An International Genetic Survey of Working Canines from the United States, Israel and Poland

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Introduction

- Genetic diseases are found in dog breeds commonly used as working dogs
- As important members of their teams, dogs are expected to operate at peak performance for several years

Introduction

- Working dogs are a significant investment for both cost of purchase and training
- Previous studies examining reasons for discharge or euthanasia failed to include genetic risks

Study Objective & Goal

- To identify breed-specific genetic risks for inherited diseases in working dogs
- With the goal of providing a justification for screening dogs prior to breeding, buying or training

Study Design, Sample, Procedures

- 304 dogs were ascertained
  - 267 law enforcement dogs
    - 122 US, 87 Israel, 58 Poland
  - 37 search & rescue (SAR) dogs (US)
- Study participants included dogs in training, active duty or retired
- Handlers collected 3 cheek swabs (US) or veterinarians collected blood in EDTA (Israel, Poland)
- Dogs were screened with routine molecular genetic methods for 1-15 disease mutations based on breed

Results – **Carrier Dogs**

- 29% (n=89) heterozygous carrier dogs identified
  - Degenerative myelopathy
    - 46 German shepherd dogs (30 US, 4 Israel, 12 Poland)
    - 9 Belgian malinois (5 Israel, 4 Poland)
    - 2 Bloodhounds (US)
    - 5 mixed breed dogs (US)

Results – **Carrier Dogs**

- 29% (n=89) heterozygous carrier dogs identified
  - Leukocyte adhesion deficiency, type III
    - 7 German shepherd dogs (5 US, 1 Israel, 1 Poland)
  - Exercise-induced collapse
    - 12 Labrador retrievers (3 US, 9 Israel)
  - Progressive retinal atrophy (PRCD)
    - 6 Labrador retrievers (2 US, 4 Israel)
  - Hereditary nasal parakeratosis
    - 1 Labrador retriever (Israel)

Results – **At-risk Dogs**

- 6% (n=19) homozygous at-risk dogs identified
  - Degenerative myelopathy
    - 12 German shepherd dogs (9 US, 1 Israel, 2 Poland)
    - 2 Bloodhounds (US)
  - Leukocyte adhesion deficiency, type III
    - 1 German shepherd dogs (US)
  - Exercise-induced collapse
    - 4 Labrador retrievers (1 US, 3 Israel)

Degenerative Myelopathy

- DM occurs in more than 150 breeds of dog
- All 304 dogs were tested and 25% were carriers or at-risk for DM
- DM affects white matter of spinal cord
- Average age of onset for symptoms is 9 years
- Mutation in *SOD1*
  - Also found in humans, Lou Gehrig's Disease (amyotrophic lateral sclerosis, ALS)
- Gradual muscle atrophy, begins in hind limbs
- Progressive disease

Degenerative Myelopathy - **GSD**

- No dogs showed symptoms at the time of study
- 150 GSD studied: 46 carriers, 12 at-risk
  - 67% US, 9% Israel, 24% Poland
- Significant number of GSD with DM mutations
  - 38% from US, 20% from Israel, 25% from Poland

Degenerative Myelopathy - **GSD**

- Analysis of molecular variance and pairwise relatedness analysis was calculated on a subset of GSD to understand any bias of ascertainment
- Analyses indicated
  - closer relationship between dogs from US and Poland, than Israel
  - Overall, 92.2% of dogs were unrelated
  - 7.8% showed some degree of relatedness
    - Only 1 pair from the US indicated full siblings

Degenerative Myelopathy - **GSD**

- Previous studies cite degenerative diseases, spinal cord disease, or musculoskeletal disease, as reasons for early discharge or euthanasia of working dogs, leading to the speculation of possible DM
- Our study showed DM in a substantial number of German shepherd dogs and other working breeds tested
- Thus, DM is likely a significant challenge among law enforcement and other working dogs

Exercise-induced Collapse - Labrador

- 16 dogs identified – 12 carriers, 4 at-risk
- Neuromuscular disorder presents with exercise intolerance
- Many dogs diagnosed after 2 years of age
- 5-20 min. of strenuous exercise results in collapse with recovery 5-30 min.
- Episodes would be stressful to the handler and could jeopardize both handler and dog in certain situations

Leukocyte Adhesion Deficiency III

- 7 dogs identified – 6 carriers, 1 affected
- Blood disorder characterized with abnormal platelets, abnormal clotting and immune system dysfunction
- Dogs may present with lameness, prolonged bleeding, recurrent infections
- One pup, identified as affected, was in training when entered into the study
  - Pup presented with severe joint swelling and persistent high neutrophil count

Search and Rescue Dogs

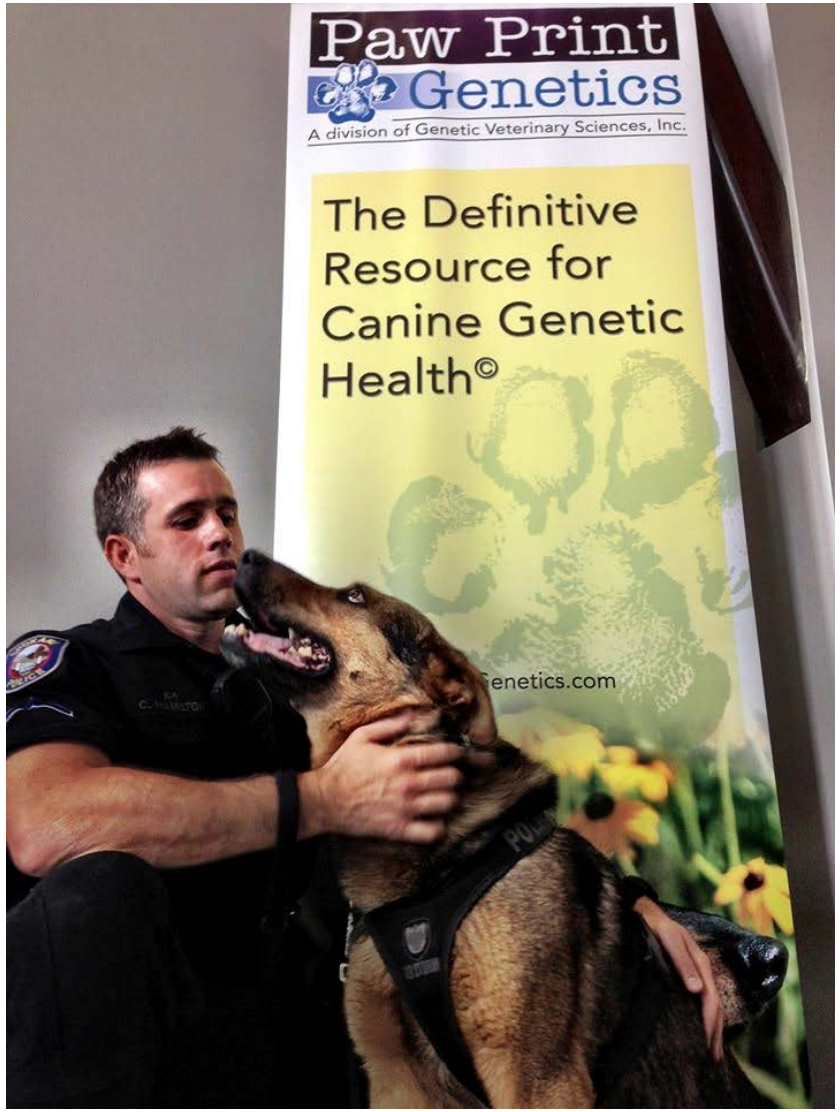
- 37 dogs studied from a variety of breeds
  - Australian shepherd, Belgian sheepdog, Belgian tervuren, bloodhound, border collie, catahoula leopard dog, Czechoslovakian vicak, Dutch shepherd, German shepherd dog, golden retriever, Labrador retriever, standard poodle, mixed breeds
- Tested for breed-specific mutations
- Australian shepherd
  - 1 dog at-risk for multi-drug resistance (MDR1)

Summary

- 35.5% of all dogs studied were either carriers or at risk for known genetic diseases
- Based on this study, before breeding, buying or training, working dogs should be screened for common, breed-specific genetic conditions
- Identifying carriers allows informed breeding decisions and avoidance of breeding carrier x carrier
- Conditions identified in this study are likely to put the dog, handler or the mission in jeopardy (EIC) or shorten a K9's career (DM)

Summary cont.

- The loss of dogs due to early retirement or euthanasia as a result of preventable genetic conditions has emotional costs to handlers and financial costs to service organizations
- Known genetic conditions are easily avoided through relatively low cost genetic testing
- These findings and conclusions are applicable to any working or assistance dogs



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