Risk Limiting Audits: Kentucky Pilot Project

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Why audit elections?

- o Detect voting system errors
  - human error
  - misconfiguration
  - manipulation
- o Provide accountability to voters
- o Deter fraudulent activity
- o Assure votes were issued, counted, and reported accurately
- o Provide feedback for process improvement

Why RLA?

An RLA is nationally recognized as a reliable method to…

- Validate the integrity of your voting equipment
- Verify the accuracy of your results
- Detect and correct outcome changing errors in vote tabulation
- Audit efficiently!

Risk-Limiting Audit

A risk-limiting audit (RLA) is…

o a post-election tabulation audit

o that examines a random sample of voted ballots

o to provide a statistical level of confidence

o that the outcome of the election is correct

Risk-Limiting Audits

All ballots, from every precinct, have an equally likely chance of being selected for audit.

The audit is designed to escalate to additional rounds of auditing, and ultimately a full hand recount, if discrepancies are discovered.

Traditional Audits

Only ballots in the selected precincts are audited.

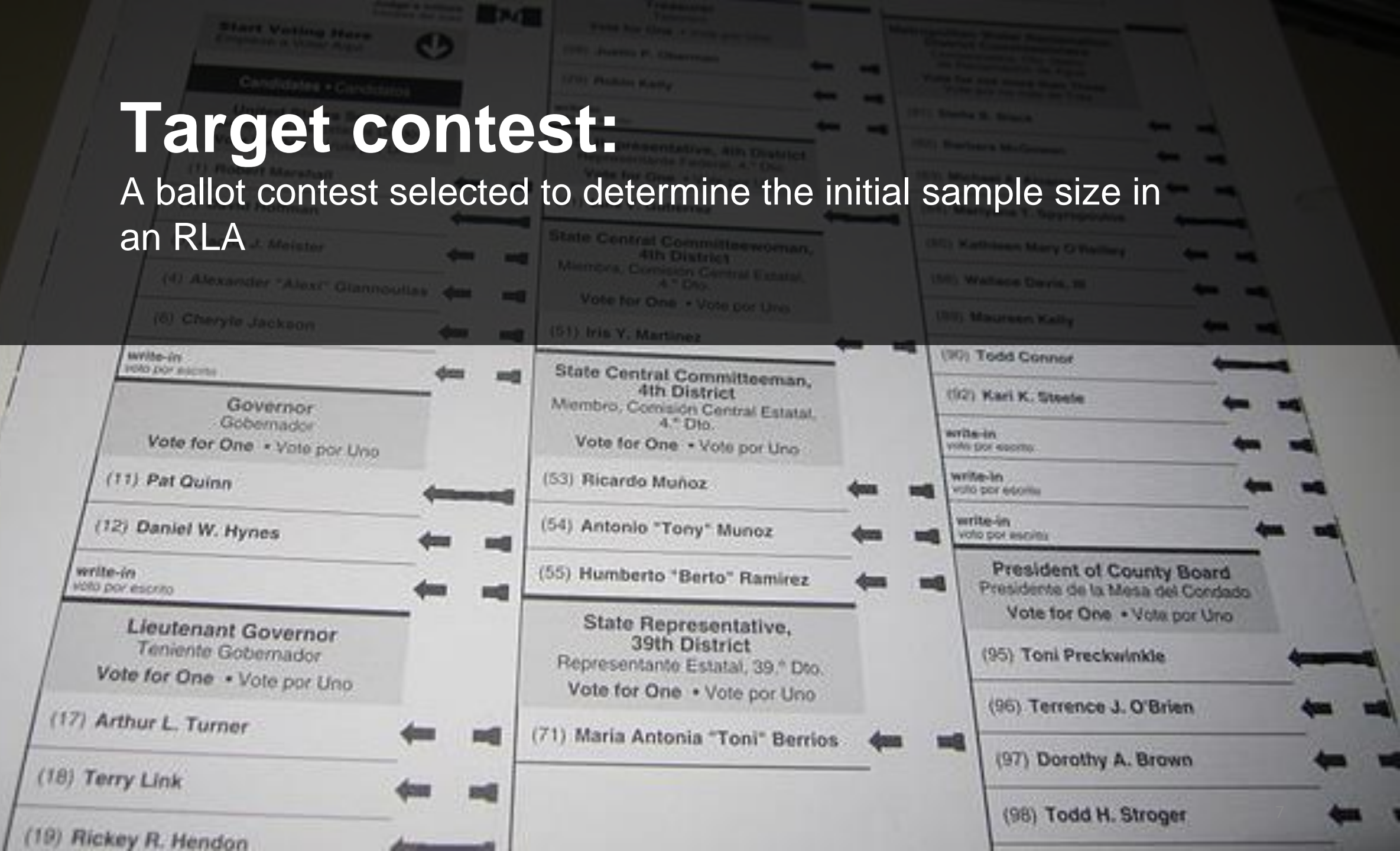The audit concludes after the designated number of ballots has been reviewed and counted, regardless of discrepancies.

Kentucky RLA Pilot Working Group

- Anderson County
- Fayette County
- Henderson County
- Johnson County
- Kenton County
- Madison County

- Kentucky Board of Elections
- Kentucky Secretary of State Staff
- Election Systems & Software
- Hart InterCivic
- Harp Enterprises
- Trey Grayson

Target contest:

A ballot contest selected to determine the initial sample size in an RLA

Risk limit:

The maximum possible chance that your audit will fail to detect and correct an incorrect election outcome

Sample size:

The number of ballots inspected during the RLA

Ballot Polling

Pre-Audit Ballot Tracking and Organization

Ballot accounting provides a way to consistently and accurately record the number of ballots in your possession at a given point in time and document any changes.

Why Ballot Accounting Matters

- o Ballot reconciliation and chain of custody are the foundation of your audit's paper trail.

- o Way to ensure votes have not been dropped, lost, or added as a result of human error or a failure of voting equipment.

- o Ensures the ballot record remains complete and intact from the moment ballots are cast through the audit.

- o Evidence the ballot record is trustworthy!

	A	B	C	D	E
1	County	Scanner Name	Batch #	Total Ballots	Container Name
2	Adams	3	12	10	TC-5
3	Adams	3	13	10	TC-5
4	Adams	3	14	10	TC-5
5	Adams	3	15	10	TC-5
6	Adams	3	16	10	TC-5
7					

- A **ballot manifest** is a log that documents how many ballot cards your voting system scanned and where they are located.
- It can be a simple spreadsheet or paper log
- It should always be created independent of the voting system.

BALLOT MANIFEST

Polling Location	Ballot Box ID	Total Ballots
North Library	60	984
Corner Church	7	422
Civic Center	25	1,167

Precint #: *North Library*
Ballot Box: *60*

Total Ballots: *984*

Seal # *A95162*

Poll Worker Initials: *TP*
Poll Worker Initials: *JM*

BALLOT MANIFEST

Scanner Name	Batch #	Total Ballots in Batch	Container Name
03	16	100	TC-5
03	17	100	TC-5
03	18	98	TC-5
03	19	100	TC-5
03	20	99	TC-5

Ballot Scanning

Scanner ID: 3   Batch #: 18

Name: Haley

Beginning Count	-	Removed for Duplication	=	Final Count
100	-	3	=	98

Scanner count verified?

Date 11-03-2020   Time 6:47 pm   Initials TP

CONTAINER NAME: TC-5

Scanner Name	Batch Number	Total Ballots
03	16	100
03	17	100
03	18	98
03	19	100
03	20	99
TOTAL BALLOTS:		497

Seal # A95162

Staff Initials: TP/JM

RLA Pilot Ballot Manifest

County Name	Batch	Total Number of Ballots
Madison	Central Count - Mail - Scanner 20378	162
Madison	Central Count - Absentee Walk-ins - Scanner 20379	15
Madison	Vote Center 1 - 101	150
Madison	Vote Center 1 - 102	206
Madison	Vote Center 1 - 103	172
Madison	Vote Center 2 - 121	100
Madison	Vote Center 3 - 123	194
Madison	Vote Center 3 - 124	167
Madison	Vote Center 4 - 131	25
Madison	Vote Center 4 - 132	61
Madison	Precinct 19 - 161	219
Madison	Precinct 24 - 182	132

RLAs can be made easier with software

- o Perform the math calculations
- o Determine the starting sample size
- o Randomly select ballots for audit
- o Account for discrepancies
- o Calculate when the risk limit has been met
- o Determine when the audit can stop

KY RLA pilot will use a spreadsheet

A spreadsheet showing:

	A	B	C	D	E	F	G
1	**Sample size estimate**						
2	Votes for reported winner	50000			helper calculations		
3	Votes for reported runner-up	40000			pW2	0.555555	
4	Desired chance of 1st-round completion	90%			pL2	0.444444	
5	risk limit	10%			plus	0.105360	
6					minus	-0.117783	
7	Total *ballots* (from manifest)	142811			threshold	2.302585	
8	Diluted margin	0.070022			z	-1.281551	
9	**BRAVO sample size (est.)**	1153			d	0.246913	
10					f	10.31885	
11	**P value estimate**				g	0.027720	
12	Sample votes for reported winner	400			q_a	0.000768	
13	Sample votes for reported runner-up	325			q_b	-0.977607	
14					q_c	106.4786	
15	**BRAVO p value**	2.097%			radical	0.792740	

Sheet tabs: Calculations | Seed and Size | Sample | Manifest

Performing the Audit

County Name	Batch	Total Number of Ballots
Madison	Central Count - Mail - Scanner 20378	162
Madison	Central Count - Absentee Walk-ins - Scanner 20379	15
Madison	Vote Center 1 - 101	150
Madison	Vote Center 1 - 102	206
Madison	Vote Center 1 - 103	172
Madison	Vote Center 2 - 121	100

Unofficial Results
Adams County, June 2019 Special Election, Jun 11, 2019
All Precincts, All Districts, All ScanStations, All Contests, All Boxes
Total Ballots Cast: 50, Registered Voters: 172, Overall Turnout: 29.0%

Choice	Votes	Vote %
All Precincts		

Best Coffee Chain (Vote for 1)
50 ballots (0 overvotes, 1 blank voted), 172 registered voters, turnout 29.0%

Choice	Votes	Vote %
Starbucks	15	30%
Peet's	4	8%
Dunkin	12	24%
Caribou	7	14%
Seattle's Best	9	18%
Tully's	2	4%
McDonalds	0	0%
Write-in	1	2%
Total	50	100%

Ballot manifest and summary results report sent to BOE

✓ Random sampling, dice rolling, and pseudorandom number generators…

Retrieve Ballots

Container Name	Scanner Name	Batch #	Ballot
Audited Ballots			
RLA Demonstration			
A	1	1	1
A	1	2	4
A	1	3	2
A	1	4	3
A	1	5	2
D	1	6	1
D	1	7	5
D	1	8	3
D	1	9	2
D	1	10	4
G	1	11	2
G	1	12	1
G	1	13	2
G	1	14	3
G	1	15	4

Container Name	Scanner Name	Batch #	Ballot
Audited Ballots			
RLA Demonstration			
B	2	1	3
B	2	2	1
B	2	3	3
B	2	4	2
B	2	5	4
E	2	6	5
E	2	7	2
E	2	8	3
E	2	9	1
E	2	10	2
H	2	11	3
H	2	12	4
H	2	13	2
H	2	14	1
H	2	15	1

Container Name	Scanner Name	Batch #	Ballot
Audited Ballots			
RLA Demonstration			
C	3	1	3
C	3	2	5
C	3	3	2
C	3	4	4
C	3	5	3
F	3	6	2
F	3	6	5
F	3	7	4
F	3	8	1
F	3	8	3
I	3	11	3
I	3	12	4
I	3	13	3
I	3	14	2
I	3	15	1

Tally Ballots

Favorite Toy Story Character	Batch	Ballot #	Batch	Ballot #	Batch	Ballot #	Batch	Ballot #	Batch	Ballot #	Batch	Ballot #	Batch	Ballot #	Batch	Ballot #	Batch	Ballot #	Batch	Ballot #	TOTAL
Bo Peep																					
Buzz Lightyear																					
Mr. Potato Head																					
Rex																					
Slinky																					
Woody																					

Write-Ins:

Overvotes:											
Undervotes:											

Completing the audit

o Audit board inputs are compared to summary results

o Determine if the risk limit is satisfied or need for additional rounds of auditing

RLA Pilot Goals

- Provide county officials with a hands-on experience to learn how RLAs work
- Become familiar with RLA terms and procedures
- Develop an RLA method that works in Kentucky
- Develop RLA procedures and a ballot manifest that works in every county

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