Examples of Superpopulations arising from a Random Permutation Superpopulation Model

Example 1. Number of Children under 5 in a Census Tract

A population is defined as the number of children under 5 years of age (m_t) in dwelling unit $t = 1,..., N$ in Census tract 5506 as of 1/1/99. The superpopulation consists of a vector of N random variables corresponding to a random permutation of these values

Example 2. Patient-s age in Physician Practice in an HMO

Let h index the physicians in an Health Maintenance Organization (HMO), where $h = 1,..., H$, and y_{ht} represent the average patient-s age for physician $h's$ patients as of Jan. 1 in year t for $t = 1,..., N_h$, where N_h represents the total number of years that physician h is employed by the HMO. The parameter m_h for $h = 1,..., H$ is the average of these patient-s ages over physician $h's$ employment period. The superpopulation corresponds to a random permutation of physicians and employment years for each physician.

Example 3. Biases in Dietary Reporting of Daily Intake

Let *t* index subjects that have agreed to participate in an observational study to identify biases in dietary reporting. Each subject-s energy expenditure is measured using doubly labeled water over a two week period. We define m_t to be the true energy expenditure of subject t during this period, and E_{tk} to be the deviation from this value for the k^{th} measure of energy expenditure in this period based on the doubly labeled water. Usually, we also assume that

$E_R(E_{tk}) = 0$. The superpopulation consists of a random permutation of the $t = 1,..., N$ subjects who agree to participate in the study.

Example 4. Noise Complaints at a Time in an Area

A list of $t = 1,..., N = 284$ dwelling units has been constructed for the geographic area #24 used by the Amherst Police Department. The geographic area consists of a central town neighborhood of older dwelling units and contains a few new building lots. The town is interested in the number of noise disturbances that occurred from April 1, 1998 through March 31, 1999.

Let m_t represent the number of noise disturbances that occurred for unit t in this time period. The list of m_t for $t = 1,..., N$ is the population. The superpopulation is a random permutation of this list. If these numbers were known for all dwelling units, then the total number of times noise disturbances occurred for dwelling units would be known for the area. If the number of noise disturbances is known only for a subset of the dwelling units (say units $j = 1,..., n$ in the superpopulation), then the problem faced by the town is estimating the number of noise disturbances for the dwelling units that were not observed. These estimates correspond to estimates of m_t for the dwelling units not observed.