

Salmonella Cost Analysis

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PulseNet Cost Benefit Analysis (Salmonella)

PulseNet Costs

- Public health dept epi
- CDC epi
- CDC lab
- PHL

Benefits

- Illnesses prevented (each illness has a cost associated with it)

Utility of Salmonella Cost Analysis

1

PART OF ON-GOING OVERALL PULSENET COST-BENEFIT STUDY

2

CAN BE USED FOR GRANTS/PLANNING PURPOSES

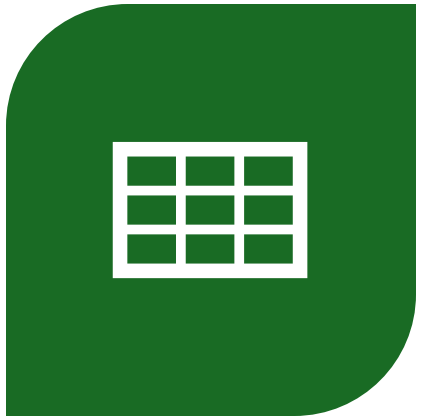
3

IDENTIFY AREAS FOR IMPROVEMENT

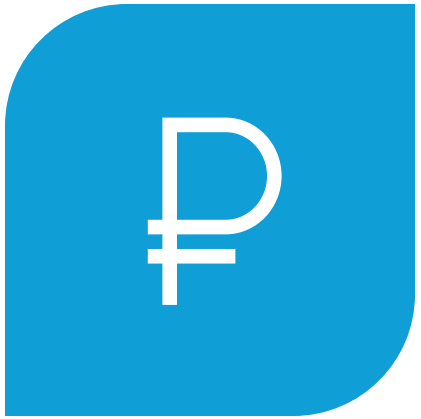
Process



GROUP AGREED STEPS TO ANALYZE



SPREADSHEET FOR EACH STEP



STANDARDIZE COSTS WHEN APPROPRIATE (CONSUMABLES)

Participating state PHLs (n=7)

State	Jurisdiction Population Rank	US Region	Average Number of Salmonella Uploaded to PulseNet per year from 2022 to 2024 (range)
New York (NY)	4	Northeast	1464 (1433-1516)
Virginia (VA)	12	East	1125 (1049-1224)
Minnesota (MN)	22	Northcentral	1016 (986-1036)
Oregon (OR)	27	Northwest	455 (423-479)
Utah (UT)	30	West	429 (368-507)
Iowa (IA)	32	Northcentral	666 (636-693)
South Dakota (SD)	47	Northcentral	221 (213-230)

Major Steps Analyzed From Stool To Sequence For Salmonella (2024)

- Sample transport
- Isolation
- Identification
- Nucleic acid extraction
- Quantification
- Library Prep
- Sequencing

Costs Included

Reagents

Consumables

Task specific equipment (eg sequencer, extractor)

- Determined equipment cost/test
- Equipment cost amortized over 10 years
- Divided by # test per year on equipment

Equipment maintenance agreement (MA)

- Determined MA cost/test
- Annual MA divided by # test per year on equipment

Labor (wages + 100% fringe)

Costs Not Included

- Sample transport (extremely difficult to measure)
- Accessioning
- Lab infrastructure (building, maintenance, utilities, LIS…)
- Lab equipment that is not task specific (eg incubators, fridges, freezers, pipetters…)
- Costs from testing not required for PulseNet (additional bioinformatic analysis, NGS LIS)

Results

- Isolation
- Identification
- Extraction
- Quantification
- Library Preparation
- Sequencing

Cost to Isolate Salmonella from Stool

	South Dakota	Iowa	Utah	New York	Oregon	Minnesota	Virginia	Average
Reagents	$6.25	$12.50	$11.30	$9.00	$16.08	$18.53	$11.50	$12.17
Labor	$18.98	$21.71	$23.34	$23.47	$23.36	$22.74	$25.58	$22.74
Equipment	NA*	NA	NA	NA	NA	NA	NA	NA
Total	**$25.23**	**$34.21**	**$34.64**	**$32.47**	**$39.44**	**$41.27**	**$37.08**	**$34.91**

*NA=Not applicable

Average: $34.91, range $25.23-$41.27
Observation: cost dependent on amount of media used

Identification of a Salmonella Isolate

	SD	IA	UT	NY	OR	MN	VA	Average
Reagents	$9.50	$1.41	$1.62	$1.69	$18.03	$1.79	$5.36	$5.63
Labor	$8.75	$2.94	$1.75	$2.34	$5.11	$2.73	$1.92	$3.65
Equipment Purchase	NA	$3.61	$2.53	$3.01	NA	$1.71	$1.70	$2.51
Equipment Maintenance Agreement (MA)	NA	$3.61	$2.53	$3.01	NA	$2.14	$1.70	$2.60
Total	**$18.25**	**$11.57**	**$8.43**	**$10.05**	**$23.14**	**$8.37**	**$10.68**	**$12.93**

Average: $12.93, range $8.43-$23.14
Observation : PHLs that used MALDI-TOF had lower costs

Extraction of a Nucleic Acid

	SD	IA	UT	NY	OR	MN	VA	Average
Method	**Manual**	**EZ1**	**EZ2**	**QIAcube HT**	**EZ2**	**Combined***	**MP24**	
Reagents	$5.42	$12.89	$15.05	$6.27	$15.05	$15.62	$17.74	$12.58
Labor	$18.25	$8.35	$3.17	$5.98	$3.96	$5.57	$4.17	$7.06
Equipment Purchase	NA	$2.26	$1.44	$0.89	$5.61	$1.49	$2.83	$2.42
Equipment MA	NA	$4.75	$1.22	$0.89	$4.73	$1.49	$2.83	$2.65
Total	**$23.67**	**$28.25**	**$20.88**	**$14.03**	**$29.35**	**$24.17**	**$27.57**	**$23.99**

*MN uses a combination of the QIAcube and MagNA Pure 24, cost were weighted based on use

Average: $23.99, range $14.03-$29.35
Observation: Larger batch sizes reduced costs

Library Preparation

Method	SD Tecan Dreamprep	IA Manual	UT Manual	NY PerkinElmer	OR Manual	MN Tecan Dreamprep	VA Manual	Average
Reagents	$46.49	$43.47	$45.35	$51.00	$42.55	$43.71	$44.22	$45.26
Labor	$8.65	$18.09	$5.83	$9.39	$7.29	$1.30	$10.39	$8.71
Equipment Purchase	$34.88	NA	NA	$0.50	NA	$20.47	NA	$18.62
Equipment MA	$45.93	NA	NA	$0.50	NA	$24.41	NA	$35.42
Total	**$135.96**	**$61.56**	**$51.18**	**$61.39**	**$49.84**	**$89.89**	**$54.61**	**$108.00**

Average: $108.00, range $49.84-$135.96
Observation: Automated instruments generally had higher costs

Sequencing

Method	SD Miseq	IA Miseq	UT Miseq	NY NextSeq 500	OR Miseq	MN Nextseq 2000	VA Miseq	Average
Reagents	$81.20	$66.64	$68.97	$17.00	$74.92	$15.55	$79.91	$57.74
Labor	$5.21	$1.50	$1.46	$9.39	$1.82	$0.78	$2.40	$3.22
Equipment Purchase	$11.39	$7.88	$2.36	$0.50	$10.25	$18.03	$1.93	$7.48
Equipment MA	$15.22	$13.21	$3.15	$0.50	$11.94	$24.49	$3.72	$10.32
Total	**$113.02**	**$89.23**	**$75.94**	**$27.39**	**$98.94**	**$58.86**	**$87.97**	**$78.76**

Average: $78.76, range $27.39-$113.02
Observation: PHLs that used NextSeqs dramatically reduced costs

Total Cost Per State (stool to sequence)

	SD	IA	UT	NY	OR	MN	VA	Average
Reagents	$150.67	$137.86	$149.99	$87.76	$168.44	$96.22	$161.37	$136.04
Labor	$61.06	$53.82	$37.01	$52.14	$42.65	$35.13	$45.20	$46.71
Equipment Purchase	$47.78	$14.15	$7.47	$5.15	$16.23	$42.14	$6.61	$19.93
Equipment MA	$61.15	$21.57	$8.66	$5.69	$16.67	$52.53	$8.25	$24.93
Total	**$320.66**	**$227.40**	**$203.13**	**$150.74**	**$243.99**	**$226.02**	**$221.44**	**$227.62**

Average: $227.62, range $150.74-320.66
Observation: Very high volume PHL had reduced costs
Observation: Very low volume PHL had increased costs

Cost per Step for all PHLs

	SD	IA	UT	NY	OR	MN	VA	Average
Isolation	$25.23	$34.21	$34.64	$32.47	$39.44	$41.27	$37.08	**$34.91**
Identification	$18.25	$11.57	$8.43	$10.05	$23.14	$8.37	$10.68	**$12.93**
Extraction	$23.67	$28.25	$20.88	$14.03	$29.35	$24.17	$27.57	**$23.99**
Quantification	$4.53	$2.58	$12.06	$5.41	$3.28	$3.46	$3.53	**$4.98**
Library Prep	$135.96	$61.56	$51.18	$61.39	$49.84	$89.89	$54.61	**$72.06**
Sequencing	$113.02	$89.23	$75.94	$27.39	$98.94	$58.86	$87.97	**$78.76**
Total	$320.66	$227.40	$203.13	$150.74	$243.99	$226.02	$221.44	$227.63

Observation: Library Prep and sequencing costs account for ~2/3 of total costs

Annual National Costs

- 55,586 clinical isolates uploaded to the PulseNet National Database in 2024
- Utilized calculation for cost per specimen/isolate
- Total costs for Salmonella lab surveillance in the US: **$11,574,950.56**

Next Steps

- Salmonella lab cost manuscript to be submitted in November
- Use cost analysis data for PulseNet Cost Benefit Study (likely publication in 2027)
- Create easier process for future cost analysis

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