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ROI metrics and PHLs

Paul Speaker, WVU College of Business & Economics

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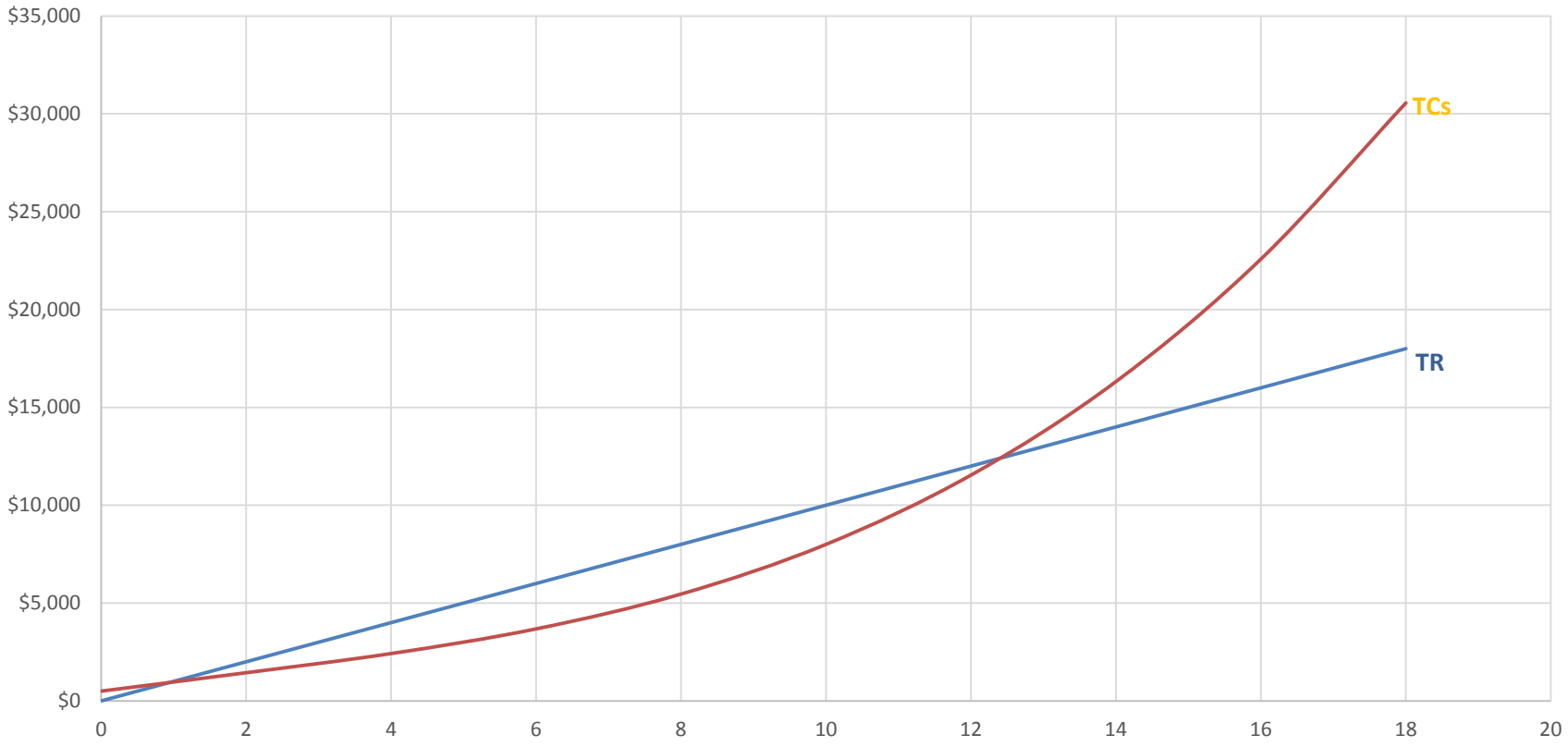
Return on Investment (ROI) Considerations

- ROI = Returns/Investment
- Efficiency
- Cost Effectiveness
- Returns
  - Lives (QALY's)
  - Dollars Saved
  - Lost Earnings

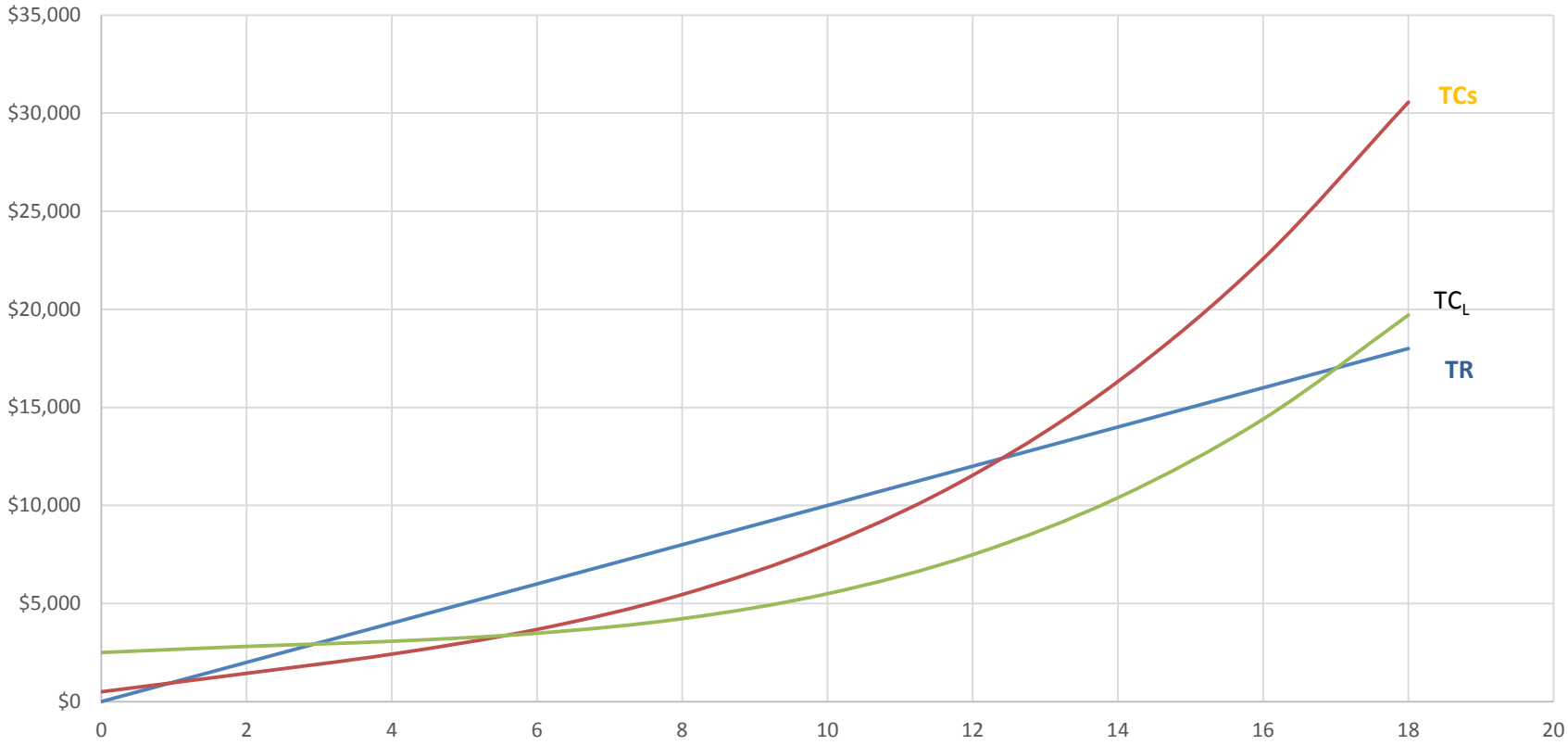
Return on Investment (ROI) in the for-profit environment

- Begins with motive: Maximize profit
- Relates profit level to Investment (equity, capital, assets, etc.)
- Return on Equity
  - ROE = Profit/Owner's Equity
- Return on Average Capital
  - ROAC=Profit/PP&E
- Return on Assets
  - ROA=Profit/Average Assets

Profit and ROI



Profit and ROI



Cost Structure represents the "right" (lowest cost) technology

- Inherent assumption in ROI calculation is an internal efficiency
- Given that internal efficiency, profit (the benefits to owners) is considered relative to the investment (equity, capital, or assets)

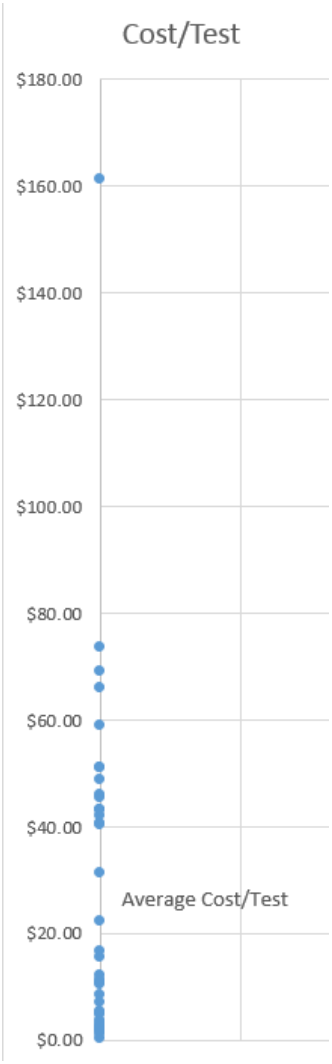
Costs

- Public health laboratories are public entities with missions unrelated to making a profit.
  - Output maximization for a given budget rather than maximizing the difference between revenue and costs
  - However, efficiency lessons from for-profit continue to apply for internal metrics on ROI

Interpreting Cost Metrics

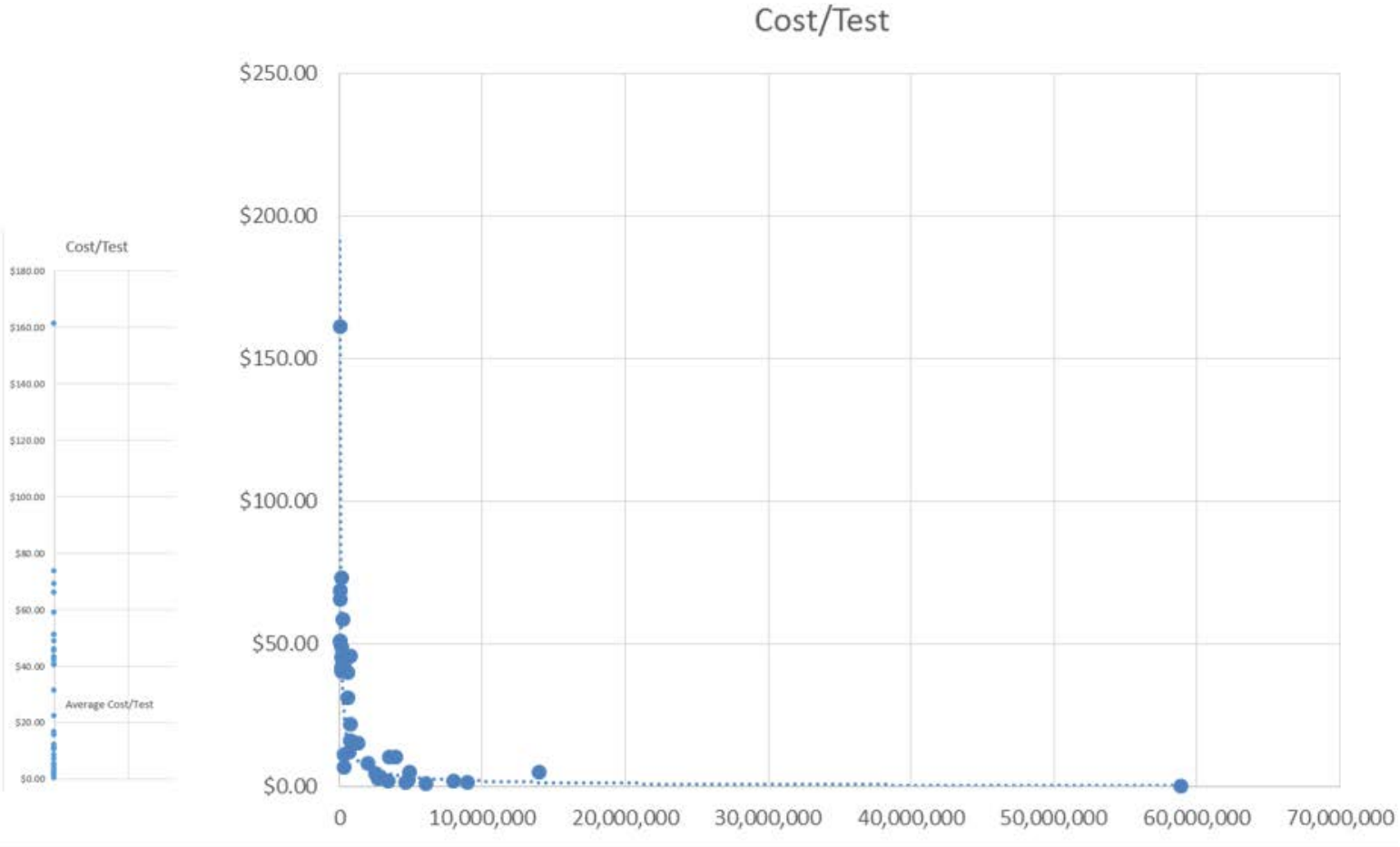
- The economic problem
- Economic law and implications
  - The Law of Diminishing Marginal Returns
  - Economies of Scale
  - Economies of Scope

Cost/Test Observations

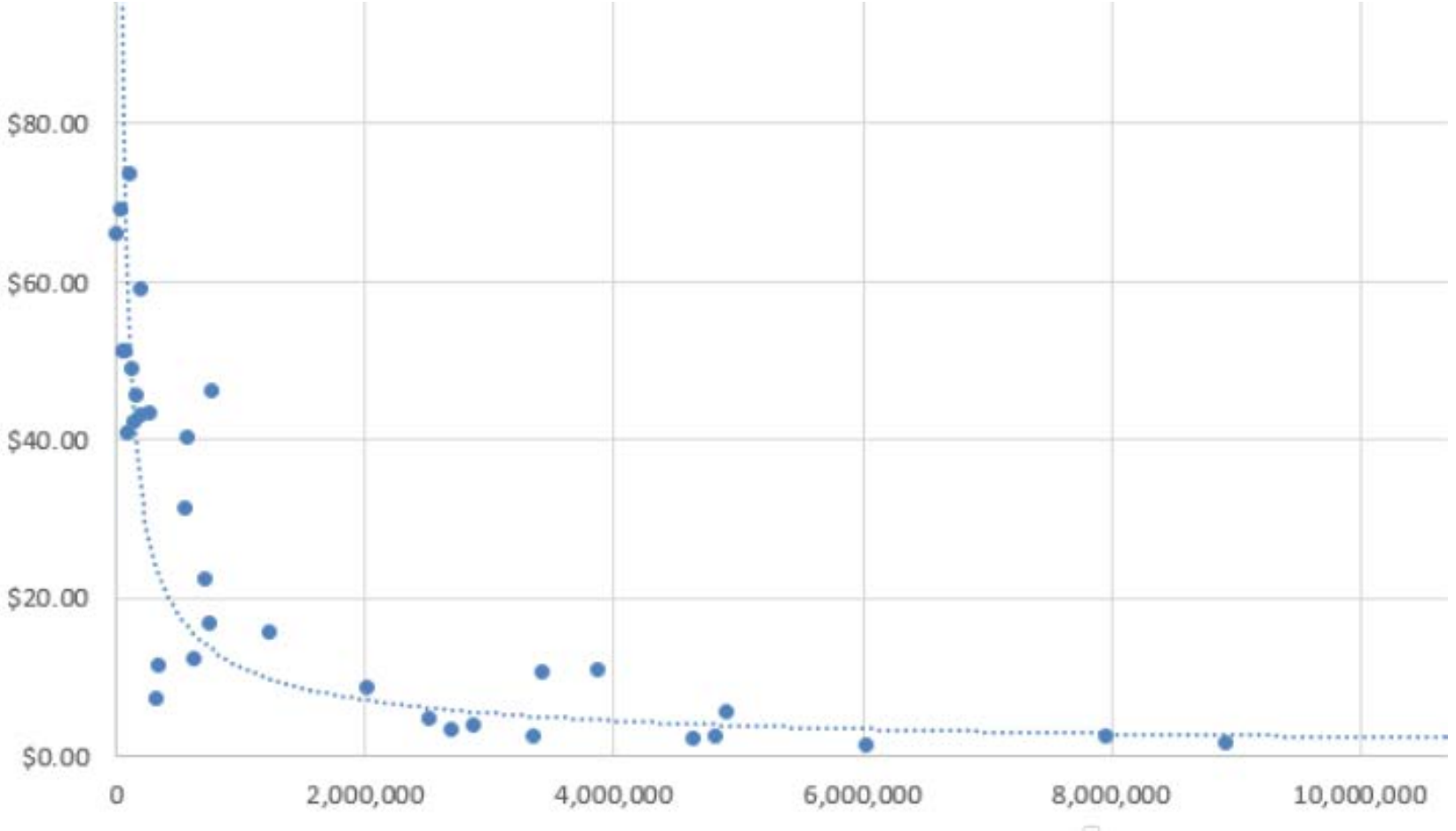


- Summary look at average costs across laboratories
- Wide dispersion
- One dimensional view can result in misleading interpretations of the data

Cost/Test Multivariate View



Cost/Test Multivariate View



Decomposition of ROI

- Size does matter
- But (shockingly) bigger is not always better
- Efficiency
- Cost Effectiveness
- Jurisdictional Efficiency

Costs and contribution to average

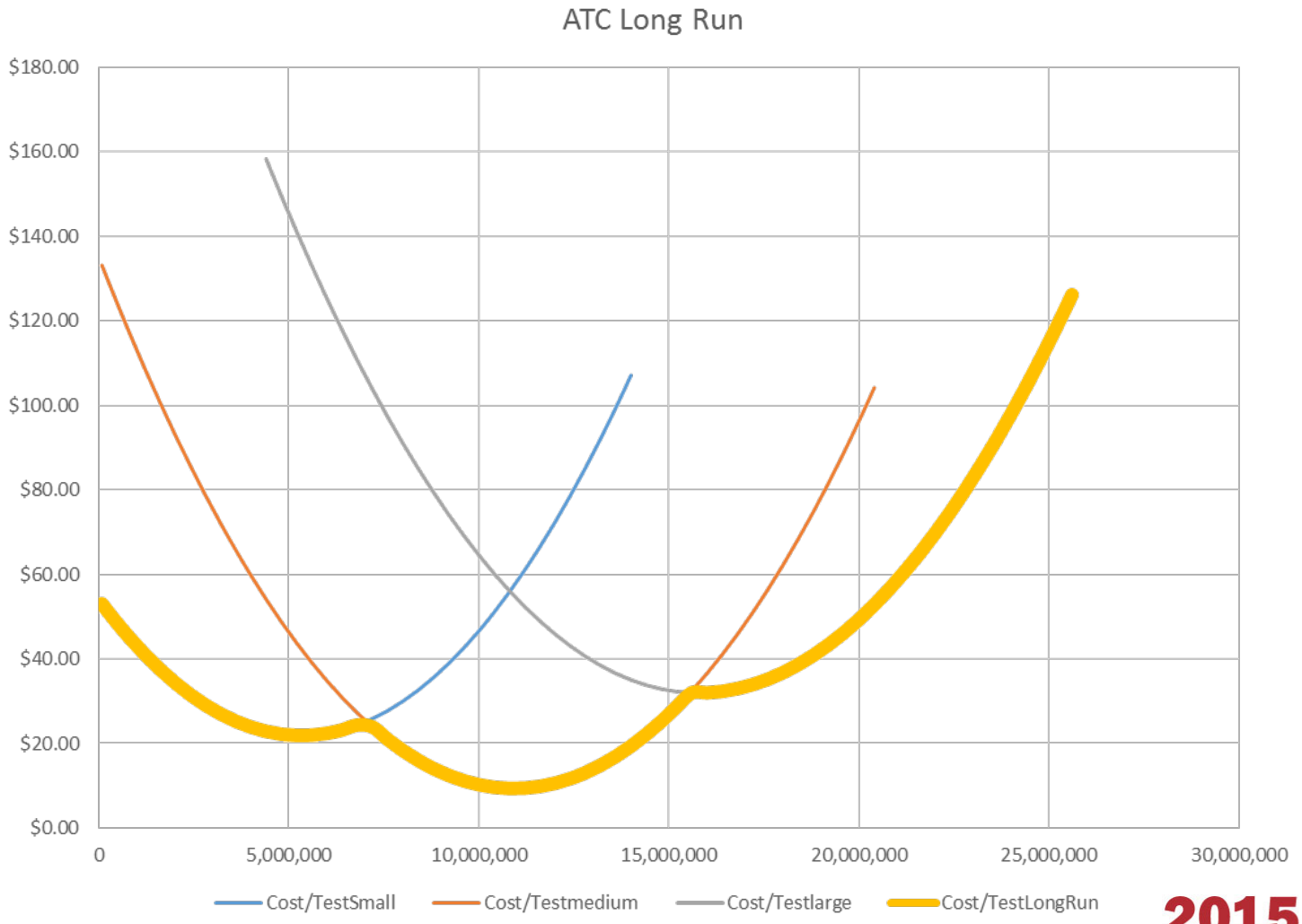
- What size laboratory to create?
- How much equipment?
- How many personnel?
- Over what volume will the laboratory be serviceable?

Changing sizes

- A jurisdiction can't change capabilities on a dime, but what if it had enough time, then what size laboratory to build?

- It depends upon the demand for the laboratory services.

Average Total Cost



In the long run . . .

- Given enough time to change, the ideal sized laboratory would be just big enough to appropriately service the jurisdiction at the lowest average cost.

Cost and Capacity

- Taking the cost behavior into account, how is this related to productivity and capacity?
- Can industry metrics be extended to your laboratory?
- Yes, but with qualifications for size.

What is Optimal?

- Existing APHL data answers the internal ROI questions:
  - Maximize Tests/Budget
  - Minimize Cost/Test
- APHL data also includes turnaround time which may be connected with epidemiological data to demonstrate the societal gain from PHL

Cost/Test v. TAT

- Consider various correlations:
- r(TAT-influenza, total tests) = 0.08 (t=0.45)
- r(TAT-influenza, virol/immun tests) = 0.02 (t=0.12)
- Size does not matter
- r(TAT-human isolate, cost/test) = -0.20 (t=-0.94)
- r(TAT-human primary, cost/test) = -0.37 (t=-1.65)
- Trade-off between cost and time
- ROI external should be discoverable from speed and societal benefits

What is Optimal?

- Efficiency, Cost Effectiveness, Population size, age, health . . .
- Market-based versus Jurisdiction-based workload
- What is the mission? What is most desired?
- Queuing issues, fund transfers
- Economies of scope issues
- Large potential gains from scale of operations

APHL LabRAT

- Review categories deployed v. alternative breakdowns
- Choice between analytics employed and issue being examined
- Also note the options for comparison of internal costs to available external benefit measurement

Example: Clean Water

- On the expenditure side, must isolate activities in this effort versus all other activity
- Second, allocate all cost of the laboratory by activities
- NBER Working Paper Series has good econometric analysis of the benefits (returns) from clean water
- Match these benefits to extraction of cost data from laboratories
- ROI roughly 23 to 1

Example: Rabies Testing

- CDC data offers marginal cost information
- Data does not include full costing
- must isolate activities in this effort versus all other activity
- then allocate expenditures of the laboratory across activities
- CDC does offer benefits
- Returns in lives saved
- Returns in dollar losses avoided
- ROI can be determined using CDC benefits and study of laboratory full cost

Example: TB Testing

- Good academic literature on treatment savings as measure of returns
- Additional literature on lives saved
- QALY benefit metrics
- Lost income dollar metrics
- As with other testing, full allocation of PHL expenditures across activities is needed to accurately identify investment in testing area

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Leveraging ROI and the Core Functions to Demonstrate PHL Value

Lorelei Kurimski, Director, Office of Organizational Development
at State Hygienic Laboratory at The University of Iowa

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ROI Workgroup

From APHL KM and LSS committees

- APHL Reps: Karen Breckenridge, Sadira Daher, Deborah Kim, Tina Su
- Members: Chris Bean, Billie Juni, Twila Kunde, Lorelei Kurimski, Denise Lopez, Bob Rej, Paula Snippes Vagnone, Victor Waddell
- CDC Rep: John Ridderhof
- Subject Matter Expert: Paul Speaker

Defining ROI & Focus Areas

- Definition (for this project): Return on Investment (ROI) is defined as one or more performance metrics that demonstrate costs and benefits of PHLs to carry out the Eleven Core Functions.

- Core Functions:
  - Public Health Related Research (Core Function #9)
  - Education & Training (Core Function #10)
  - Partnership & Communication (Core Function #11)

Which View Matters?

Service Structure

Organized by program, mandate, organization-specific mission

- SDWA
- Congenital Birth Defects (NBS)
- Ryan White (HIV)
- Infertility Prevention (CT/GC)
- TB Program (AFB, A/R)

PHL Structure

Organized by field of science, area of expertise

- Env Chem- Organics
- Env Chem- Inorganics
- Env Chem- Rads
- Env Micro
- NBS
- Virology
- Bacteriology
- Serology
- Support Services

Changing Our Perspective

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Source: http://www.shl.uowa.edu, http://www.wisegeek.net/what-is-a-food-truck.htm

Step 1:
Begin with the end in Mind

As a Decision-Maker, what are the outcomes you want to know?

- Public Health Related Research

  What is the value of advancing PHL test capabilities?
- Education & Training

  What is the value of a competent PHL workforce?

  How have PHLs contributed to safety and security?
- Partnership & Communication

  How have partnerships improved efficiency of training?

Step 2:
Translate Outcomes to Measures

The Outcomes

Public Health Related Research

- What is the value of advancing PHL test capabilities?

The Measures (Cost, Benefits)

Internal Cost Measure

- What was cost for validating new methods/tests?

  total $ expenses to develop new methods/total # of new methods

Internal/External Benefit Measure

- How did validating new methods impact our response time?

  total reduction in TAT/total # of new methods

Step 2: Translate Outcomes to Measures

The Outcomes

Public Health Related Research

- What is the value of advancing PHL test capabilities?

The Measures (Cost, Benefits)

External Benefit Measure

- What is the cost savings by improving time for individual treatment?
- What is the cost savings by improving response time and therefore decreasing population infection rates?
- How many people avoided exposure? How many people avoided hospitalization? How many people avoided death?
- How many dollars are saved from non-missed days at work or school?

What can the literature tell us?

Step 3:
Determine Data Availability

- Does the data needed to calculate the metric already exist?
- If the data already exists, where is it stored?
- Which metrics are likely to be the most readily available and easiest to collect?
- Which outcomes are the most important to answer?

Keep at Program Level

Not a single metric

Investment (Expenses) = Labor

Benefits= $ Savings, Years of Life Savings, Time

Example: Public Health Related Research ROI

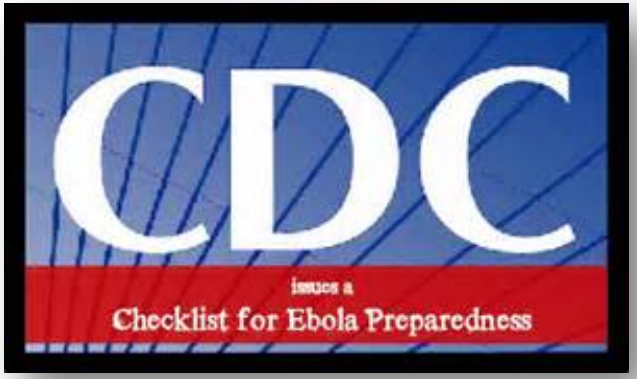
- The Outcomes: What is the value and risk of advancing PHL test capabilities? What is the benefit to the population served?
- The Measures: For a specific program (e.g. TB, Hep C, Rabies, SDWA- Arsenic)
  - Investment- Labor Costs
  - Benefits- Quality of life and lives saved (QALY)– links to prevention/decreased transmission, changes in time (to perform the test, to respond)
  - Others- prevention from unnecessary treatment (rabies), changes from new technology (costs, send-outs, accuracy, sensitivity)

Example: Education & Training ROI

- The Outcomes: What is the value of training/educating sentinal/clinical laboratories?
- The Measures: For a specific program
  - Investment- Labor Costs
  - Benefits- Quality of life and lives saved (QALY), changes in time (improved transport, holding)
  - Others- improved isolate submission, quality (rejection rates), compliance to referral requirements, challenge sets

Example: Ebola Preparedness

- If you are the Decision-Maker, what are the <u>outcomes</u> you want to know?
- What would be the measures?
  - Investments?
  - Benefits?



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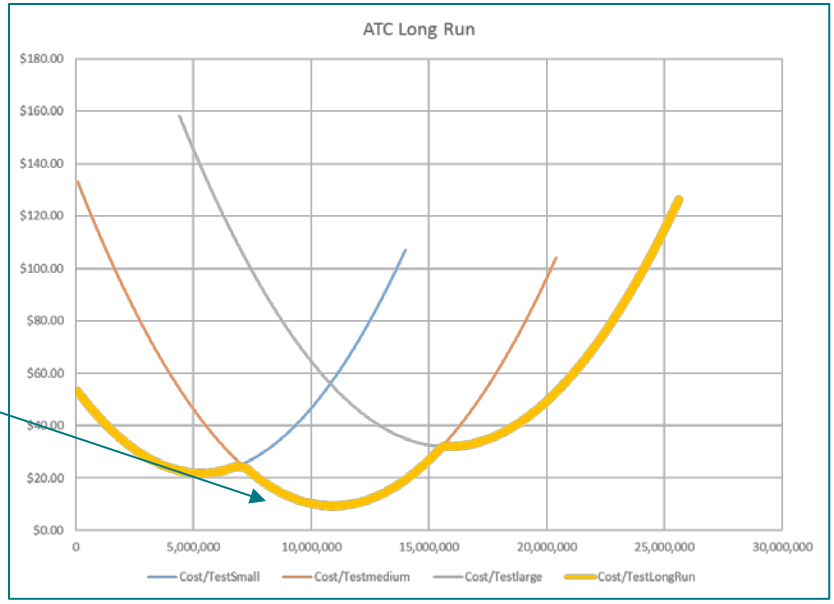
Source: www.cdc.gov

Maximizing the Investment

For a specific test (with a given number of FTEs, space, and equipment under current conditions), how many tests do we need to perform to minimize costs?

- How would this change if we added another FTE?
- How would this change if we added another instrument?
- How would this change if we added another FTE and another instrument?



Source: Paul Speaker, WVU

Maximizing the Investment

- How do we determine that we are performing the test at the right location? (multiple sites, some sites have test redundancy and some do not)
- How do we determine the impact of relocating a unique testing program from one site to another site?

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ROI metrics for PHLs in action!

Christine Bean, Christine L. Bean, PhD, MBA, MT(ASCP), Laboratory Director, New Hampshire Public Health Laboratories

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Return on PH Lab Investment

- Expenditure Data
  - Personnel costs estimated at 65%
  - Large capital expenditures
- Outcome Data
  - Transmission averted/disease prevention
  - Medical costs of treating newly diagnosed patients averted/timely treatment of new cases
  - Long-term exposure averted
  - Benefit to health of population

Rabies Testing

- 4.5 hours per specimen from receipt of specimen to reporting of results. Reading of the slide requires a 2nd scientist confirmation read.
- Rabies is staffed with 5 FTE, 4 are in the rabies rotation with one back up as needed
- Work load is 450 to 500 specimens per year
- Cost for reagents (500 specimens) approximately $8,000 to 10,000 per year.

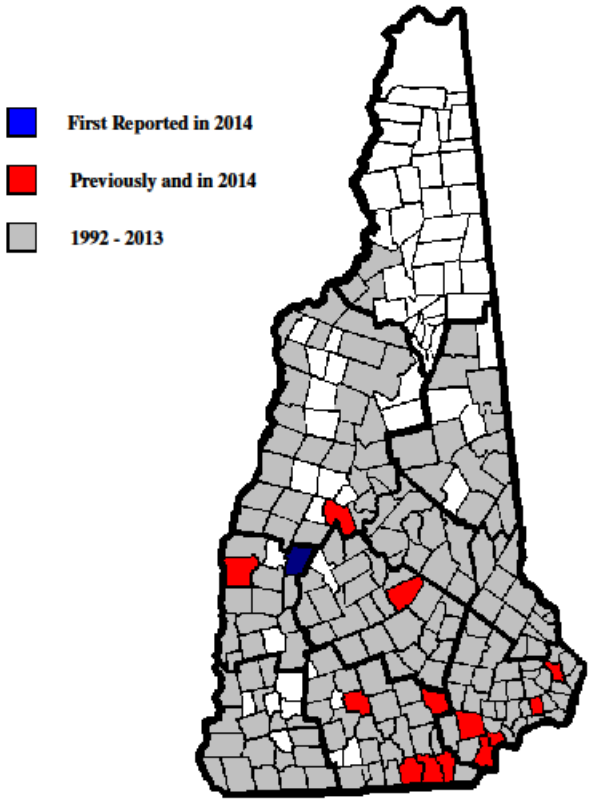
04/14/2015 DHHS was notified of a rabid skunk in Pembroke. There was an individual that may have been exposed by second hand contact of 2 domestic dogs that interacted, had contact with the skunk. PEP was recommended. Person exposed, F&G, PD, State Vet and HO were all notified of test results. No other human or animal exposure known.

RABIES MONTHLY REPORT

NH Division of Public Health Services
Public Health Laboratories
29 Hazen Drive Concord NH 03301

PROGRESSION OF RABIES EPIZOOTIC BY TOWN

December 31, 2014



Total Number of Specimens

	December 2014	YTD
Received	24	458
Negative	21	427
Positive	2	23
Unsatisfactory	1	8

Outcome Data- Benefits

- Transmissions averted
- Preventing human cases of rabies- 100% fatal
- Prophylaxis averted- any human exposed to an animal that is not tested is subject to PEP
  - 4 doses of rabies vaccine required over a 14 day period plus Rabies Immune Globulin
  - estimated cost- $4,000.00 per person
  - Side effects of vaccine

HCV Testing

- PHL's performing HCV testing for certain populations- prisons in NH
- HCV is one pilot test being used in the NEEPHLD LEI- shared testing services
- Efficiencies gained by offering testing to other states- maximizing ROI
- Genotyping for selection of appropriate treatment

Hepatitis C virus infection in USA: an estimate of true prevalence

- The study estimates that there were at least 142,761 homeless persons, 372,754 incarcerated persons and 6805 persons on active military duty unaccounted for in the NHANES survey. While the NHANES estimates of drug users (both injection and noninjection) appear to be reasonable, the survey seems to have underestimated the number of HCV-positive veterans.
- Our most conservative estimates suggest that there are at least 5.2 million persons living with HCV in USA today, approximately 1.9 million of whom were unaccounted for in the NHANES survey.

Eric Chak, Andrew Talal, Kenneth Sherman *et al*. Liver International 2011.
DOI:10.1111/j.1478-3231.2011.02494.x

Test Cost

Cobas Taqman HCV Test 2.0

Test Name: HCV Taqman

Normal Batch Size: 10 # of Batches/Yr: 50

Annual Test Volume: 500 Year: 2014-2015

Materials Cost

Reagents	$/Per sample/assay	Cost/test	Cost/test
High Pure RNA extraction system (36 samples/kit)	6.00	6.00	108.62
Cobas Taqman HCV 2.0 Amplification (36 samples/kit)	53.77	53.77	
Sample Consumables (vials/caps, etc.):			
Gloves (5 prs/assay)	1.20	1.20	
Pipette Tips (9 tips/sample @ .19/tip)	1.80	1.80	
PCR Tubes and caps (1152/box @ $864/box)	0.75	0.75	
Others:			
Service contract 13000/500	26.00	26.00	

Material/Reagents: $ 89.52

Labor Cost

Position Title	Hours	$/Hour	Pre-analyst.	Analyst.	Post-Analyst.	Non-Lab Staff	Cost/yr	
Lab Supervisor	100.00	34.00		x	x		#######	
Micro II	125.00	25.00		x	x		#######	
Lab assistant	25.00	18.00	x				$450.00	
LIMS Administrator	10.00	37.00					$370.00	
							$0.00	
						Direct Labor:	#######	$14.69
						Fringe Benefits:	1,469.00	$2.94
						Indirect %:	734.50	$1.47

Outcome Data- Benefits

- LEI- greater efficiencies realized
- Decreased turnaround time for results
  - Early detection and treatment to prevent cirrhosis
- Preventing further cases of HCV
  - QALYs
  - Financial burden of HCV therapeutics
    - Estimates $63,500-83,500 per patient

SDWA- Arsenic

- Sample prep 30 mins
- Sample analysis 4 hrs
- Data entry, review, approval and reporting 2hrs
- Total time 6.5 hrs
- Annual tests performed 1800

Treatment Options

- As levels <200 and no other issues like iron, manganese or other contaminants. Treats only the water at kitchen sink used for drinking and cooking (Point of Use), cost approx. $200
- As levels >200 or if one needs to treat for other contaminants as well. Point of Entry, or Whole House Filters. Can cost 1500-3000.

Outcome Data/Benefits

- Treatment options exist
- Prevent long-term health effects to exposure in drinking water
  - Serious effects of the neurologic, respiratory, hematologic, cardiovascular, gastrointestinal
  - Carcinogen in multiple organ systems

SDWA- Nitrates

- Sample and reagent prep 1hr 45 mins
- Sample analysis 1 hr 45 mins
- Data entry, review and reporting 1 hr
- Total time 4.5 hrs
- Annual tests performed 2800

Treatment Options

- Ion Exchange, distillation, reverse osmosis
- Dangerous especially for infants and pregnant women
- Flooding events can lead to nitrates from human/animal waste and/or fertilizers entering well water

Outcome Data/Benefits

- Knowledge of nitrate levels to make decisions about drinking well water
  - Source of drinking water
  - Agricultural activities in proximity
  - Sewer System used
  - Flooding events in area
  - Have private wells tested for Nitrates

TB Testing

- Three laboratory staff:
  - Annual Salaries Total 168,272
  - Employee Related Expenses Total 64,601

Total overall costs for three FTE's in TB lab:

$232,873.00

2014 Calendar Year Data

- 3,248 tests performed in 2014
- 118 cases identified
- Total of 250 cases per year in state (includes tests performed in other labs)

Outcome Data/Benefits

- Transmission averted/prevention
- Timely diagnosis and treatment of TB
- Cost for treatment of TB case:

TB Treatment Cost

Compared with the treatment of one DS-TB patient at $17k

- MDRTB $134,000 per case
  - Including productivity losses: $260,000
- XDRTB $430,000 per case
  - Including productivity losses: $554,000

Discussion