Public Abstract
Huwaida Rabie
Ph.D.
Statistics
Optimal Designs for Dose-Finding In
Contingent Response Models
Advisor: Dr. Nancy Flournoy

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Advisor's signature

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We study D- and c-optimal designs for dose-finding in contingent response models. In particular, we study the contingent response models of Li, Durham and Flournoy (1995). In the contingent response model, there are two opposing types of failure. We call one failure type *toxicity* and the other *disease failure*, short for *failure due to disease*. No disease failure is *efficacy*. No toxicity and no disease failure is a *success* or *cure*. We assume disease failures are contingent on toxicity in that they are only observed in the absence of toxicity. We also assume the probability of toxicity increases with the dose, and the probability of disease failure given no toxicity decreases with dose.

We find canonical c- and D-optimal designs and show that other designs in the location-scale family can be obtained from a canonical design. For c-optimality, interest is in finding designs for estimating the dose that maximizes the cure probability, which we call the *optimal dose*. We use the positive-negative extreme value contingent response model to provide a specific illustration of the D- and c-optimal designs. We examine the efficiency of relevant up-and-down procedures in the literature for estimating the optimal dose based on the maximum likelihood estimation. We show that these procedures are inefficient for estimating the optimal dose.