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Response-Adaptive Randomization urn designs in clinical trials

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During a clinical trial, we may know the results from past patients when assigning new patients to the treatments. It may not be ethical for equal allocation of treatment if we know that one treatment performs better than the other. Response-adaptive randomization methods use the information from past patients to increase the probability of the next patient receiving the better treatment. This paper compares the following three response-adaptive randomization urn designs: Randomized Play-the-Winner (RPW), Modified Play-the-Winner (MPW), and Birth-and-Death Urn (BDUI) with Immigration, to the traditional equal allocation (EA) design. Simulations were conducted to compare the power and allocation of patients to the more effective treatment. For every other sample size 30 to 210, 1000 simulations were run, each with the following three combinations of treatment and control success probabilities: (0.1, 0.3), (0.2, 0.6), and (0.5, 0.7). The allocation proportion increased as sample size increased for MPW for (0.1, 0.3), (0.2, 0.6), and (0.5, 0.7), and for BDUI and RPW for (0.5, 0.7). Because MPW allocated too many to treatment, power could not be assessed. For (0.1, 0.3), (0.2, 0.6), and (0.5, 0.7), power of BDUI, RPW, and EA increased with sample size. MPW tends to be unpredictable and can result in all of the patients being allocated to the better treatment. RPW allocates more patients to the better treatment than BDUI, but BDUI is more consistent in its allocations. The RPW and the BDUI designs produce allocations that have comparable powers to the EA design.

Biography

Annalisa Piccorelli received her PhD in Epidemiology and Biostatistics, with a concentration in Biostatistics, from Case Western Reserve University in 2010. Her dissertation work focused on joint modeling longitudinal and time to event data subject to left truncation with applications to cystic fibrosis. After completing her PhD, she has worked at the Cleveland Clinic, the University of Akron and is currently an Assistant Professor of Statistics at the University of Wyoming. In addition to joint modeling, her research interests include prediction models of health outcomes, often displayed with nomograms, clinical trials and mixed models.

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