

RLAs and Evidence-Based Elections

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Evidence and Trustworthiness

An audit is no better than the paper trail it uses.

- No paper trail; no audit.
- Paper trail not verifiable (e.g., some BMDs); audit does not verify winner.
- Paper trail not trustworthy; audited outcome not trustworthy.

5 Cs

- *Create* durable, trustworthy record of voter intent
 - ideally, hand-marked paper ballots with BMDs for voters who benefit from them
 - usability of BMDs for verifying voter intent is in question
 - if system can mark ballot without voter seeing, not voter-verifiable
 - w BMDs, voter responsible for machine errors, not just her own errors
- *Care* for the paper record
 - verifiable chain of custody, 2-person custody rules, ballot accounting, good seal protocols, etc.
- *Compliance* audit: establish whether paper trail is trustworthy
 - ballot accounting, including VRDB, pollbooks, etc.
 - check chain of custody logs, video, etc.
 - eligibility audits
- *Check* reported outcome against the paper
- *Correct* the reported outcome if it is wrong

What's an RLA?

Any procedure such that:

If an accurate full hand count of the paper would find different winners than were reported, the procedure has a known minimum chance of requiring a full hand count.

Risk limit is the largest possible chance that, if the reported outcome is wrong, the audit won't correct it.

Starting sample size doesn't matter.

What matters is when you *stop* auditing.

RLA: if the outcome is wrong, the audit has a known minimum chance of correcting it.

- No assumption about voter preferences
- No assumption that people vote randomly
- Answers question about this election

Bayes audit: hypothetical population of elections, voter preferences random, known distribution.

Among elections where the audit results match the current audit results, what percentage have outcome different from reported?

- Assume voters have random preferences
- Assume particular probability distribution of voter preferences
- Answers question about a hypothetical population of elections
- For “least favorable” preference model, upset probability = risk
- In general, upset probability $<$ risk.

Both require trustworthy paper trail, random sampling, etc.

Difference is the rule for stopping the audit.

- RLA: stop if, on the assumption that the outcome is wrong, the audit data are unlikely
- Bayes: stop if unlikely that a hypothetical election generated randomly from model preferences that agrees with the audit data has different outcome.

Sampling schemes

- sampling unit: batches or individual ballots
- stratified or not
- sample units with equal or unequal probability
- sample with replacement, without replacement, Bernoulli, Poisson

What do you do with the sample?

- Polling
- Comparison

Acronym Soup

- BRAVO
- Kaplan-Markov, Kaplan-Wald, Kaplan-Kolmogorov
- SUITE
- BBP
- SPRT & sequential hypothesis tests