Assessing Fox Mortality in Fox Penning Trials

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What is fox penning?

- Fox hunting is an ancient sport where human trainers and dogs hunt wild foxes.
- For fox penning, the foxes are brought into an enclosure and are then hunted for training or entertainment.
- Legislation restricting the growth of the practice has recently been passed in Virginia.

Origins of the Project

Talk about LISA
CMI
VDGIF
Relevance - of project

Policy Question

- The clients were concerned with cruelty to the foxes.
- While we had no data concerning cruelty, we could tell when a fox died based on its transponder signal.
- Thus, we were in a position to investigate what influences fox mortality.

Data Overview

- Data was provided for trial days and included, fox tag IDs, the experience of the foxes, mortality data, and the number of dogs.
- For interim days, we knew when a fox died could infer their experience, but only had vague information about the number of dogs.
- We handled this limitation by taking a missing data approach to the analysis.

Missing Data

quick overview of missing data
add math to show Data Augmentation to integrate out

Modeling Specification

$$
\begin{aligned}
y_{it} &\sim Bernoulli(p_{it}) && (1)\\
probit(p_{it}) &= \alpha + X_{it}\beta + \theta_{it} && (2)\\
\theta_{it} &\sim N(0, \phi^{-1}) && (3)
\end{aligned}
$$

where $X_{it} = [Num.dogs_t\ log.experience_{it}\ (num.dogs * log.experience)_{it}]$, $i = \{1, ...27\}$(fox), and $t = \{1, ..., T\}$ (trials). Let R_{it} be the risk matrix, where

$$
R_{it} = \begin{cases} 1 & \text{if fox i is alive and collared on day t-1} \\ 0 & \text{otherwise} \end{cases}
$$

Modeling Specification

We use data augmentation where

$$Y_{it} = \begin{cases} 1 & Z_{it} > 0 \\ 0 & Z_{it} \leq 0 \end{cases}$$

and then

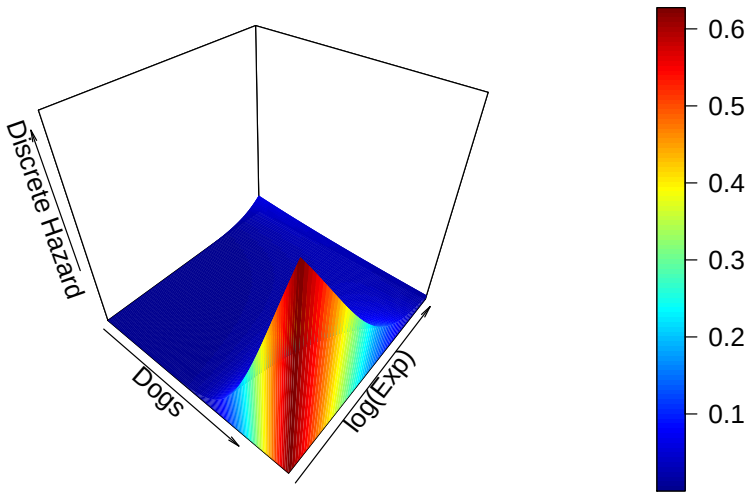
$$Z_{it} \sim N(\alpha + X_{it}\beta + \theta_{it}, 1). \tag{4}$$

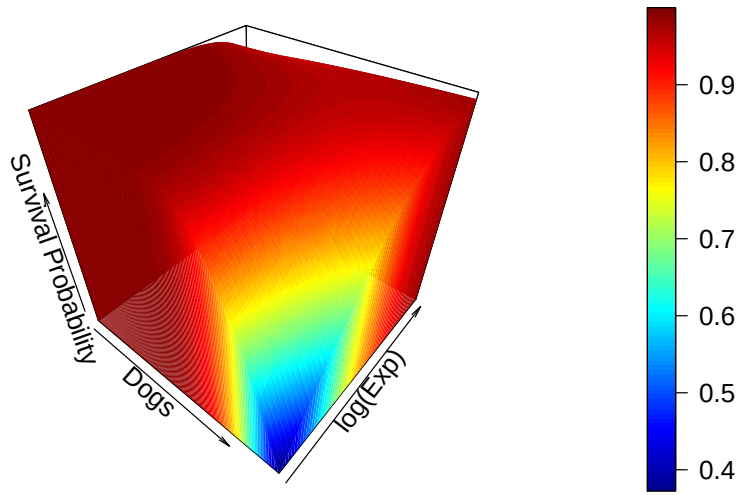
discuss priors here and missing data piece

Posterior Summaries

	mean	CI
α	5.4	(3.0,11.6)
β_{dogs}	-.008	(-.015, -.004)
β_{exp}	-.65	(-2.04,-.10)
$\beta_{dogs*exp}$	.0014	(.0006, .0030)

Response Surface



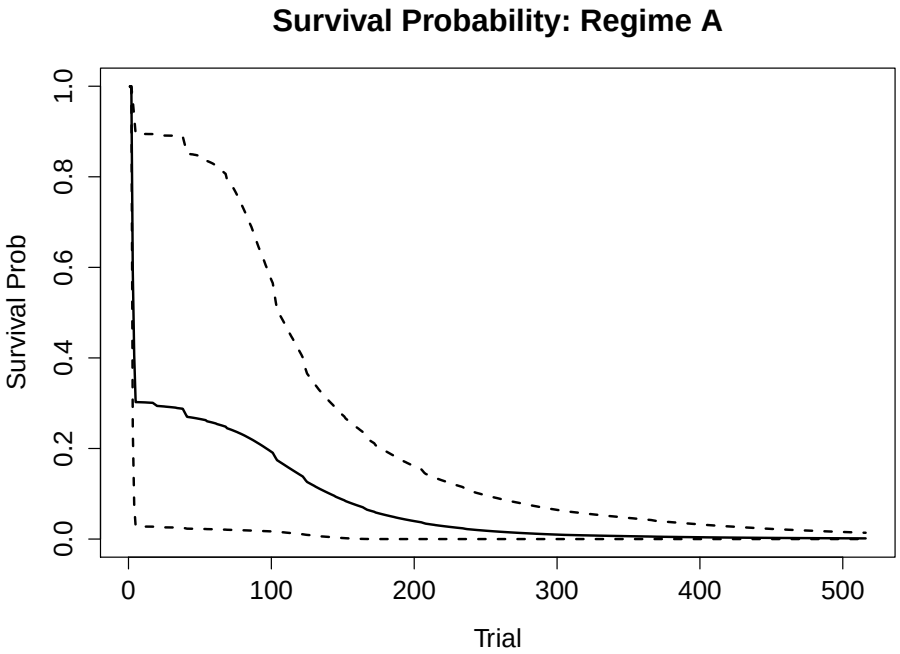


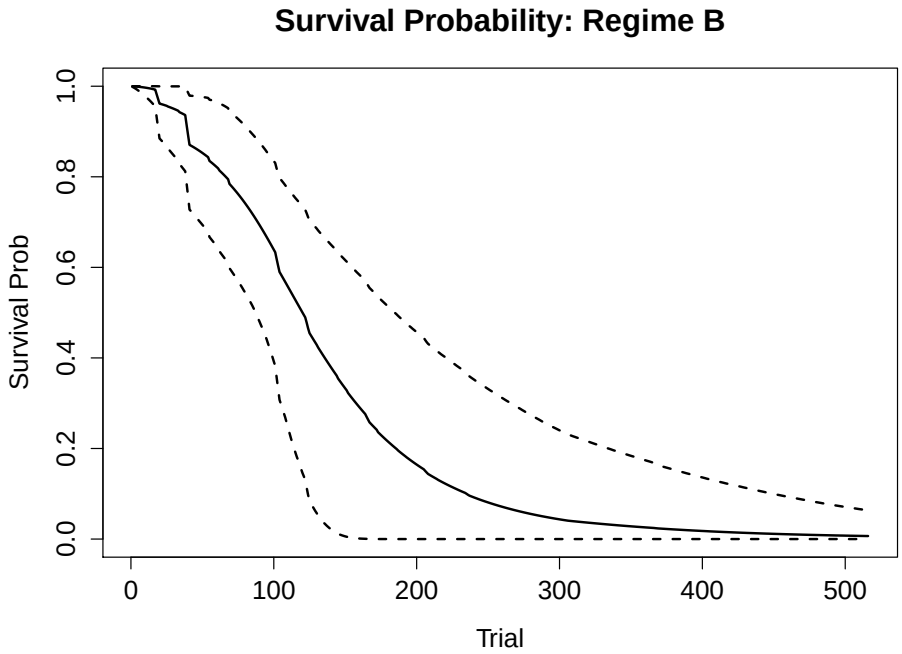
Regime Study

All regimes assume a fox was placed in the pen on the first day of the study.

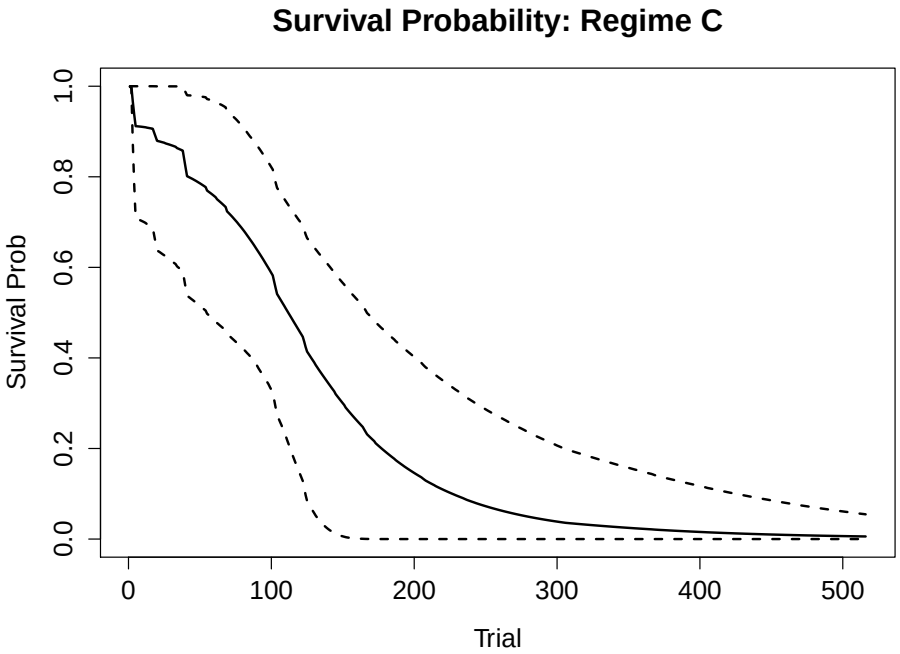
- Regime A: No constraints on number of dogs or allotted acclimation time.
- Regime B: Two weeks acclimation time with no dogs.
- Regime C: No more than 400 dogs allowed in pen at a time.
- Regime D: Two weeks acclimation time and 400 dog limit.

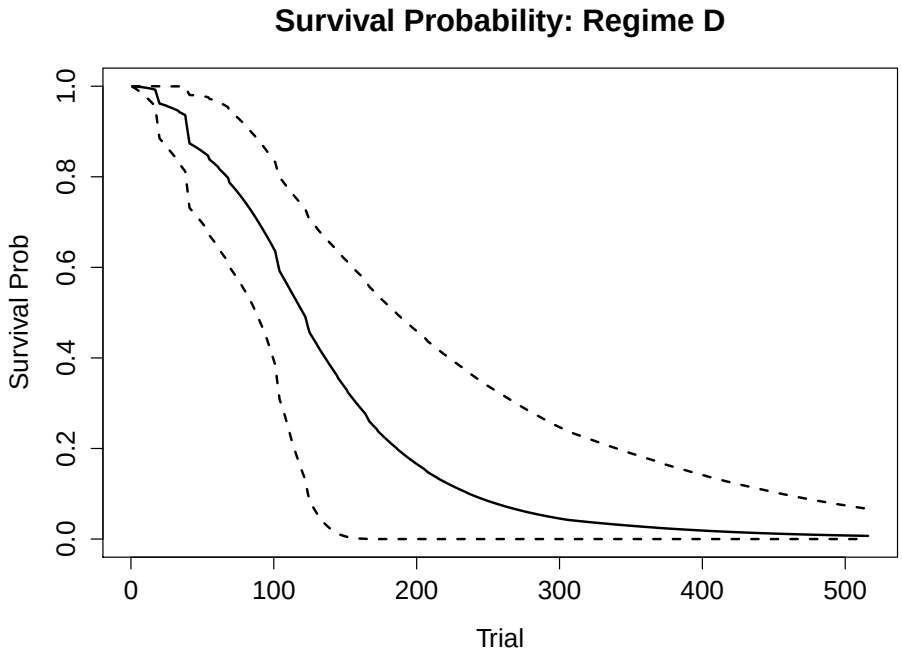
Regime Survival Plots





Regime Survival Plots





Regime Analysis

- Mortality is greatest with many dogs and for inexperienced foxes, but survival greatly improves either with a capped dog count or some time for the foxes to acclimate to the pen.
- Trials are run weekly, so two weeks acclimation is impractical. Thus, we can most practically smooth out fox mortality by capping the number of dogs in the pen.

What's Ahead

While we have addressed fox mortality, it remains to make the connection between mortality and cruelty.