

Degradation of Benzodiazepines
After 120-Days of EMS Deployment

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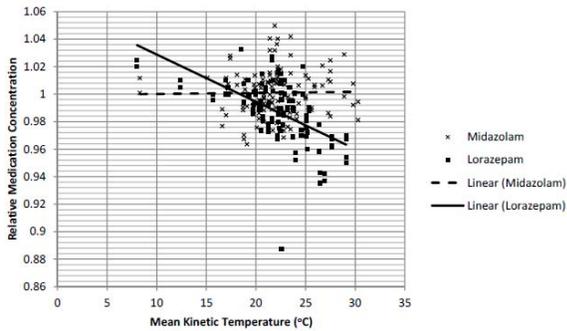
Background

- EMS treatment of status epilepticus improves outcomes
- Benzodiazepines are the mainstay of therapy
- Unclear which benzodiazepine is *best* for the EMS environment
 - Efficacy
 - Durability

Background

- Lorazepam may not be heat-stable
- Diazepam is likely heat-stable
- Midazolam's heat-stability is unknown

60-Day Stability (QA data)



Objective

- Describe the degradation of diazepam, lorazepam, and midazolam as a function of temperature exposure and time over 120-days of storage on active EMS units.

Methods

- Two EMS agencies in Southwest US
 - Summer 2011
- Four EMS units at each agency
- Vials of diazepam, lorazepam, midazolam
- Stored with other medications per EMS agency policies

- Study boxes logged q1' temperatures

Methods

- At 30 day intervals, 2 samples of each drug was removed from each study box

- HPLC at a central commercial laboratory to determine concentration

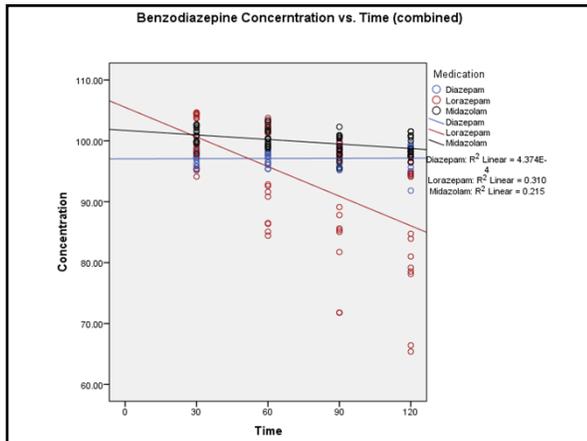
- Mean Kinetic Temperature exposure derived for each sample

Methods

- Relative concentration (actual v labeled) analyzed
 - Means with 95%CI
 - Groups compared with repeated measures ANOVA

Results

- 192 total samples
 - None lost
- Mean MKT 30.2°C (95%CI 28.5-31.0)
- No difference in ambient temperatures



Results--Diazepam

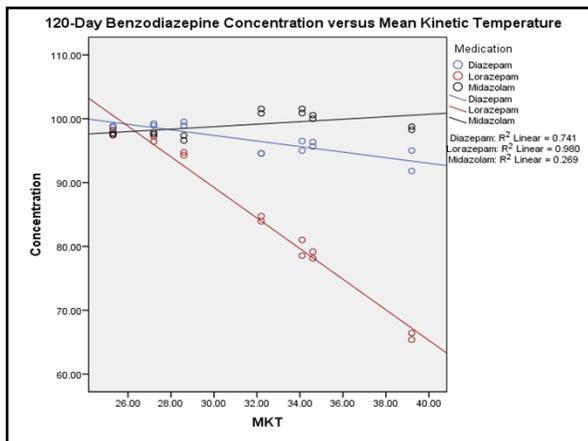
- Minimal degradation at each time point
- 120-day concentration 97.0% (95.7-98.2)

Results--Midazolam

- Minimal degradation at each time point
- 120-day concentration 99.0% (97.7-100.2)

Results--Lorazepam

- Moderate degradation at each time point
- 60-day concentration 95.6% (91.6-99.5)
 - Half of samples <95% concentration
- 90-day concentration 90.3% (85.2-95.4)
- 120-day concentration 86.5% (80.7-92.3)



Results

- Statistical difference at each time point
- Increasing MKT associated with greater degradation of lorazepam
 - No effect on diazepam or midazolam

Conclusions

- Midazolam shows no heat-related degradation over 120-days of EMS deployment
- Diazepam shows little degradation
- Lorazepam experiences significant and progressive degradation with time and increasing MKT
 - 60-days may or may not be safe
