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The QSIT Sampling Tables

The FDA has taken some of its own words to heart in its new Guide to Inspections of Quality Systems.¹ The Guide is a reference for FDA investigators to use when performing an inspection using the new Quality System Inspection Technique (QSIT). The Agency has long required that device manufacturers base their sampling plans on a valid statistical rationale. Now, for the first time, investigators are being instructed to use sampling tables when inspecting quality records.

The QSIT represents a major change in the way the FDA performs a general inspection. Investigators traditionally used a “bottom-up” process that began by examining records to identify nonconformities related to production or device problems. Investigators often went into a facility assuming that the company was doing something wrong, and the investigator’s job was to find evidence in the records to support this assumption. There was no need for sampling tables — the point was to continue digging into records until a nonconformance(s) was found. By contrast, the QSIT uses a “top-down” process that begins by reviewing top-level quality policies and procedures. After the investigator has verified that the company has defined an adequate quality system, then the inspector will examine the company’s records to determine if the system has been effectively implemented. Records will be examined to verify compliance with the Quality System Regulation (21CFR 820) and internal procedures. The QSIT approach is designed to identify significant and systematic deficiencies.

Device manufacturers should benefit from the QSIT sampling tables. The tables guide the investigator in deciding how many records to review. The good news for the manufacturer is that the FDA will make fewer “fishing expeditions.” The good news for the FDA is that the inspections should move more quickly, so the investigators can cover more territory in less time, with better accuracy.

The tables should also reduce the variation from one inspection to another. Many companies believe that there are “easy” and “hard” investigators within their District. Before the QSIT tables, investigators had to decide for themselves how many records to examine in order to demonstrate compliance or noncompliance. That number could vary depending upon the investigator and the expectations of the investigator’s supervisor. The sampling tables will make the evaluations more objective by providing a statistical basis for deciding how many records to examine.

The tables provide a binomial sampling plan. Binomial sampling may be used when trying to make a decision about an endpoint that has only two potential outcomes (e.g., the device history record is compliant or the device history record is noncompliant).

However, record review will still be somewhat subjective. Investigators must still use personal judgment when they employ the sampling tables. First they must decide which of the two sampling tables in the Guide to use. One table provides a confidence limit² of ≥ 0.95 , and the other provides a confidence limit of ≥ 0.99 . Then the investigator must decide how many records to examine. The tables give sample sizes ranging from 11 to 190. The Guide notes that the investigator may base these decisions on the risk of the device being inspected or the records being sampled, and the amount of time allocated to that portion of the inspection.

The tables in the Guides are reproduced below. An explanation of how to read the tables follows.

Table 1
Binomial Stages Sampling Plans
Binomial Confidence Levels

	Confidence Limit .95 \leq	0 out of:	1 out of:	2 out of:
A	.30 ucl*	11	17	22
B	.25 ucl	13	20	27
C	.20 ucl	17	26	34
D	.15 ucl	23	35	46
E	.10 ucl	35	52	72
F	.05 ucl	72	115	157

Table 2
Binomial Staged Sampling Plans
Binomial Confidence Levels

	Confidence Limit .99 \leq	0 out of:	1 out of:	2 out of:
A	.30 ucl*	15	22	27
B	.25 ucl	19	27	34
C	.20 ucl	24	34	43
D	.15 ucl	35	47	59
E	.10 ucl	51	73	90
F	.05 ucl	107	161	190

*ucl = Upper Confidence Level

CRC Handbook of Probability and Statistics: Second Edition.

How to Read the Tables

Table 1

Column 1 on the far left designates the rows as A – F. Reading across Row A, if the inspectors randomly select a sample of 11 records and find no nonconforming records among the 11 examined, then there is at least a 95% probability (confidence limit of at least 0.95) that no more than 30% of all of the records are nonconforming (at least 70% of all records conform to requirements). If the inspectors randomly select 17 records and find 1 nonconforming record among the 17, or if the inspectors select 22 records and find 2 nonconforming records among the 22, then the inspectors will again conclude that there is at least a 95% probability that no more than 30% of all of the records are nonconforming (at least 70% are conforming).



As you read down the columns, the upper confidence level decreases from 0.30 to 0.05 as the sample size increases. For example, compare row B to row A of the “0 out of:” column. Row B shows that, if the inspectors randomly select 13 records and find no nonconforming records among the 13 examined, then there is at least a 95% probability that no more than 25% of all of the records are nonconforming (at least 75% of all records conform to requirements).

Table 2

Table 2 provides a higher degree of assurance than does Table 1, since the confidence limit is at least 0.99 for Table 2. Looking at row F, for example, if the inspectors randomly select 161 records and find one nonconforming record among the 161 examined, then there is at least a 99% probability that no more than 5% of all records are nonconforming (at least 95% of all records meet requirements).

The QSIT tables are similar to attribute sampling plans based on the Lot Tolerance Percent Defective (LTPD). The QSIT tables show the LTPD as the “ucl”, or “upper confidence level.”² The two QSIT tables show LTPD values at the 5% and 1% probabilities of acceptance (confidence limits of 0.95 and 0.99, respectively). For example, Table 1 Row A provides an LTPD of 30% at the confidence limit of 0.95 (5% probability of acceptance), regardless of whether 0/11 or 1/17 or 2/22 nonconformances are found.³

The FDA will not use the tables for acceptance sampling. As the QSIT Guide states, “There are no ‘acceptable’ violations of the Quality System Regulation. All Quality System Regulation violations encountered must be handled appropriately according to current FDA policies and procedures. *When using the ‘1 out of:’ and ‘2 out of:’ columns, it does not mean no more than that number of Quality System Regulation violations per the appropriate sample size is acceptable.*” [Italics added.] Acceptance sampling plans typically allow some predetermined level of nonconformance that is appropriate to the risk. In contrast, the FDA’s position is that every nonconformance represents a violative, unacceptable condition.

The QSIT Approach is Working

The FDA implemented the QSIT methodology in October, 1999. Early evidence shows that the new approach meets the goals of focusing on quality system issues and reducing inspection time. To assess the possible impact of the QSIT approach, the FDA conducted a preliminary study in which 12 investigators from three Districts performed 42 inspections over a 4-month period using the QSIT approach. The Agency reported the results of the study on April 26, 1999.⁴ Over 80% of the investigators and companies involved said that the QSIT approach resulted in more efficient, shorter inspections.

- ¹ Food & Drug Administration, ORA Inspectional Reference, “Guide to Inspections of Quality Systems,” August 1999.
- ² The FDA uses the term “confidence limit” where many statisticians use the term “confidence level.” The FDA uses the term “upper confidence level” where many statisticians use the term “upper confidence limit.” This article uses the FDA’s terminology.
- ³ The LTPD represents the “consumer’s risk” end of the operating characteristics curve. The AQL (Acceptable Quality Level) represents the “producer’s risk” end of the operating characteristics curve. While the LTPD remains constant across a given row, the AQLs change. For example, the AQLs associated with Row A of Table 1 are 0.46, 2.1, and 3.8 respectively as you read across the row.
- ⁴ The complete study results can be viewed on the FDA website under letter “Q” in the “Topic Index” at www.fda.gov/cdrh/index.html.

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