The (shifted) Beta-Geometric Probability Distribution and its application in predicting who will not return for repeat breast cancer screening

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Breast cancer early detection through mammography screening reduces a woman's risk of breast cancer morbidity and mortality. Women should engage in regular on-schedule repeat mammography to gain the greatest mortality benefit screening can offer.

This research focuses on women who do not return for on-schedule repeat screening. We develop a model that accurately estimates the probability of nonadherence over time given an initial set of training data. We do this by projecting out the survival curve of screened women. We study the shifted beta-geometric probability distribution discussed by Peter S. Fader and Bruce G.S. Hardie in the paper "A Simple Probability Model for Projecting Customer Retention" (2005). This mixed-model probability distribution is superior for projecting customer retention versus linear or curved regression models. Though the conceptual model using the (sBG) was designed for customer retention, we examine the shifted beta-geometric model for predicting mammography nonadherence. We propose that mammography adherence is a particular case of customer retention. Therefore nonadherence (churn) is (1 - P(retention)) in the contractual case.

In this thesis we project out the survival curve using the shifted beta-geometric distribution to predict the churn rate of women enrolled in the Louisiana Breast and Cervical Cancer Early Detection Program. We wish to know for whom interventions to increase repeat screening need to be developed. Accurate and successful prediction of the nonadherence survival curve will be useful for measuring repeat mammography intervention effectiveness. We can do this by comparing the projected survival curve of nonadherence before intervention to the observed nonadherence survival curve after intervention.