Post-Election Audit Basics

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Why Audit?

• Be sure that the winner won
• Find common sources of recurrent errors (so that they can be fixed – will they?)
• Deter fraud (needs appropriate follow-up)
• Assure the public that the process is fair

• Do “all of the above” efficiently
How To Audit

• Don’t “reinvent the wheel”
• Statisticians and auditors know how to
  – Examine “large enough” random samples + a few “high interest” units (designated by the loser)
  – Follow good protocols; evolve better ones
• Work with “elections people” to create practical practices to ensure Statistically Accurate, Fair and Efficient (SAFE) audits
Key Concepts

• Sample “whole units” (that are as small as possible consistent with voter confidentiality)
  – Precincts, machines, batches …
• Compare manual vs. machine counts
• Good confidence about who won does not depend on “percentage” of units audited
  – Does the soup taste right?
    • Can’t tell from one drop
    • A tablespoon should be enough – even from a large pot (if well-stirred)
• Need to look at “enough” units
  – Requires more when the race is close
Statistical Power

• Power = the probability that (if the outcome were wrong) we would find a problem in the audit

• Typically, races are not close and small audits have high power

• Very close races
  – Are very rare
  – Require large audits (maybe even 100%)
SAFE Sample Selection

• Audit precincts with visible problems, regardless
• Calculate minimum number of apparently-OK precincts that must have ("invisible") corrupt counts to flip the election ($B_{\text{min}}$)
• Calculate how many apparently-OK precincts you must randomly select to make it extremely likely that you will find at least one corrupt one
  – Requires more when precinct size varies
• Randomly select and audit this many precincts
• If no problems found, outcome is certified
Federal Elections (2002-2006) Total Hand-Counted Votes by Type of Audit

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<thead>
<tr>
<th>Tiered</th>
<th>3-5-10%</th>
<th>3%</th>
<th>5%</th>
<th>10%</th>
<th>99% power</th>
<th>95% power</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least 95% power</td>
<td>88.2%</td>
<td>85.2%</td>
<td>88.0%</td>
<td>92.7%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Less than 50% power</td>
<td>3.7%</td>
<td>5.0%</td>
<td>4.1%</td>
<td>1.4%</td>
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Audit size (millions) | 20.5 | 15.3 | 19.4 | 57.6 | 23.0 | 19.0 |

Bottom line: High statistical power in all elections is a feasible goal