Risk-Limiting Audits: Frequently Asked Questions and Answers

A "risk-limiting" post-election audit checks if the election **outcome** is correct. It can catch outcome-changing tabulation errors and correct wrong results. A "risk-limiting" audit *limits the risk* that the wrong election result will be certified because of a tabulation error.

Why do we need post-election tabulation audits?

For a thriving democracy, we need a voting process that we can trust. Unfortunately, computer and human errors can produce large miscounts. In past elections, the wrong candidate has been declared the winner because of a software glitch or programming error. Since the 2016 election, there have been additional concerns that election results could be hacked and changed. Post-election tabulation audits check whether a vote **tabulation** error led to the wrong result. (Other kinds of audits can detect other errors.)

Would you provide examples of incorrectly reported election outcomes?

In North Kingstown, RI during the November 2016 election, a simple programming error led to the wrong result. The ballot scanner was programmed and tested using the wrong style ballot. As a result, a measure to create community septic system loan program was defeated – 8471 votes to 5. The results were so lopsided that Rhode Island election officials conducted a recount after reprogramming the ballot scanner using the correct ballot style. After the recount was conducted, they discovered that the ballot measure passed, with a vote of 9481 yes to 4562 no.

In a municipal election in Palm Beach County, Florida during March 2012, a "synchronization" problem with election management software allotted votes to the wrong candidate and the wrong election contest. The error was caught in a post-election audit and the results were changed by officials, after a court-sanctioned public hand count of the votes.*

How do conventional post-election tabulation audits work?

Election officials sample a percentage of the ballots, typically by choosing machines or precincts at random. They manually tally the votes on those ballots and compare the tally to the reported results. Generally, audits stop there. Conventional audits – say, a flat audit of 3% of precincts – **do not actually check whether election results are correct**. They just spot-check the accuracy of some machines.

What is a "risk-limiting" audit?

A "risk-limiting" post-election audit has a large chance of correcting the reported result if the reported result is wrong because of a tabulation error. A risk-limiting audit generally

starts by examining an initial sample of ballots. If necessary, more ballots are sampled and examined until there is convincing evidence that the machines found the right winners. If the audit fails to confirm that the machines found the right winners, election officials will conduct a full hand count.

What is the "risk limit"?

A risk-limiting audit *limits the risk* that the result will be certified if it is wrong. If the audit has a *risk limit* of 5% and the outcome is wrong, there is at least a 95% chance that the audit will correct the outcome.

What does a risk-limiting audit require?

Risk-limiting audits require:
- a trustworthy audit trail of voter-verified paper ballots
- a "ballot manifest" that describes how the ballots are stored
- sampling ballots (or groups of ballots) at random
- interpreting voter intent manually from the ballots in the sample
- performing calculations to determine whether and when the audit can stop—i.e., whether there is enough evidence that the reported outcome is correct.

How does a risk-limiting audit work?

Essentially, a risk-limiting audit involves manually reviewing randomly selected ballots. The audit stops as soon as there is convincing evidence that the outcome is correct. At any time, the election administrator can stop examining randomly selected ballots and perform a full hand count. (Normally, this should not be necessary.) For instance, regulations might say that "if the audit has not stopped by the time 10% of the ballots have been inspected, perform a full hand count."

As long as it is statistically plausible that a full hand recount might overturn the result, a risk-limiting audit continues to examine more ballots. Risk-limiting audits determine precisely how much hand counting is necessary to confirm election results to a given level of confidence. The closer the contest, the more ballots must be examined to have strong evidence that the reported outcome is right. The higher the desired confidence (i.e., the lower the desired risk) the more ballots must be examined – because higher confidence requires more evidence.**

What methods for risk-limiting audits have been piloted?

A) Ballot polling audits. Ballots cast in a given race are selected at random and reviewed manually until enough evidence is gathered that the winner won, or a full hand count has been conducted. (Ballot-polling audits are like exit polls, but instead of

surveying people, the ballots themselves are reviewed and tallied and ballots don't lie or refuse to reveal their votes.)

B) Ballot-level comparison audits: A ballot-level comparison audit is similar to checking an expense report. In an expense report audit there is a two-step process.

> 1. Check to see if the individual numbers add up to the reported totals
> 2. Check to see if the receipts back up the individual numbers.

Similarly, a ballot level comparison audit is a two-step process.

First, the audit checks that the subtotals add up to the reported totals. Ideally the subtotals are published, so that anybody can add them up and check using whatever software they want. But in general, the auditors check the voting system's arithmetic using other software.

Second, individual ballots are pulled and checked against the record of the vote in the voting system. (This is called a cast vote record.) This is similar to checking paper receipts against numbers entered into a spreadsheet. Enough ballots are pulled and examined to provide strong evidence that the outcome is correct.

C) A batch-level comparison audit: This method will check a random sample of ballot "batches" and compare the total vote counts in those batches against the voting machine's counts. A batch may, for instance, comprise all the votes cast in a precinct or counted on one voting machine. Ideally, for efficiency, it is best if the batches are as small as possible.

Where can I learn more about risk-limiting audits?

Video about Colorado's risk-limiting audit. This is useful to share with election officials who are very interested in how a risk-limiting audit works.

Philip B. Stark, Testimony to the California Little Hoover Commission

Citations

*Jaikumar Vijayan, E-voting System Awards Election to Wrong Candidates in Florida Village. Computerworld (April 4, 2012)

**California Secretary of State Post-Election Risk-Limiting Audit Pilot Program 2011-2013 Final Report to the United States Election Assistance Commission p. 2.

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