








## The effect of surgical and chemical sterilization on canine testosterone levels

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## Background

- Veterinarians Without Borders – Canada in Latin America (since 2009): free-roaming dog research and management programs
- Interest in chemical sterilization as a form of rapid and easy sterilization in males
- Potential value in Latin American countries for its cultural acceptance
- Effects on behaviour (and testosterone levels) unknown



## Puerto Natales, Chile

### Chilean Patagonia

- 3,100 km south of Santiago
- 16,978 inhabitants (2002 census)
- Estimated dog population: 4,000
- Tourist town surrounded by rural area
- 2,000,000 sheep in region

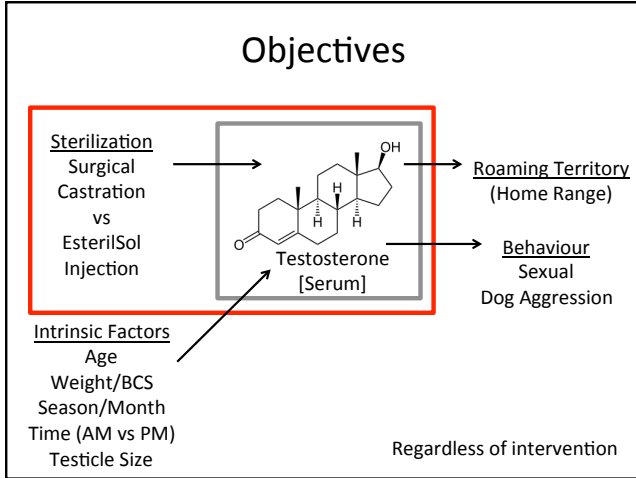


## Puerto Natales, Chile

### Justification

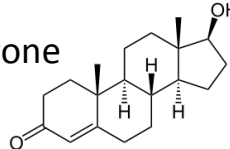
- One of the highest prevalence of hydatid disease in the world (Ministry of Health, SAG)
- Highly motivated to reduce/control dog population

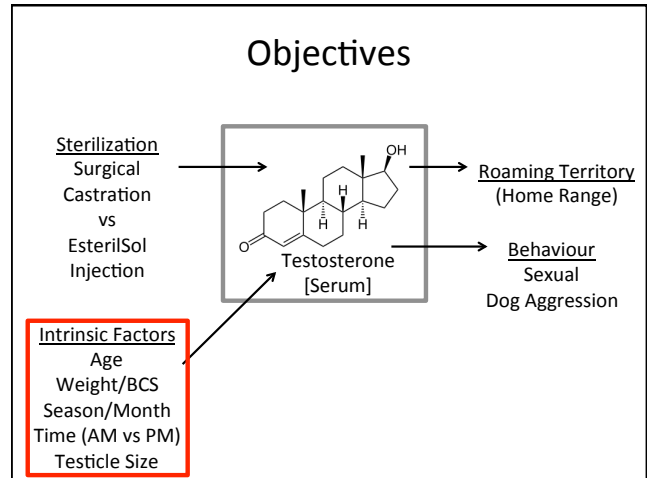
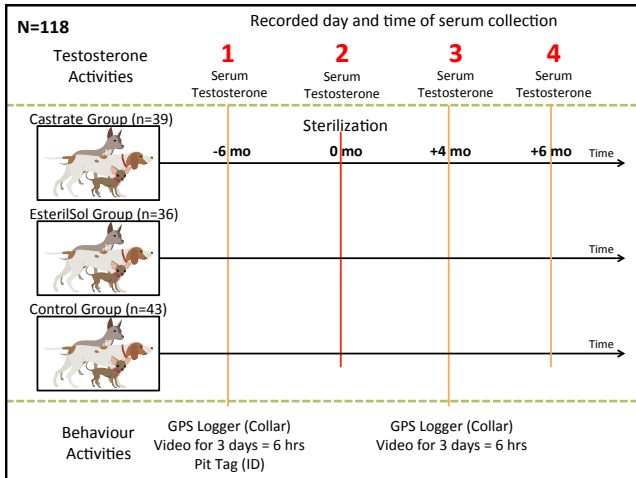




### Testosterone

- Steroid hormone
  - Derived from Cholesterol
- Majority (~95%) produced by Leydig cells in testes (males)
  - Adrenal Glands produce small amounts
- Behavioural changes in adult male dogs
  - Sexual
  - Aggression
  - ~60% of surgically castrated dogs change behavior
    - Maarschalkerweerd et al. (1997) Vet Rec. 140:617
    - Neilson et al. (1997) JAVMA. 211:180
    - Hopkins et al. (1976) JAVMA. 168:1108
- Immulite 2000 Immunoassay System (Siemens)
  - Enzyme-link immunosorbant assay (ELISA)
  - Atlantic Veterinary College





## Intrinsic Factors

- Samples from intact dogs = 201 samples
  - All Pre = 124 samples (95 dogs)
    - Sample 1 (36 controls + 25 EsterilSol + 27 Surgery) = 88
    - Sample 2 (36 controls) = 36
  - Control Post = 77 samples (41 dogs)
    - Sample 3 (41 controls) = 41
    - Sample 4 (36 controls) = 36

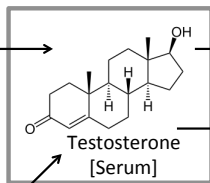
## Intrinsic Factors

- Factors that were investigated for their potential effect on testosterone
  - Age
  - Weight/BCS
  - Testicle size (EsterilSol)
  - Season/Month
  - Time (morning vs afternoon)
- Statistical Model
  - Linear Mixed Model, accounting for repeated measures within dogs (up to 4 samples)
  - Significance was set at  $p < 0.05$
- NOTHING SIGNIFICANT...



## Objectives

Sterilization  
Surgical  
Castration  
vs  
EsterilSol  
Injection



Roaming Territory  
(Home Range)

Behaviour  
Sexual  
Dog Aggression

Intrinsic Factors  
Age  
Weight/BCS  
Season/Month  
Time (AM vs PM)  
Testicle Size

## Sterilization Effect on Testosterone

- 410 samples from 118 dogs
  - Sample 1 (n=88)
    - 36 Controls, 25 EsterilSol, 27 Surgery
  - Sample 2 (n=107)
    - 36 Controls, 35 EsterilSol, 36 Surgery
  - Sample 3 (n=111)
    - 41 Controls, 33 EsterilSol, 37 Surgery
  - Sample 4 (n=104)
    - 36 Controls, 32 EsterilSol, 36 Surgery
- Samples per dog
  - Minimum = 1, Maximum = 4, Average = 3.5

## Sterilization Effect on Testosterone

- Interested in estimated testosterone levels for sterilization group over the 4 serum samples



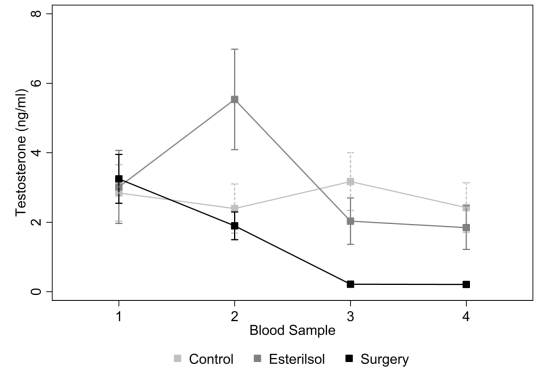
Zinc Gluconate  
(neutralized by arginine)



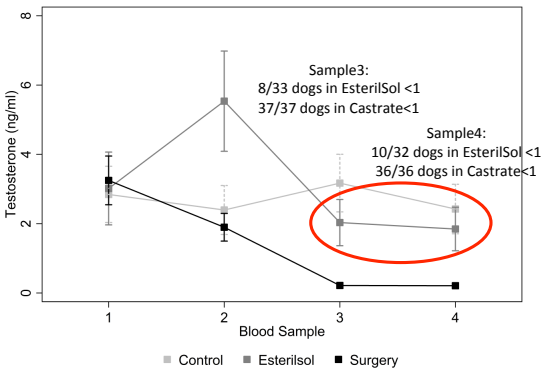
- Statistical Model

- Linear Mixed Model, accounting for repeated measures within dogs (up to 4 samples)
- Sterilization effect was estimated by an interaction
  - Sterilization group and sample
- Significance was set at  $p < 0.05$

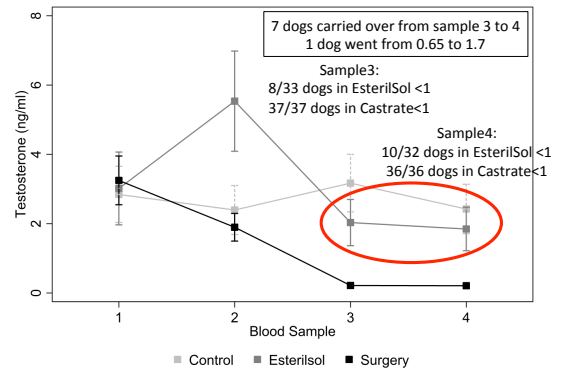
## Sterilization Effect on Testosterone



## Sterilization Effect on Testosterone



## Sterilization Effect on Testosterone



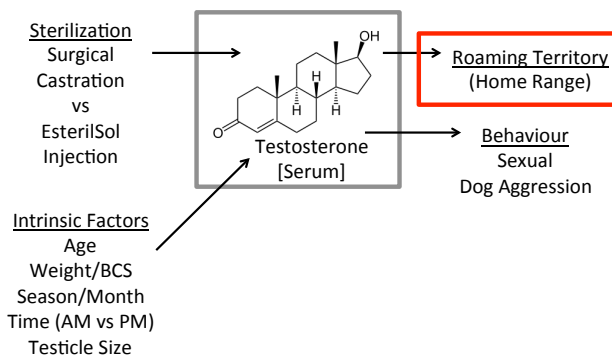
## Sterilization Effect on Testosterone

- Why the increase in Testosterone post injection (within 1 hour)?
  - Increased intratesticular pressure?
    - Induces release of testosterone in blood
    - Nothing in the literature
  - Destruction of tissue?
    - Evidence of tissue necrosis
      - Confirmed to be present in adverse reactions, not in 'normal' testicles
      - Manuscript submitted
        - » 2 ADRs / 36 injected dogs, 7 and 8 days post injection
        - » How sudden is the inflammation/necrosis?
  - Saline trial

## Sterilization Effect on Testosterone

- Testosterone levels does not equate fertility status
  - Semen was collected from 4 dogs, 3 months after the procedure
    - From all dogs with large testicles (>27mm)
    - All were considered infertile with testosterone values:
      - Dog A: 1.51, 19.68, 2.82, 4.71
      - Dog B: 2.56, 2.36, 4.01, 1.27
      - Dog C: 4.37, 2.86, 3.13, 7.28
      - Dog D: 8.32, 14.30, 3.21, 2.38
  - 4 months after EsterilSol injection, 24 % of dogs had testosterone levels comparable to those surgically castrated dogs
  - 6 months after EsterilSol injection, 31% of dogs had testosterone levels comparable to those surgically castrated dogs
    - Although one dog reverted back to higher T (control levels)

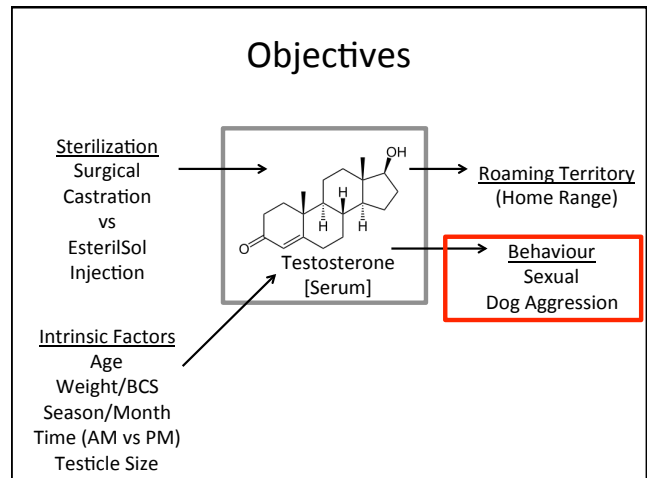
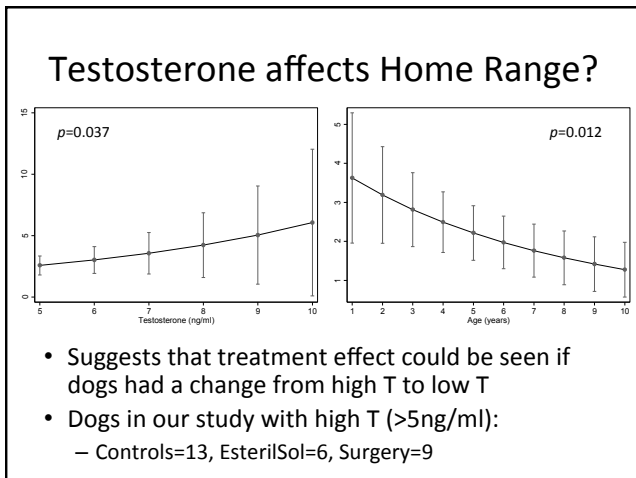
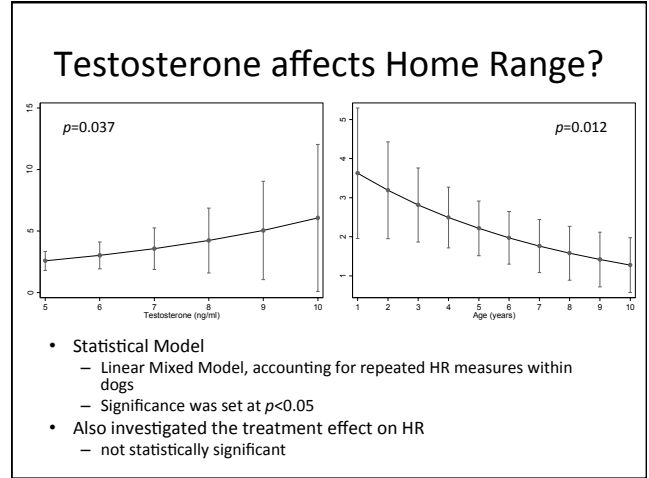
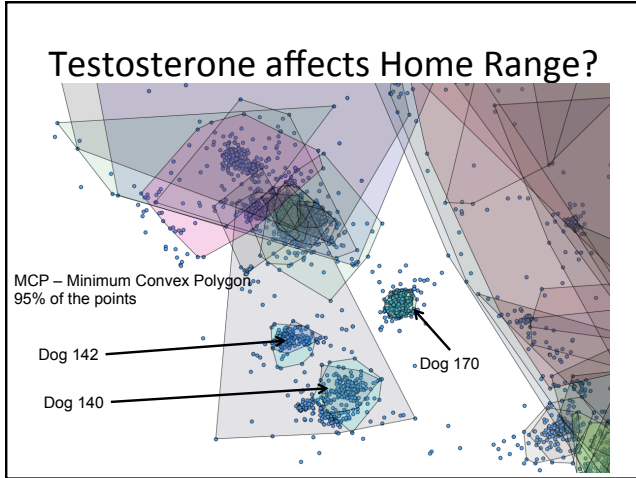
## Objectives



## Testosterone affects Home Range?

- GPS units
  - CatTrack™ for 72 hrs
- 153 home range estimates from 86 dogs
  - Pre-Sterilization (n=67)
    - Sample 1 [T]
  - Post-Sterilization (n=86)
    - Avg Sample 3 & 4 [T]
- Samples per dog
  - Min=1, Max=2, Avg=1.8





## Testosterone affect Behaviour?

- Plan to use the collected behaviour data to assess the effect that testosterone had on behaviour...
  - Could potentially explain more than simply the treatment effect
- Tomorrow...
  - “Behaviour assessment of male free-roaming dogs following surgical and non-surgical sterilization in Puerto Natales, Chile”

## We'd like to thank our funders:



## Special thanks to:

- The community of Puerto Natales
- Municipality of Puerto Natales
- Volunteers & Students