

THE EFFECTS OF TEMPERATURE VARIATION ON PHYSICAL CONTACT AND GROWTH RATE IN ORPHANED NEONATAL KITTENS HOUSED IN THE SAME INCUBATOR

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BACKGROUND

- Many neonatal kittens are abandoned by their mothers shortly after birth each year due to death, neglect, or accidental separation.
- Adverse life experiences are associated with immature physiological processes and overall reduced rate of survival.
- Kitten mortality is highest during first week of life when >90% of all kitten mortality occurs.
- Orphaned neonates are extremely vulnerable since they lack the maternal care needed for pediatric survival.
- Although competition for resources exists among littermates, there are benefits for young mammals to have siblings. A study of ambient temperatures in natural rabbit burrows found that pups raised with littermates had a greater chance of survival than pups raised alone.



Figures 1, 2, 3: Abandoned, neonatal kittens are often found by good Samaritans

RATIONALE

- Individual differences in early growth, physiology, and behavior are shaped to an extent by early sibling relations and can be an important factor in thermoregulation.
- Body temperature deviations in the neonatal kitten are important signs of illness and stress, but ambient temperature settings can vary between caretakers.
- It is imperative to study the different thermoregulatory factors that play a critical role in kitten survival and offer a more cost-affordable alternative to an incubator.
- With the number of homeless kitten populations continually rising, more caretakers are adopting common practices of pediatric care and management, but specific recommendations related to neonatal kittens can vary greatly and warrants more well developed standardized guidelines.
- The purpose of this project is to develop a standard of care for neonates to increase their chance of survival during this critical period of their lives.

HYPOTHESIS AND SPECIFIC AIMS

- Decreased environmental temperature will increase physical contact between littermates. Contact will conserve energy expenditure, resulting in an increase in individual growth rate (measured by weight gain per day) compared to litters that display less huddling behavior. As kittens get older, they will be able to thermoregulate on their own and we would expect to see huddling behavior to decrease.

Specific Aim 1:

- To determine the effect that decreased incubator temperature has on neonatal kitten physical contact with other kittens in the same incubator.

Specific Aim 2:

- To determine the effect that decreased incubation temperature, and contact with other kittens have on neonatal kitten growth rate.

Specific Aim 3:

- To determine if huddling behavior will decrease as kittens get older.

METHODS



Figure 4: Rcom MX-BL600N Pet Incubator used in the study to house kittens.



Figure 5: A litter of two and a half week old kittens enrolled in the study.

- Selected kittens were fostered through UC Davis Orphan Kitten Project.
- A total of 24 kittens (10 litters) were used in the study. At least 2 litters (aged less than 1 week upon intake) were each housed in commercial grade incubators for a maximum of 3 weeks.
- Litters were randomized to each condition (with at least 2 litters per condition): TEMP/humidity (RH): 80/50, 80/60, 90/50, 90/60.
- Kittens were observed using scan sampling, where the behavior of each kitten at a given instant was recorded at least 6x per hour for at least 12 hours of video footage per day (with at least 1 hour between each observation).
- The total number of kittens huddling was recorded.
- Huddling was defined as kittens in physical contact of the head, abdomen, back, or extremities, excluding physical contact by just one extremity or by the tail (Figure 6). Non-huddling was defined as no physical contact (Figure 7).
- Feeding time and volume were recorded at each feeding time for all kittens. Individual growth rates (GR) were recorded and compared between week 1, week 2, and week 3.
- Linear mixed models assessed the effect of TEMP, RH, age, and litter size on huddling behavior. Litter identity was included as a random effect.



Figure 6A



Figure 6B

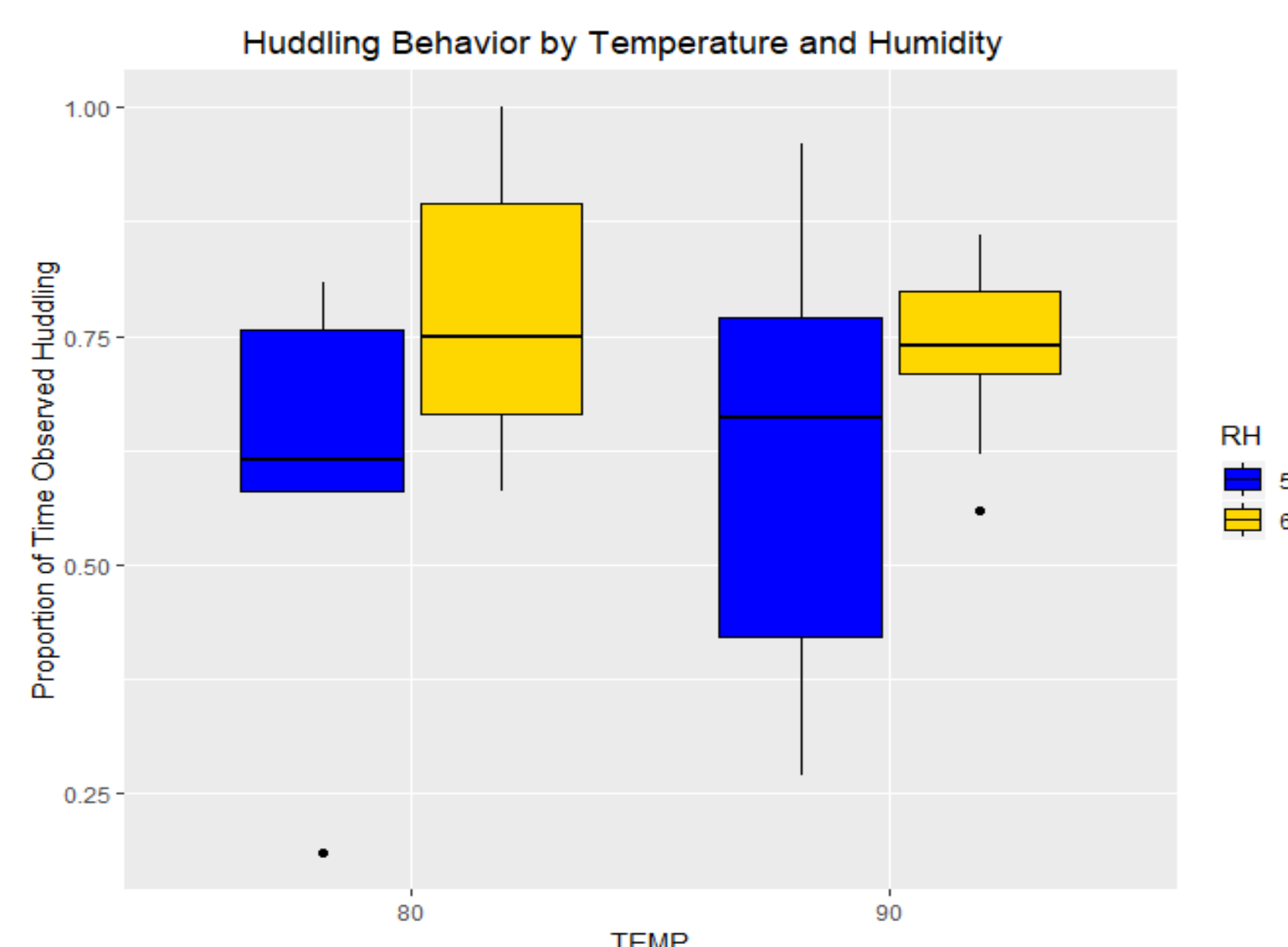


Figure 7

Figure 6A, 6B: 100% of kittens huddling Figure 7: 50% of kittens huddling

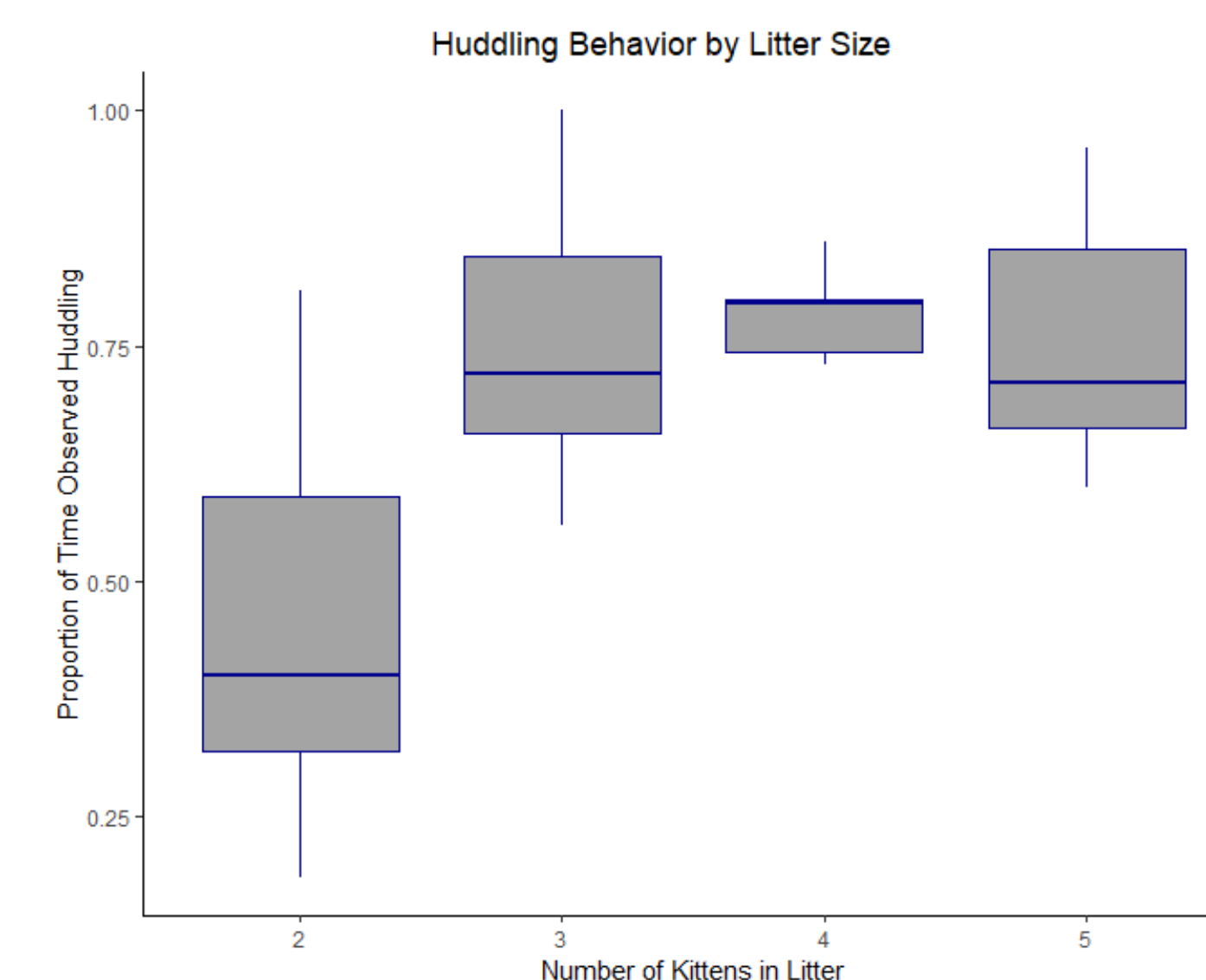
RESULTS

- All included variables had an effect on huddling behavior, Adj. R² for the model was 0.70.

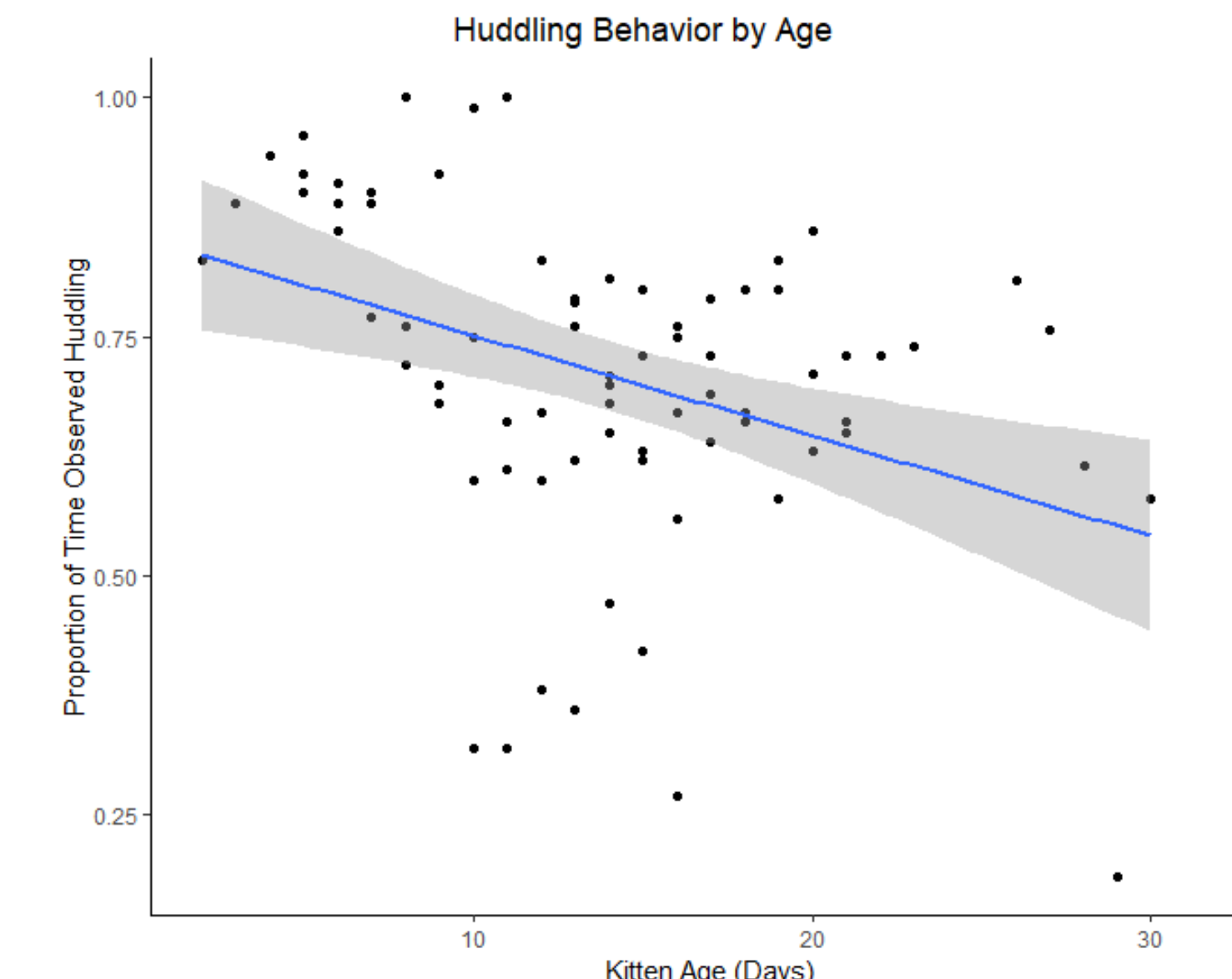


Graph 1: Increases in temperature ($\beta = -0.22$, $t = -7.26$, $p < .001$) and humidity ($\beta = -0.22$, $t = -3.50$, $p = .001$) decreased huddling, but there was an interaction between TEMP and RH ($\beta = 0.53$, $t = 6.29$, $p < .001$).

RESULTS CONTINUED



Graph 2: As litter size increased, so did proportion of time spent huddling ($\beta = 0.10$, $t = 6.96$, $p < .001$).



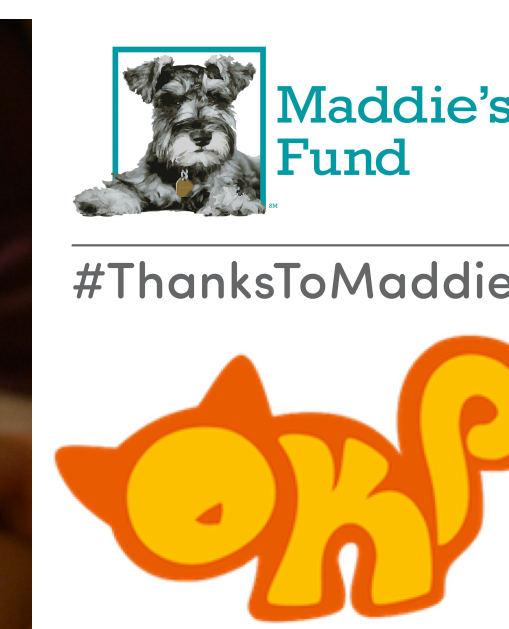
Graph 3: Kittens huddled less as they aged ($\beta = -0.02$, $t = -6.77$, $p < .001$).

DISCUSSION

- Less huddling behavior was observed at TEMP 90°F than at 80°F, suggesting incubators set at a lower temperature more likely results in increased huddling as a thermoregulatory mechanism for kittens.
- More variability in huddling was observed in the incubators set at 90°F than incubators set at 80°F. The effect was somewhat dependent on RH. When RH=60, there was less huddling compared to RH=50.
- As kittens increased in age, there was a decrease in huddling behavior. This supports our hypothesis that as an individual kitten grows in size and develops their own thermoregulatory methods, they do not seek out their littermates for warmth.
- We also explored the effects of huddling time, litter size, TEMP, and RH on growth from weeks 1 to 2, and from weeks 2 to 3. Growth was defined as the percent change in body weight during each period. There was no relationship between huddling time and growth. The model suggested that RH60 increased growth at both time periods
- As the litter size increased, the proportion of time spent huddling increased. There was significant variation in huddling behavior across each litter. Due to a small sample size (N=22) of this study, further research is warranted to explore litter size as a possible influencing factor on huddling behavior.

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