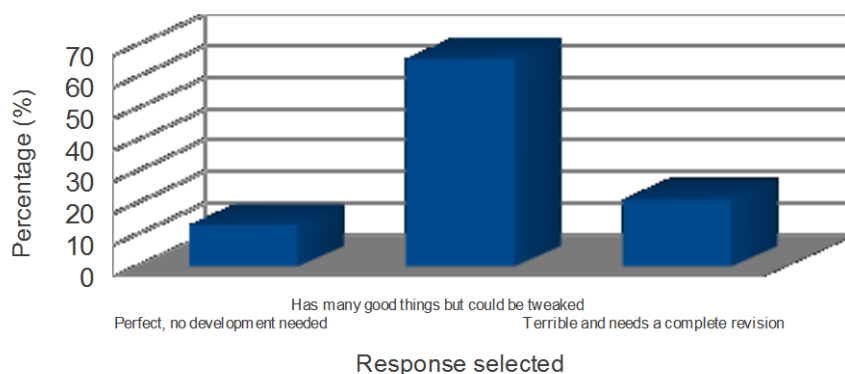
*Figure 11. Potential for hind limb / iliopsoas injury. Dogs are landing unevenly on hind limbs and/or straddling the fly box.*

### • Competitors perception and injuries to competing dogs

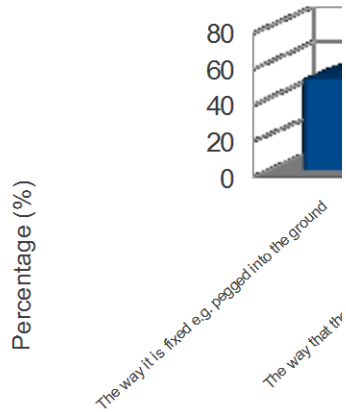
Using an online electronic survey a number of questions were voluntarily answered by past or present competitors of flygility in NZ. The survey was advertised over Facebook, and the online Yahoo groups that are the most common form of communication between members of this community.

The survey was left open for one month, had 83 respondents, and results analysed via the website provider (surveymonkey.com).

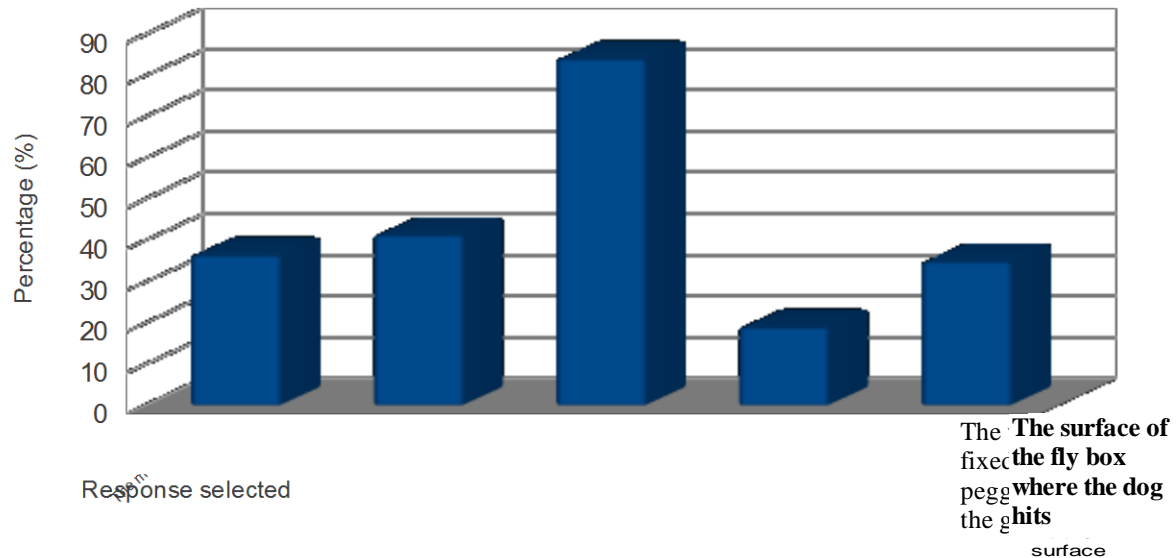
Question 1. Do you believe that the current fly box used in NZ is



Question 2: Which of the following points in the design do you think are good'

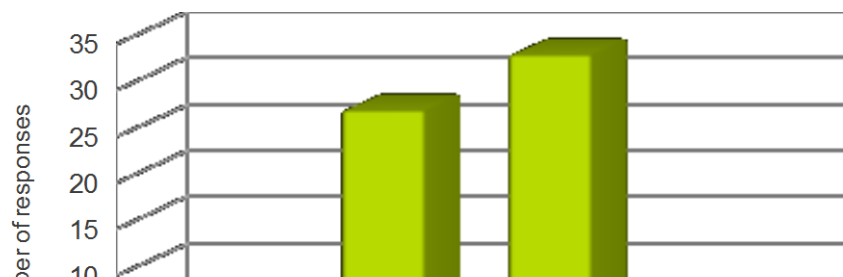


3. Which aspect of the current fly box design do you think is BAD?

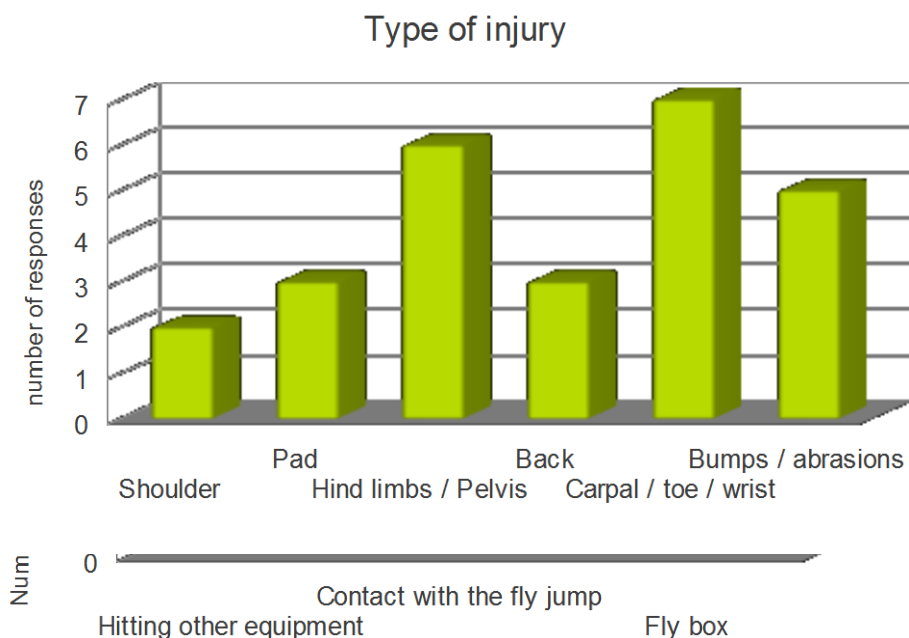


4. Have you ever had a dog (or seen another dog) injured in flygility? If so please describe the injury, and how it occurred.
- 5.

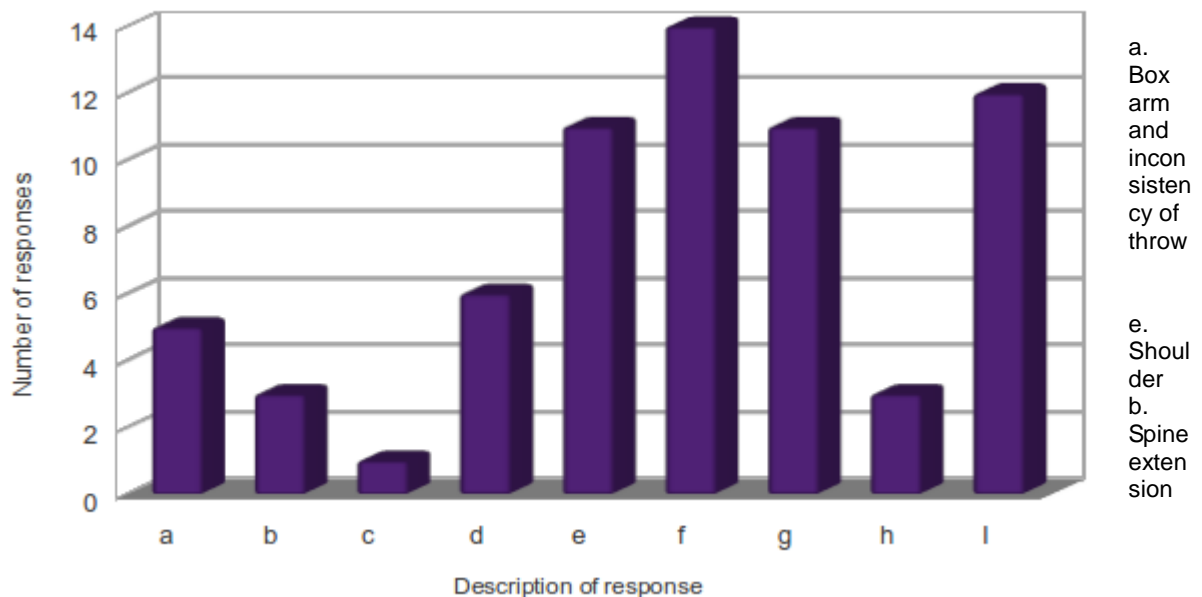
Has an injury been observed?



5. For you



r dog / dogs which specific aspect of approaching, hitting and catching the ball do you believe puts the most stress on the dogs body, and which part of the body do you think is under most stress.



f.

Forces on the front legs

c. Jumping over the box

d. Carpal / wrist when hitting the box

g. tight turn off the box

h. Vague answer / unsure

## Other comments of interest:

“Turning after catching in midair - if the dog has been running quickly as most do, the stop start aspect is hard on their whole body. However that is the name of the game unless we can ensure no dog can jump over the box.”

“I don't particularly like the way the ball is thrown up, I think it encourages dogs to go over the top of the box. I remember looking at some American boxes and thinking they made more sense with the ball coming out forward and the curved, wider trigger plate seems to make more sense too as the dog triggers and turns from it.”

“You have made no connection with small dogs, who have different issues. Mostly the size/weight of the ball is different and throws differently. So if you can find a way that evens the field out for all sizes I would be happy to hear about it. Maybe training needs to be done better”

“I think the boxes should be a lot wider - say like at least 2x as wide as a large dog. A lot of dogs barely trigger the box before flying over the back of it, and this could be to do with the stride from their last jump and their jumping style. Many dogs hit the box with their chest rather than their paw. A wider box/plate would give a bigger area to target and should avoid slippages if the rubber chip coating is used.”

“For small dogs like mine, small balls are often impossible for them to catch on the full. When they are thrown high in the air, they either have to make unduly high vertical leaps or wait until the balls descend into catching range.”

“I believe the small surface area that the dog hits combined with the fact that a lot of dogs go over the box to get the ball has huge cause for concern with injury. The worst part is the arm IMO. I much prefer the larger boxes in the USA where the ball comes out of the surface of the box.”



## ***Discussion: Recommendations***

The following are recommendations based on the literature review, and results of this investigation.

### **• Fly box**

This report strongly recommends that the NZ flygility committee changes regulations for the fly ball box to the style seen overseas (e.g. the cam or boomerang box) as soon as possible, both in being required to be used in competition, and also recommend this box to be used for training. The important aspects of the box that must be changed are that the trigger surface should be larger, wider, with an angled or curved front, balls visible to approaching dog and have more consistency in throw.

It is recommended that the possibility of manufacturing in NZ is investigated due to the cost of importing boxes from Australia or the USA (at around \$1000AUD per box).

The justification for this recommendation is both potential and actual injury to dogs using the current style of box. This occurs as a result from a large number of factors including the ability for dogs to launch over the narrow box, catch the body on numerous components of the box, and inconsistency in ball throwing. The overseas style of box encourages the 'ideal' swimmers turn, and has proven overseas to have a very low injury rate.

### **• Fly jumps**

This report recommends that the NZ Flygility committee consider altering the regulations on the fly jump to widen the jump, and make the slats break apart.

The reasoning for this is that the NZ agility committee (as well as other overseas research and associations) has presented research on the improved safety for wider jumps, and that dogs hitting the fly jump is the next biggest source of injuries, after the box. By making the slats break apart (e.g. with a seam in the middle and velcro) you would not alter the mechanics or function of these jumps whilst making it safer with minimal cost.

### **• Other equipment**

This report recommends that the NZ Flygility committee consider altering the regulations on the hoop at the end of the contact ramp to make it uniform across all clubs, and increase the size of the hoop slightly.

The justification for this is that there is inconsistency currently in this piece of equipment, and as well as a possible source of injuries, this would smoothen the running of shows as there would be less stopping to fix the hoop. This would also be relatively easy and cheap to do.

## • **Competition**

It is recommended that both competitors and clubs are aware of both the surface during competitions, and all effort be made for the surface to be even and not slippery. Clubs should also be considerate of competitors efforts to warm up dogs appropriately and be aware that this can be difficult to manage with the nature of fly shows. Please see appendix I for warm up information.

Competitors may wish to also consider their overall schedule of competitions (agility and flygility) and plan break weekends. Competing once a month rather than every week will significantly reduce the chance of injury and allow physical recovery from the intense and demanding competitions. Also consider using your runs during competition appropriately, considering the potential for damage from the repetitive activities that occur during a flygility run.

## • **Dogs condition and age**

This report recommends that the NZ clubs and competitors consider the weight of dogs training and competing, and examine the structure of training sessions. Increasing weight significantly increases the forces acting on the dog while triggering the box. Overweight dogs are at extra risk of injury (both traumatic and cumulative). The addition of strength, conditioning and general fitness activities will also make competition dogs much stronger and reduce risk of injury. See the appendix for examples of such activities.

This report also recommends that the NZ flygility committee considers changing regulations, or recommendations, regarding dogs beginning competition at 12 months of age, particularly the larger dogs.

The justification for this is that it is proven that increasing the size of the dog increases the force on joints when triggering the box. Given that the majority of maxi dogs are still growing at 12 months there is potential for injury and long term damage starting high impact exercise so young whilst joints are still developing and strengthening.

## • **Training**

Training sessions should be evaluated in structure to ensure that training does not consist of purely full runs, instead break down individual skills as well as working on full runs. This will significantly decrease the repetitive effect of some actions that cumulatively may contribute to injury.

The justification for this is that the several of the noted common injuries, both in the overseas literature, and survey responses, can be attributed to repetitive motions that occur during flygility, and are often cumulative in nature.

Whilst the current style of fly box is being used, consider including in training emphasis on catching style, aiming to reduce jumping and contorting in the air, miscatching, uneven landing, and turning the same way every time. Ideal box triggering motion is to hit the box and trigger the ball, then turn without vaulting over the box e.g. the swimmers style of turn.

## • Other

It is also recommended that the NZ Flygility committee investigate the effectiveness of wrist protection devices in flygility. There are no conclusive studies to the effectiveness of such supports, but some evidence indicates that there may be a reduction in injuries, particularly soft tissue damage and arthritis in wrist joints, by using such devices due to reduced hyper extension of the wrist joint.

This report also highly recommends that the NZ Flygility committee start collecting evidence from events about injuries sustained so that trends and issues can be identified. This could be an online google form, or downloadable form on the fly website.

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## **Appendix I: An appropriate warmup**

Warming up your dog appropriately before training and competition can benefit your dog in several ways. Firstly an appropriate warm up can significantly reduce the chance of injury. A Warm up can help your dog focus on you, and mentally prepare for competition, and lastly an appropriate warmup can significantly improve performance – studies with professional athletes show up to 7% improvement.

Warm up should occur approximately 15 minutes prior to strenuous activity. Dogs will stay 'warm' for approximately 15 minutes. The same activities should be completed as a cool down after vigorous activity.

### ***Below are some suitable warmup activities:***

- Gentle on lead walking around 5 minutes
- Sustained trotting for around 5 minutes
- Spin / twisting in both directions to warm the spine
- Backing the dog up
- Leg weaves
- weight shift exercises
- sit wait and release to sprint
- Throw and catch with the ball (small throws)
- tugging
- equipment specific work e.g. jumping
- Joint rotation
- Static stretching e.g. neck, back, front and rear limbs

### ***For more information:***

- Bobbie Lyons: <http://www.pawsitive-performance.com/blog>
- <http://classroom.daisypeel.com/courses-offered/k9-conditioning-rehab-classes/>
- <http://agilitynerd.com/blog/dog/health/WarmUp.html>

- <http://veterinarymedicine.dvm360.com/vetmed/Medicine/Agility-dogs-Warming-up-and-cooling-down/ArticleStandard/Article/detail/765503>
- The Healthy Way to Stretch Your Dog: A Physical Therapy Approach. By Sasha Foster and Amy Foster ([http://www.amazon.com/The-Healthy-Way-Stretch-Your-ebook/dp/B005C5ILC2/ref=pd\\_sim\\_kstore\\_4?ie=UTF8&refRID=1V3KH5M5021TYE X7VFRF](http://www.amazon.com/The-Healthy-Way-Stretch-Your-ebook/dp/B005C5ILC2/ref=pd_sim_kstore_4?ie=UTF8&refRID=1V3KH5M5021TYE X7VFRF))

## **Appendix II: Conditioning, strengthening, fitness**

Building activities into your dogs training schedule other than equipment of skill specific activities will not only benefit your dogs competitive sports, but also reduce the chance of injury.

### ***Examples include:***

- Hydrotherapy
- Swimming
- Swiss ball / wobble cushion / wobble board work
- Cavaletti / ladder work
- sustained trotting
- tricks e.g. paw targetting, bow, spin / twist etc.
- Rotation through sit / stand / down for strength
- Stretching poses e.g. bow, say prayers

### ***For more information:***

- <http://classroom.daisypeel.com/courses-offered/k9-conditioning-rehab-classes/>
- <http://www.pawsitive-performance.com/blog>
- Peak Performance – Coaching the Canine Athlete. By M. Christine Zink. ([http://www.amazon.com/Peak-Performance-Coaching-Canine-Athlete-ebook/dp/B005UFBWSY/ref=sr\\_1\\_1?ie=UTF8&qid=1404776117&sr=8-1&keywords=Peak+performance+coaching+the+canine+athlete](http://www.amazon.com/Peak-Performance-Coaching-Canine-Athlete-ebook/dp/B005UFBWSY/ref=sr_1_1?ie=UTF8&qid=1404776117&sr=8-1&keywords=Peak+performance+coaching+the+canine+athlete))
- <http://blog.fitpawsusa.com/agility-canine-sports/#.U7sw7aqXVGA>
- Canine Cross Training: Building Balance, Strength, and Endurance in Your Dog. By Sasha Foster ([http://www.amazon.com/Canine-Cross-Training-Building-Endurance-ebook/dp/B00B787OWG/ref=sr\\_1\\_1?s=digital-text&ie=UTF8&qid=1404776433&sr=1-1&keywords=Canine+Cross+Training](http://www.amazon.com/Canine-Cross-Training-Building-Endurance-ebook/dp/B00B787OWG/ref=sr_1_1?s=digital-text&ie=UTF8&qid=1404776433&sr=1-1&keywords=Canine+Cross+Training))