Military Repellent Testing

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Our Customer

Our Criteria

- **Disease prevention**
  - Vector-borne disease = lost manpower = decreased combat effectiveness; cost of treatment/evacuation from theater

- **Efficacy and duration**
  - Efficacy against a wide range of vectors
  - Duration of at least 8 hours, preferably 12

- **We are not your typical repellent customer**

Testing

- **Laboratory screening**
  - *In vitro*: mosquitoes (working on sand fly assay)
  - *In vivo*: K&D module - multiple repellents simultaneously; less exposure to bites

- **Field testing***
  - Culicoides, ticks, sand flies, mosquitoes
  - Collaboration with overseas laboratories

Field Testing

- **Candidate repellents tested against 33% DEET (Ultrathon® or EDTIAR)**

- **Repellency measure endpoint = relative protection (RP)**

  – Number <u>landing</u> in 20 minute challenge

    • Approx. 1 mosquito per minute

  – Treated vs. Untreated leg

  – Challenge at 2, 4, 6, 8, 10, and 12 hours post application

- **Relative Protection (RP)**

- **Percentage reduction in probes/bites**
  - Time to first confirmed bite (TFCB)
  - Landing with intent to bite (LIB)

- **Percentage reduction in <u>landings</u>****

- **Assumptions**
  - DEET has 95% efficacy
  - Candidate is no more than 20% less efficacious
  - 1 mosquito landing per min. (20 min. challenge)
  - With this kind of data, even with a large sample size, you won't get normally distributed data
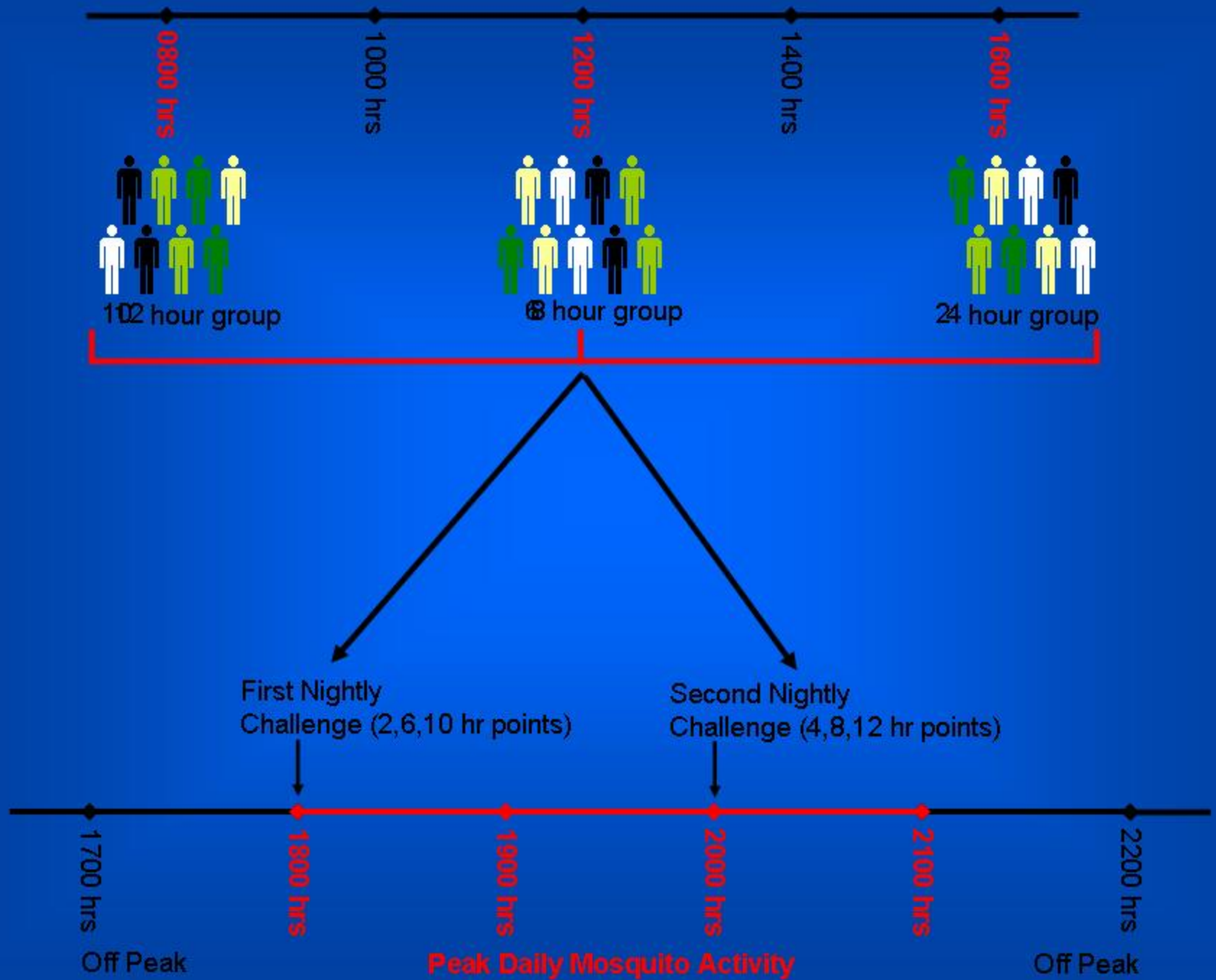 - Variability: subject, location, date, time
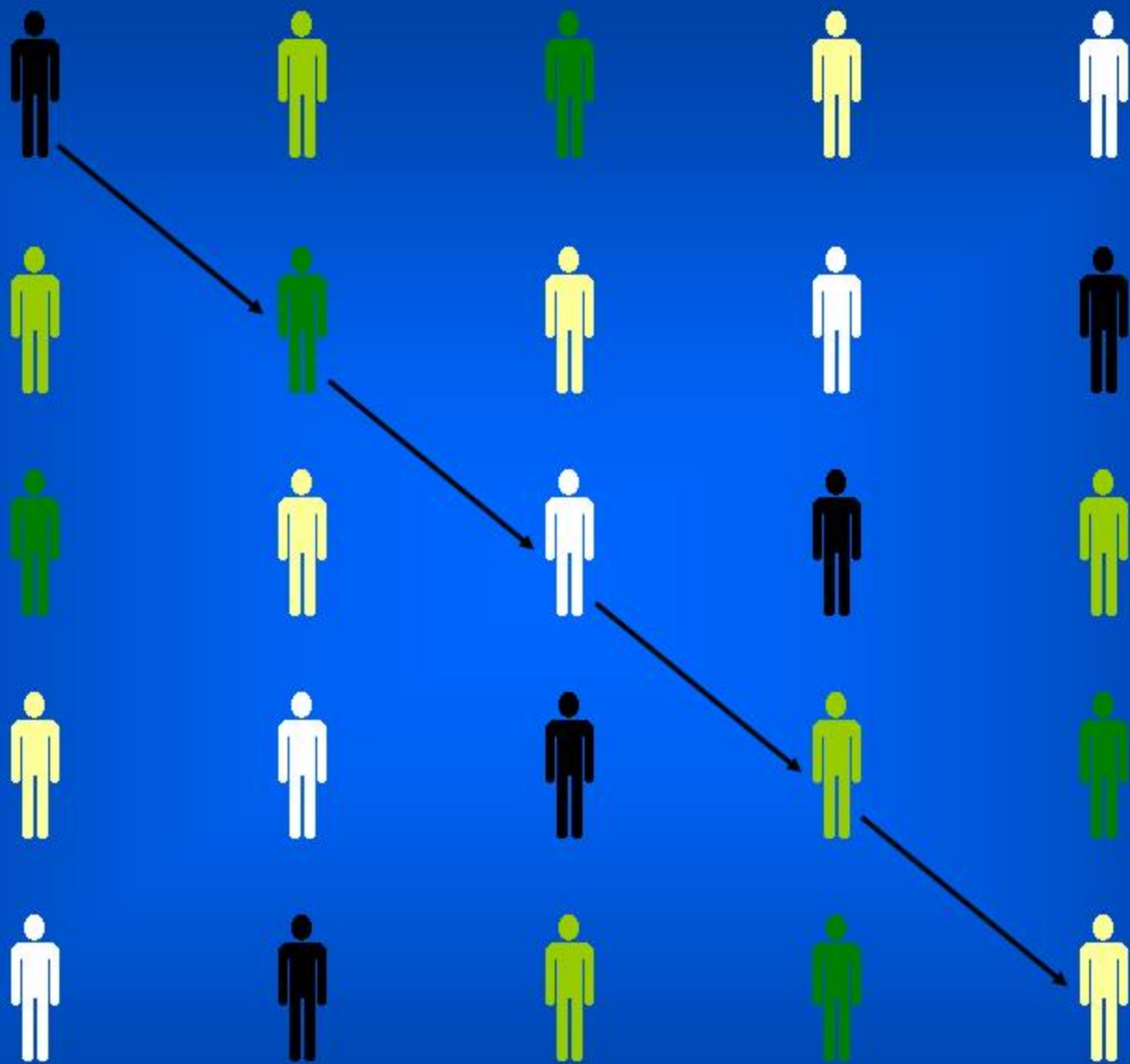
Belize Feb. 07

Belize Sept. 07

- **4 candidate repellents plus EDTIAR**
- **6 volunteers per treatment**
  - Each volunteer wears the same repellent each day
- **Tested at 6 post-application time points**
- **Peak activity: 1800-2100**
  - Challenge at 1800, 2000
- **Staggered treatment during the day**
  - 0800, 1200, or 1600

Analysis

- **Calculate**

  $$PP = 100 \times [(ARC\text{-}ARP) / (ARC)]$$

  - ARC = attack rate for control
  - ARP = attack rate for repellent

- **Data transformation**

- **GLMM**

  - With and without interaction (repellent x duration)

Our Bias

- **95% is a desirable goal but there is much variability**
- **Better to design it this way to have greater power**
- **Not 'perfect' design but field studies = limitations**
  - # of volunteers
  - # of days required (peak activity)
  - Compensation
  - Minimizing risk
  - Weather

Our Bias

- **Compare against EDTIAR**

- **Each person needs to serve as own control**
  - Positive controls: cannot establish biting pressure
  - One control (sentinel): artificially reduces inherent variability

- **Landing counts**
  - Volunteers can easily collect from themselves
  - Possibly reduces actual exposure

Our Bias

- **Negative (true) controls are necessary**
  - Clear risk communication to volunteer
  - Covered except for treated area
  - Adequate follow-up

- **Alternative – putting out a product that doesn't really do what it claims**
  - Unreliable data
  - What is the greater good?

Questions?