A166 Statistical Drug Sampling I: Training Narcotics Custodians in the Sampling of Large Marijuana Seizures

Elizabeth A. Gardner, PhD, University of Alabama at Birmingham, Department of Justice Sciences, UBOB 210, 1530 3rd Avenue South, Birmingham, AL 35294-4562*

After attending this presentation, attendees will be able to understand how to calculate the number of random samples that must be selected from a population in order to be 95% confidence that 90% of the items in a population are a controlled substance. The attendee will also have the tools to generate their own table of the Hypergeometric distribution for a range of populations.

This presentation will impact the forensic community by presenting the Hypergeometric Equation in an easily digestible form and to serve as a model for the training of non - scientific personnel in the statistical sampling of large drug seizures.

Backlog is one of the most important issues in forensic crime labs. A training program was developed for narcotics custodians in the sampling of large marijuana cases in order to reduce the backlog of suspected controlled substances waiting for analysis. The objective of this presentation is to use simple statistics to derive the equation:

$$P_0 = [N_1!(N-n)!]/[(N_1-n)!(N)!] \leq \theta \qquad \text{Eq. 1}$$

This equation is equivalent to the Hypergeometric Equation, assuming zero negative samples. After attending this presentation, attendees will be able to understand how to use Eq. 1 to calculate the number of random samples that must be selected from a population in order to be 95% confidence that 90% of the items in a population are a controlled substance. The attendee will also have the tools to generate their own table of the Hypergeometric distribution for a range of populations.

Teasing out the meaning of the equations used in statistical sampling can be one of the most difficult aspects of developing protocols for drug analysis. The impact of this work on the forensic science community is by presenting the Hypergeometric Equation in an easily digestible form and to serve as a model for the training of non-scientific personnel in the statistical sampling of large drug seizures.

There are about as many ways to sample populations in a drug seizure as there are labs that perform the analysis of controlled substances. Some methods are straightforward, as in testing for the presence of a controlled substance to prove possession or in testing to the lower limit of a penalty range. There are also ‘accepted methods’ arbitrary methods that include everything from *testing one*, *testing the square root of a population*, all the way to *testing all*.

However, the disadvantage of non-statistical methods is that the results of the tests performed on the samples do not reflect the composition of the entire population. For this, a statistical sampling method is required. There are several statistical methods that have been recommended for use by drug analysts. These include the Hypergeometric Distribution, The Binomial Distribution, and the Bayesian EquationApproach. The most commonly applied method is the Hypergeometric method. The strength of the Hypergeometric Equation is that it can be used to calculate the number of random samples to be selected even in the case where 1 or 2 negatives might be encountered during the testing. In reality though, most labs determine the number of samples that need to be analyzed by assuming that zero negatives will be encountered and then reading the number of random samples that must be selected from a table where the Hypergeometric Distribution has already been calculated. The goal of this presentation is to demonstrate how to solve the Hypergeotric Equation and how the tables are generated.

There are three concepts that are essential for deriving Eq. 1. The first concept is simple probability:

$$P(E) = n(E)/n(S) \qquad \text{Eq. 2}$$

Where P(E) is the probability for E, n(E) is the number of desired outcomes and n(S) is the total number of possible outcomes. The second concept is that of N factorial (N!):

$$N! = N \times (N-1) \times (N-2) \times (N-3) \ldots \times 1) \qquad \text{Eq. 3}$$

Where N is any integer. The final concept is N choose *n*: $(N-n)!/(N!n!)$ Eq. 4

This equation is used to calculate the number of ways that n items can be selected from a population of N items when order does not matter. These three concepts will be used to generate Eq. 1, which will is all that is required to build a table of the Hypergeometric Equation.

Statistical Sampling, Hypergeometric Distribution, Illicit Drugs

 ** Presenting Author*