Lot Quality Assurance Sampling
A Management Tool to Efficiently Assess Program Outcomes

Freedom from Hunger

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Introduction

Many organizations want or need to assess how well their institutions are progressing on achieving various program outcomes. To do this well, they need a way to use a relatively small **sample** of clients to make statements about the clientele of the entire institution, its individual branches or its different lines of service. This paper attempts to summarize sampling options that permit a statement about the programs clients or beneficiaries.

The greatest recurrent cost in assessing program outcomes of clients is in physically going to the clients to observe them or ask questions. In general, the larger the sample required for making meaningful statements, the higher the cost. Therefore, we need to find a sampling approach that allows visiting as few clients as possible while giving confidence that the results represent the reality. Lot Quality Assurance Sampling (LQAS), applied to assessing program outcomes, such as changes in knowledge, attitudes, skills, behaviors or practices, is a powerful tool for the following reasons:

1. It relies on small samples to provide immediately useful information.
2. Data analysis and interpretation are simple.
3. Further action can be quickly focused on the most problematic branches or service lines.

Sampling Approaches

Some error is to be expected with sampling because a part is used to describe the whole. Taking a random sample helps us eliminate **systematic error** and gives us a result "representative" of the population. Random sampling also enables us to quantify remaining **sampling error** and indicate how confident we are in the result.

Suppose we want to assess the percentage of adolescent girls who opened up a savings account among the clientele of an organization's branches or one of its lines of service (products). There are at least two ways to state the results of our assessment:

1. Give an **estimate of the percent of girls that opened the savings account**—"45 percent of the girls opened a savings account."
2. State whether, **yes or no, there is evidence that the percentage of girls with a savings account meets a predetermined standard (say 50 percent with a savings acccount)**—"Yes, the branch has reached the standard." In this second approach, we only need to state whether "yes" or "no" we have reached a given standard. From a management perspective, we are most concerned with accurately identifying those cases in which the standard was not met. As a result, the sample size needed is relatively small, thereby helping reduce the cost of the assessment.

Estimating the Percentage of Clients who are Poor

The first approach is known as "point estimation." Many are familiar with using measurements from a sample to estimate the true value of some variable, such as the percentage of girls with a savings account in a total population of adolescent girls. Unfortunately, such estimates are rarely given with a statement of the margin of error (error due to **sampling**), and this can be misleading. For example, if we say that we estimate that 45 percent of girls have a savings account in microfinance branch X, we need to include a statement about the margin of error with our estimate. We should say, for instance, "Our estimate is that 45 percent of the adolescent girls in MFI branch X have a savings account with a margin of error of ±10 percent." This means that we are very certain that the **true** percentage of adolescent girls with a savings account in the total adolescent girl population of branch X is somewhere between 35 and 55 percent.[1] To increase the precision of the estimate (reduce the margin of error) requires a larger sample size. The above example is characteristic of a sample size of about 100, assuming the sample yielded a point estimate of 45 percent.

[1] We won't discuss the issue of "confidence intervals" here, but such margins of error are usually calculated with a 95 percent confidence interval: for example, we are 95 percent sure that the **true** percentage of adolescents having a savings account is between 35 and 55 percent in that 95 percent of repeated samples will yield intervals containing the true percent having a savings account.

*Adapted by Bobbi Gray from an article written by Robb Davis at Freedom from Hunger called: "Lot Quality Assurance Sampling (LQAS) for Microfinance Institutions: A Management Tool to Efficiently Assess Poverty Outreach," June 2002.

Estimating Achievement of a Pre-determined Standard

The second approach can be referred to as a "quality assurance approach"—taking a small sample to determine whether, yes or no, a desired standard is being met. The manufacturing industry has figured out how to do this through Lot Quality Assurance Sampling (LQAS). With LQAS, a relatively small random sample—typically 19 observations —is drawn to represent the larger "lot," i.e., a sample of light bulbs to assess the quality of an entire production unit. LQAS can only be applied to yes/no indicators, so managers have determined in advance what characteristic must be met for a single observation to be considered "acceptable."[2] Whether a lot is judged to be acceptable or below the pre-determined standard is based on a *decision rule*. A *decision rule* is the number of all sample observations that must be classified as "acceptable" for the lot to be considered acceptable. LQAS tables are available that provide the necessary *decision rules* for various standards.

Valadez (1991) has adapted this method for use in public health program quality assessments. He has stated that it also adapts well for the purpose of determining whether or not the proportion of clients or beneficiaries in a "lot" or population of people being served meets or exceeds a desired percentage, such as those regarding changes in knowledge, attitudes, and practices. As in the previous approach, we must quantify the error due to sampling. This time we are not stating a point estimate. Rather, we are classifying an organization's branch or line of service as having reached a standard or not. Therefore, we describe error in terms of the chance of misclassifying a branch or line of service. We state our result: "There is evidence that branch Y has **not** reached the standard of 45 percent of adolescents with a savings account." Then we state the chance that we misclassified the branch (or service line): "There is only an 8 percent chance that if branch Y really reached the standard (50 percent poor clients), we misclassified it as **not** having reached the standard." This result would be characteristic of a sample of only 19 clients with a decision rule of 7 or more poor clients.

The reality of misclassification makes **LQAS forgiving** to underachievers approaching but not reaching the standard. Without resorting to a chart of probabilities, let us consider some examples. If the organizations goal is set at "50 percent of adolescents have a savings account," a line of service that has between 35 and 50 percent of adolescents with a savings account is very likely to be classified as meeting the standard.[3] Thus, marginal performers are given a "break." In contrast, an organization's branch or line of service with genuinely low achievement of this standard, say less than 20 percent of adolescents have a savings account, is very likely to be judged as below standard. In short, those not even close to meeting the standard will be reliably identified. On the other hand, an organization's branches with 50 percent or more of adolescents with savings accounts have very little chance of being misclassified as below standard (only 8 percent chance, as we saw in the example). Indeed, those with 55 percent having a savings account have almost no chance of being classified as below standard, and above 60 percent as having a savings account, they will essentially **never** be misclassified as below standard (with a sample of 19 and "decision rule" of 7 or more with a savings account).

Unlike point estimation, LQAS is not designed to allow fine-tuned comparisons of different "lots." It is a tool to alert managers to problematic lots. It is like a "toggle" switch that can read "all is well" or "change is needed." "Yes or no." "Success or failure." It permits us to use smaller sample sizes but it does not permit us to estimate a proportion of adolescents with a savings account **based on a single sample**.

LQAS as a Management Tool

The strength of LQAS lies in its use by managers to discover very poor performers so action can be directed at the neediest. Because sample sizes needed are relatively small, an organization with several branches can carry it out in each branch.[4] In this way, the organization could evaluate how each branch (autonomous management area) is doing relative to the standard. Then the organization can focus on understanding why some branches or locations or lines of service are doing well and others are not. Is there a management problem? Are the clients different in some way?

[2] A sample size of 19 is commonly used since only a much larger sample size would provide additional useful information.
[3] With a sample of 19 and a "decision rule" of 7 or more as having a savings account.
[4] Those organizations with multiple product lines might do it by product line instead of by branch.

Assessing the client outcomes by branch (or product or geographical area) is probably the most helpful application of LQAS because it helps identify needy branches. In addition, there is a valuable by-product of using LQAS in multiple branches. Individual LQAS samples can be combined and a single point estimate with margins of error can be calculated.[5]

Conclusion

The choice of which sampling approach to use to measure changes in client knowledge, attitudes, skills, and practices depends on what an organization (or donor) really needs. If a precise estimate of the percentage of adolescents with a savings account is absolutely required, then the more expensive point estimation approach should be used. Keep in mind, however, that even with a **sample size of 100,** the margin of error will be fairly broad (between ± 6–10 percentage points depending on the point estimate). On the other hand, an LQAS **sample as small as 19** can give useful information to categorize the organization (or branch, etc.) as achieving a standard or not. The great strength of LQAS, if used to assess individual branches, is that it allows for both an assessment of the "adequacy" of the individual branch (or region or product) and an overall estimate of the percentage of poor in the entire organization.

Reference:

Valadez, Joe. *Assessing Child Survival Programs in Developing Countries: Testing Lot Quality Assurance Sampling.* 1991. Boston: Harvard University Press.

Other Resources:

The CORE Group: LQAS Series (for public health professionals)
http://207.226.255.123/working_groups/monitoring.cfm

For further questions about how Freedom from Hunger uses LQAS, please contact Bobbi Gray, Research and Evaluation Specialist at Freedom from Hunger at bgray@freedomfromhunger.org.

[5] If certain branches have more clients than others, the results could be "weighted" to give them more weight. Results of weighting, however, show that it makes little difference to the overall estimate in most cases.