Design Considerations for Intervention Studies

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What’s the objective?

Prevent people from getting sick
Intervention studies: how do they differ?

- Objectives
- Outcomes
- Approximation of “real-world”
Objectives

- Can it kill ticks?
- Can it protect people from tickborne disease?
- Will it protect people from tickborne disease?
Can it kill ticks?

- Ticks/Animals
  - Tick density
  - Infectivity rate
- Studies
  - Small lab/field studies
  - Implementation optimized
Can it protect people?

- **Human**
  - Ticks crawling/attached
  - Tickborne disease
  - Biomarkers (including seroconversion)

- **Studies**
  - Sample size larger
  - “high-risk” participants
  - Implementation less-well controlled than tick/animal studies (efficacy $\rightarrow$ effectiveness)

- Necessary to ensure relevance to public health
Will it protect people?

- Actions to deliver services
  - Acceptability
  - Feasibility
  - Cost/Coverage

- Studies
  - Factors affecting implementation (e.g., social, political)
  - All types of participants (no exclusions)
  - “Real-world” settings
  - Implementation in non-ideal settings
The Intervention “Pipeline”
Design Considerations

- Experimental vs. observational
- Control groups
- Single vs. multiple interventions
- Group (cluster) vs. individual
- Sample size and power
- Approximation of “real-world”
Types of study design

Experimental
- Randomised Controlled Trial (RCT)

Observational
- Cohort (longitudinal)
- Case-control
- Cross-sectional
- Ecological

Individual-based vs. population-based
<table>
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<tr>
<th>Experimental vs. Observational Studies</th>
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<tr>
<td>Participants randomly assigned to treatments</td>
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<td>Treatment is the only factor varied</td>
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<td>Causal claim can be made</td>
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<td>Claim can ONLY be made about study participants or similar groups</td>
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<td>Good experiments include: random allocation to treatments, control groups, placebos, and use blinding</td>
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Hierarchy of Study Designs for Assessing the Efficacy of Interventions

- **Randomised controlled** trial (individual or cluster randomised)
- **Randomised** cross-over study, step-wedge design, controlled before-and-after study, controlled time series or controlled interrupted time series
- **Non-randomised** cross-over study, step-wedge design, controlled before-and-after study or controlled interrupted time series
- **Case-control, cohort** or **cross-sectional** study
- **Non-randomised controlled trial** or **non-randomised controlled time series**
- Studies without a control group or using a historical control group
Control Groups

- Considerations
  - Strive for comparable
  - Make them concurrent
  - Collect data on factors relevant to disease occurrence
  - Recognize potential for selection bias/confounding

- Alternative designs
  - Crossover
  - Randomization
Multiple interventions typically viewed as better, but...

- Environmentally conscious
- Evidence of synergy
- Cost-effective
- Practical
Cluster vs. Individual
Sample Size and Power

- Be clear about expected effect size (e.g., 50% reduction)
- Small samples will affect the standard error
- Sample must be large enough to minimize probability of Type II error
- Larger samples for cluster studies due to between-cluster variation
Approximation of “Real-World”

- Participant selection
- Location
- Timing
- Cost
- Selection of monitoring sites
Other considerations

- Blinding (sometimes not possible)
- Adherence to the intervention
- Follow-up periods
- Spillover effects
- Limited resources
Summary

- Common problems/deterrents exist with tickborne disease intervention studies
  - Surrogate endpoints
  - Resource limited
  - Implementation (large-scale) is difficult
- Methodologically stronger study designs exist
- Human outcomes need to match interventions
- Entomologists and epidemiologists need to partner...
Thank you!

For more information, contact CDC
1-800-CDC-INFO (232-4636)

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.