

The Odds are Against Auditing!

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ABSTRACT

The purpose of auditing is to identify failures in the system or gross negligence. The real question, “how bad does the system need to be for auditing to work?” This talk will look at statistical distribution for rare events to show that the sample size needs to be larger when the systems are better. This is a paradox for most auditors who when a problem is discovered increase their sample size.

Most auditing sampling plans are based on either the binomial or normal distribution, though rare events usually follow the Poisson distribution. This talk will show how the Poisson relates to the binomial and normal distributions. Special attention will be given to risk management strategies. A review and comparison of different sampling strategies will be presented.

INTRODUCTION

Typically audit sample sizes are selected as a proportion of the “population”, such as the ten percent rule. Should the sample size be a function of the expected failure rate of the system being audited? The paradox is that for more compliant systems, a larger sample size would be needed to detect any findings, while a smaller sample size might be sufficient to assess noncompliant systems. Statistical distributions typically used to determine sample size fail when the true percent defective is very low. The Poisson distribution calculates the probability of having a finding in highly compliant systems where the actual number of errors on the system is a finite low number.

SELECTING A SAMPLE

It is impossible to audit every document, record or process. Usually we need to make a decision based on our analysis of a sample. How we select the sample is very important to minimize bias, be representative of the population and sufficient size to detect abnormalities if they exist. There are several different strategies that can help to meet these objectives. The most common method is the simple random sample where each sampling unit has an equal probability of being sampled with each selection. A second strategy called stratified random sample allows the auditor to ensure that each major category is represented in the audit sample. The stratified random sample required that each category (or strata) is specified and non-overlapping (items to be audited have to fall in one and only one category). For example, you can select training records, batch records, complaints and standard operating procedures as the strata. The number of items sampled in each stratum does not have to be equal, allowing for audits to concentrate on a few facets without overlooking other facets. The third method is called systematic sampling. This method is used when audits are time based where the auditor wants to ensure that all time points are sampled adequately. Systematic sampling entails sampling every nth item in the audit.

BINOMIAL

The binomial distribution is used when the outcome of an event has only two possible outcomes. For auditing this is either compliant or noncompliant. Typically one can use the binomial to calculate the probability of finding a set number of noncompliant findings during an audit. The formula for the binomial distribution is in Figure 1 where p is the percent noncompliant in the sample of size n.

:

$$\alpha = \binom{n}{x} \cdot p^x \cdot (1-p)^{(n-x)}$$

Figure 1

The main advantage of the binomial is that it is sample size dependent.

POISSON

The Poisson distribution describes the number of times an event occurs in a finite observation space. The Poisson distribution is defined by one parameter: lambda. This parameter equals the mean and variance. Using a Poisson distribution, a confidence interval can be calculated using the following one-sided upper interval:

$$\lambda \leq \frac{1}{2} \chi^2_{0.05;2(x+1)}$$

Figure 2

The main drawback of using the Poisson distribution is that it usually requires a large sample size to estimate the mean.

STATISTICAL IMPLICATIONS

Using either the Poisson distribution or binomial will give comparable confidence intervals for large sample sizes. For smaller sample sizes, the binomial gives tighter intervals where the Poisson is not population size (or sample size) dependent. This will allow for a better acceptance range for an audit where the population size might not be known.

Table 1

Sample Size	Poisson		
	Mean		UCL
	5		10.51
Binomial			
50	0.1	19.88	9.94
100	0.05	10.22	10.22
500	0.01	2.09	10.45
1,000	0.005	1.05	10.47

DECIDING TO AUDIT

The value to using statistics is not the sample size calculation, but how you use the sample size to determine what is an acceptable audit. As long as the observed number is lower than the upper confidence interval, the system is in control. Need to use risk or statistical probability to determine when to audit, what are the appropriate acceptance criteria for establishing a system is in control. The results of an audit can help to establish acceptance controls. Better audit results would have less risk, and require smaller sample sizes for incoming inspection.

CONCLUSION

The use of the correct sampling strategy helps to assure coverage during an audit, though use confidence intervals to determine if a system is in control. More compliant systems require larger sample sizes since the likelihood of finding an error is smaller.