Forensic Laboratory Financial Management/Return on Investment: Project FORESIGHT Revelations

Paul J Speaker, PhD
Department of Finance
College of Business & Economics
West Virginia University

Project FORESIGHT

- West Virginia University Forensic Science Initiative
- NIJ funded project FY09 and FY10
- Connect casework, financials, and personnel data
- Create business metrics to understand the “industry” of forensic science laboratories
- Share what works; improve what does not

Project FORESIGHT Areas of Investigation

- Blood Alcohol
- Crime Scene Investigation
- Digital evidence - Computer, Audio & Video
- DNA Casework
- DNA Database
- Document Examination (including handwriting)
- Drugs - Controlled Substances
- Evidence Screening & Processing
- Explosives
- Fingerprint Identification
- Fire analysis
- Firearms and Ballistics
- Forensic Pathology
- Gun Shot Residue (GSR)
- Marks and Impressions
- Serology/Biology
- Toxicology ante mortem (excluding BAC)
- Toxicology post mortem (excluding BAC)
- Trace Evidence (includes Hairs & Fibers, Paint & Glass)

FORESIGHT Participation

- Annual submissions from FY2005 - FY2016
- 136 laboratories in FY2016; 116 U.S.
- Six continents represented
- Dramatic increase expected with FORESIGHT 2020

Project FORESIGHT Metrics

- Speaker, Paul J. Financial Management of Forensic Science Laboratories: Lessons from Project FORESIGHT 2011-2012. ***Forensic Science Policy & Management, An International Journal*** 6(1-2). August 2015, 7 - 29.

FORESIGHT 2020

- ASCLD Project
- Funded by the Laura and John Arnold Foundation
- Cooperative effort with major LIMS providers
- Automatically generate reports for Project FORESIGHT, NIJ, etc.
- Dashboard for real time operational and business metrics

2nd Logic
Innovation · technology

Last Updated: None

- Home
- Foresight
- Units
- Offenses
- Evidence
- 2017 KPIs
- Cases Map
- Help

Year to Date From 10/01/2016 To 03/21/2017

Cases

View Data Download

PERIOD TOTAL
2920
YESTERDAY TOTAL
0
DAILY AVERAGE
19

Service Requests

View Data Download

PERIOD TOTAL
8763
YESTERDAY TOTAL
0
DAILY AVERAGE
57

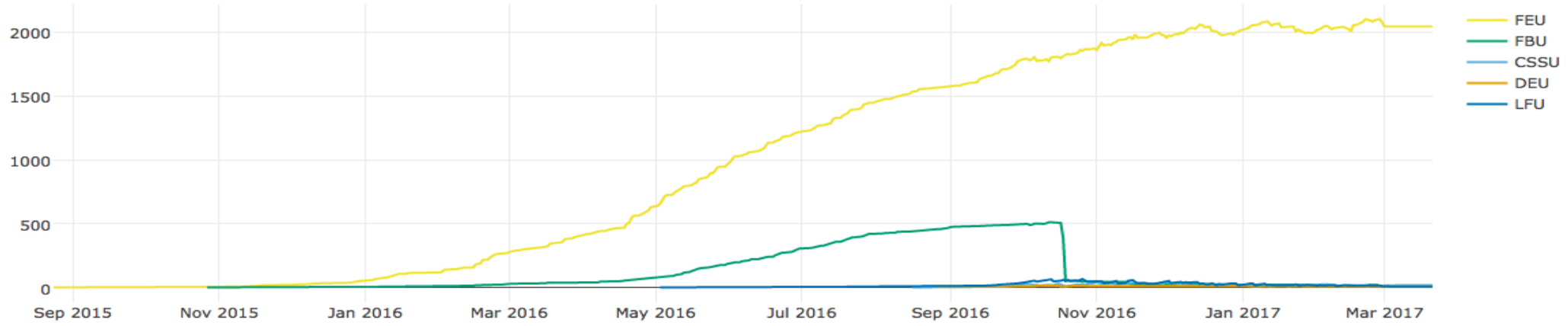
Evidence

View Data Download

PERIOD TOTAL
38405
YESTERDAY TOTAL
0
DAILY AVERAGE
252

Backlog By Unit

View Data Download



2nd Logic
Innovation · technology

Last Updated: None

- Home
- Foresight
- Units
- Offenses
- Evidence
- 2017 KPIs
- Cases Map
- Help

Year to Date | From 10/01/2016 | To 03/21/2017

Foresight cases

View | Data | Download

4sight Service	Case Count
CSI	1444
FING	872
FIRE	793
DNA	97
DE	13

Evidence Count

View | Data | Download

4sight Service	Item Count
CSI	12007
FING	6488
FIRE	5579
DNA	977
DE	14

Tests

View | Data | Download

4sight Service	Test Count
CSI	2513
FIRE	1018
FING	929
DNA	101
DE	76

Last TAT

View | Data | Download

4sight Service	Last Turnaround Time
DNA	57
FING	16
FIRE	12
DE	10
CSI	9

2nd Logic
Innovation - technology

Last Updated: None

- Home
- Foresight
- Units
  - CSSU
  - DEU
  - LFU
  - FBU
  - FEU
- Offenses
- Evidence
- 2017 KPIs
- Cases Map
- Help

FBU Home | Service View

FBU Service Request Data

Year to Date | From 10/01/2016 | To 03/21/2017

Service Requests

View | Data | Download

PERIOD TOTAL
629
YESTERDAY TOTAL
0
DAILY AVERAGE
5

Cases w. Unit Requests

View | Data | Download

PERIOD TOTAL
578
YESTERDAY TOTAL
0
DAILY AVERAGE
2

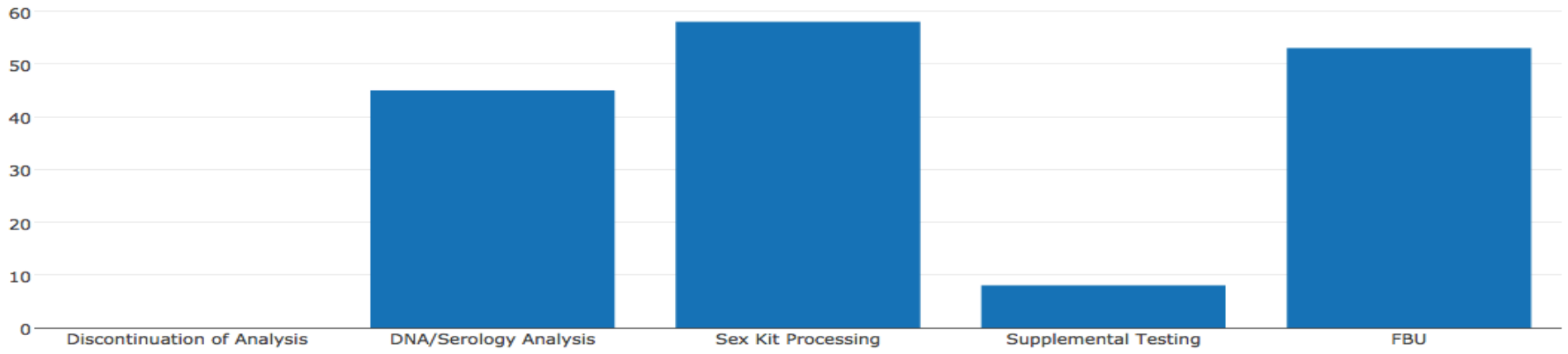
Pieces of Evidence w. Unit Requests

View | Data | Download

PERIOD TOTAL
2387
YESTERDAY TOTAL
0
DAILY AVERAGE
9

Unit Report TAT

View | Data | Download



Current Research Underway

- The Return on Investment (ROI) from investment in the DNA Database
- Process Improvement, Reduction in Turnaround Time, and Capacity Enhancement: Forecasting and the Financial Foundations Embedded in Strategic Changes
- U.S. Forensic Science laboratories v. International laboratories and performance over time
- The Queuing Elasticity of Demand for Forensic Science Services

The Return on Investment from investment in the DNA Database

- “In 2010, 761,609 offender profiles were uploaded to CODIS. . ., this cost the state and federal governments approximately $30.5 million, but saved at least $1.2 billion annually by preventing new crimes.”
- Doleac, Jennifer L. The Effects of DNA Databases on Crime. ***American Economic Journal: Applied Economics*** 9(1), 2017, pages165-201.
- Applies the Doleac societal returns to individual contributions from FORESIGHT laboratories.
- Policy implications on distribution of funds and jurisdictional versus regional cooperative efforts.

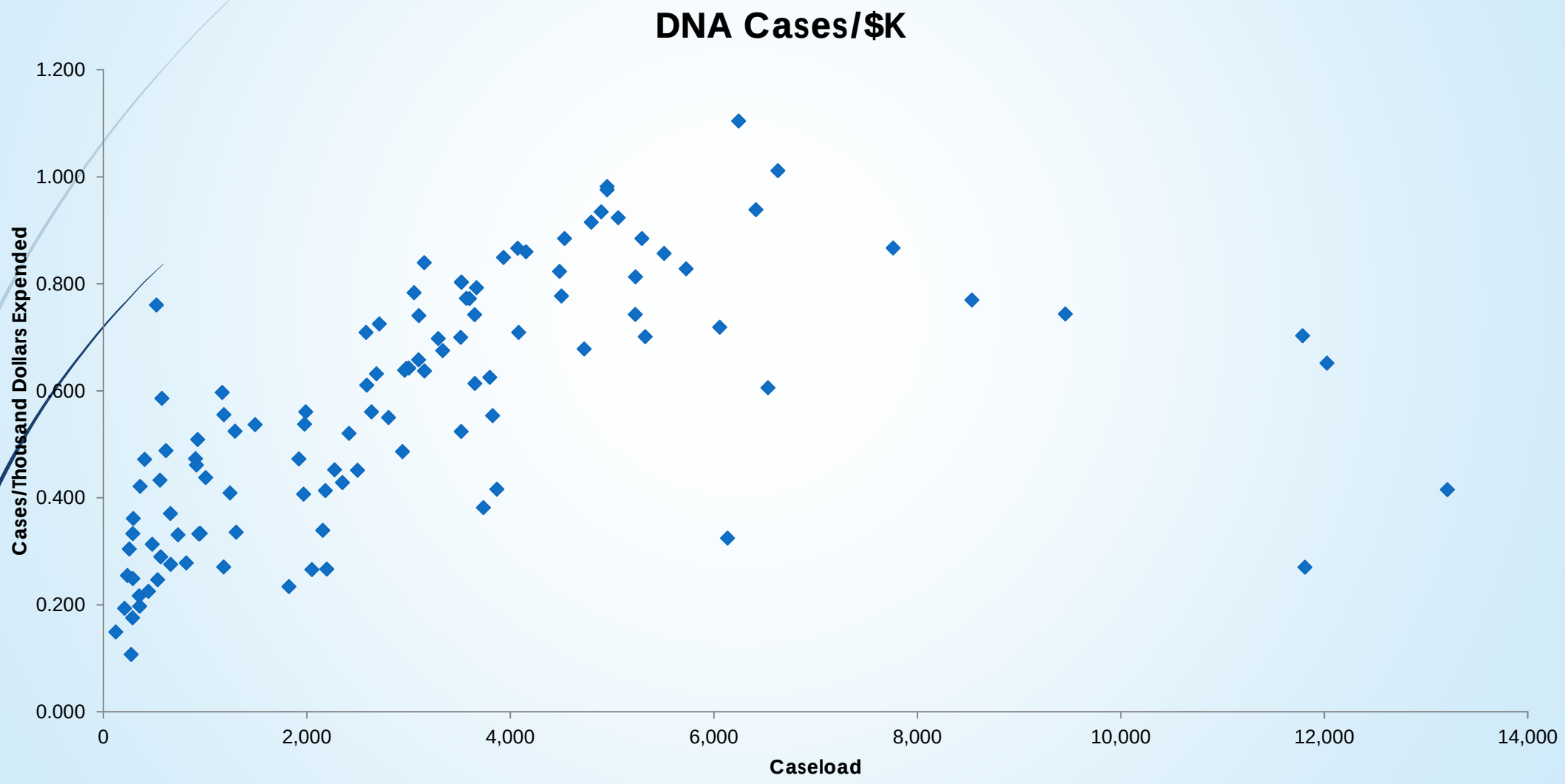
The Return on Investment from investment in the DNA Database

- Operational improvements can offer dramatic increases in productivity and efficiency
- Right-sizing operations to take advantage of economies of scale
- TAT reduction will be met with increased demands for services
- Plan for the moving target
- Data driven decision-making
- Societal ROI: 890% to 3,800%, depending upon jurisdictional scale of operations

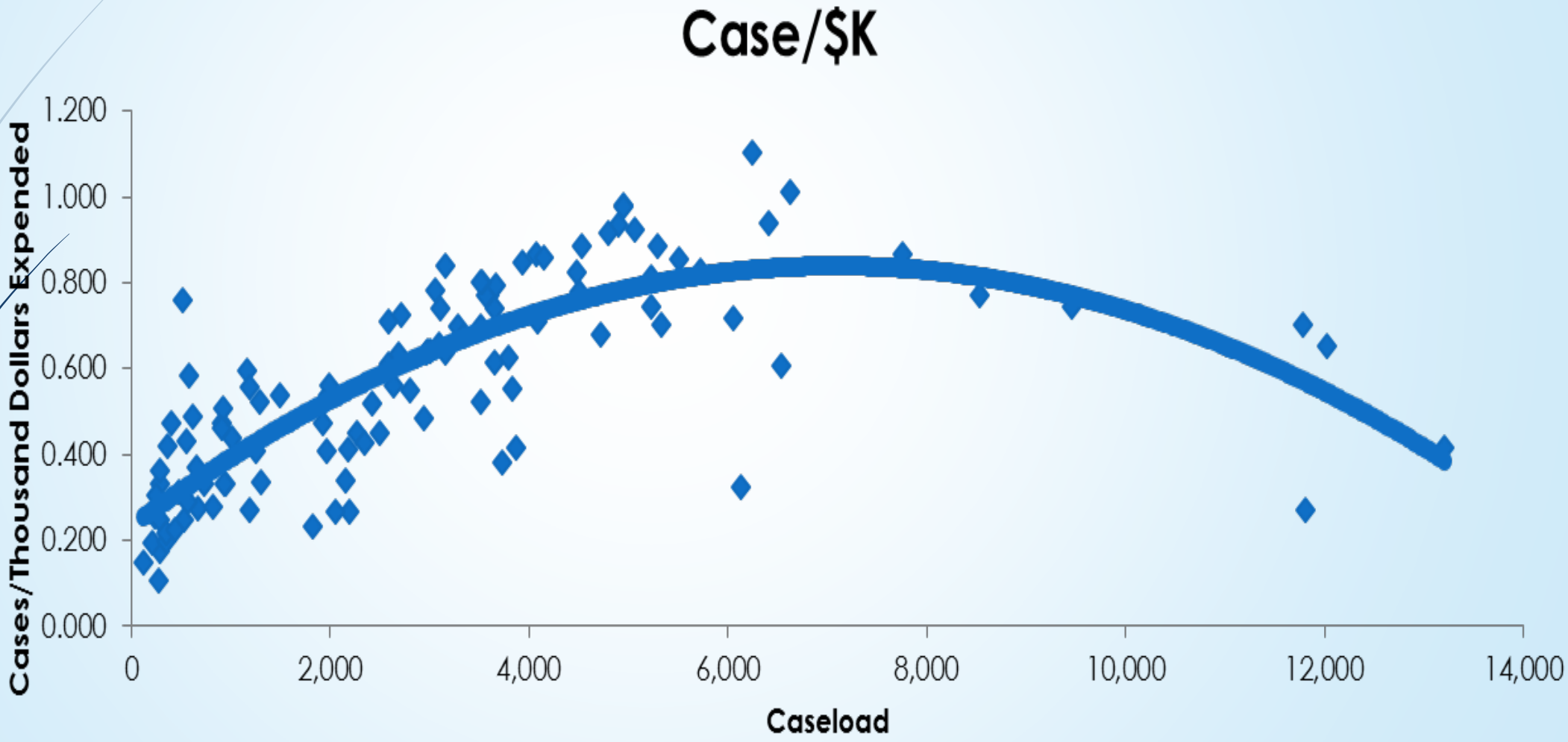
Process Improvement, Reduction in Turnaround Time, and Capacity Enhancement: Forecasting and the Financial Foundations Embedded in Strategic Changes

- Decomposition Redux
- Econometric estimation of the efficient frontier for each investigative area
- Offers advance metrics on potential gains from operational changes (such as lean six sigma programs)
- Policy implications

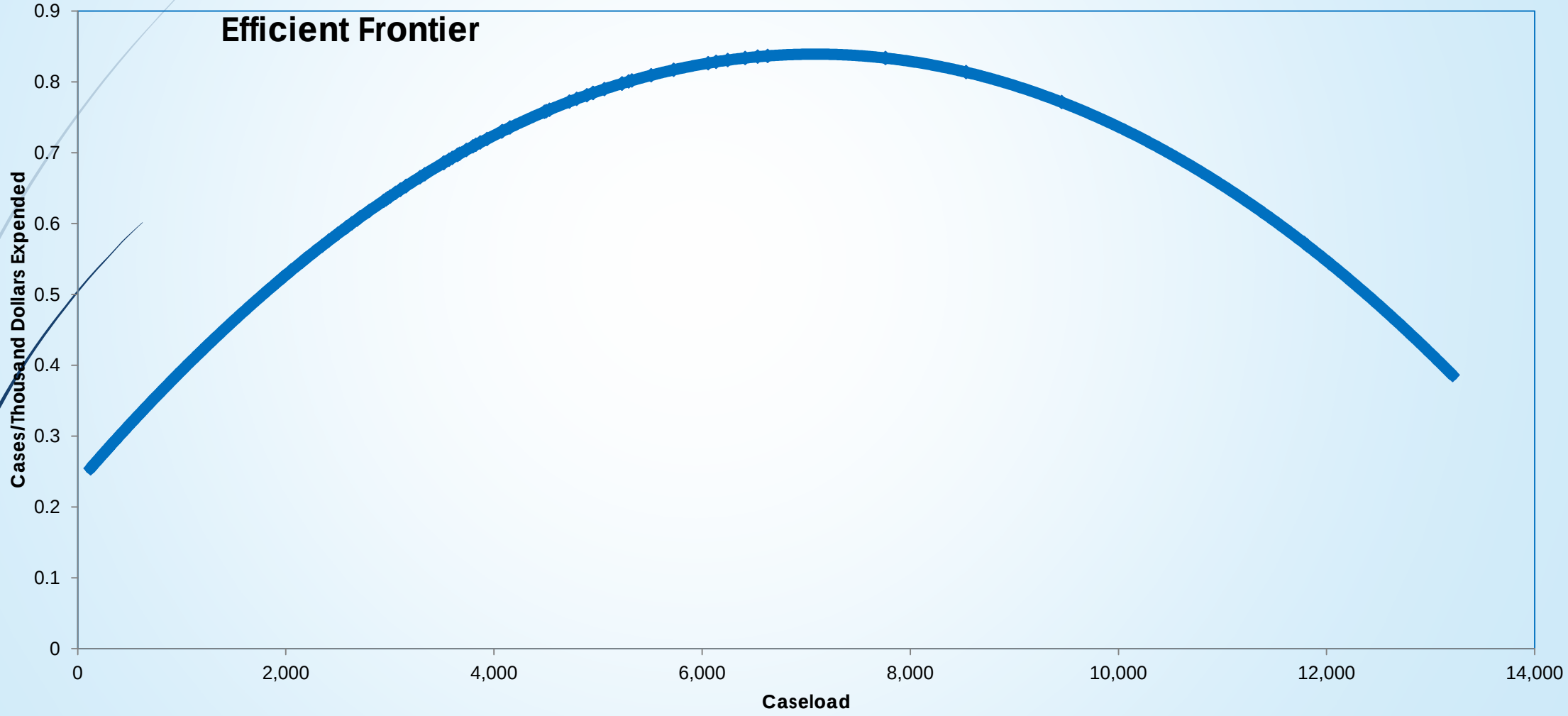
Lean Six Sigma and Potential Gains



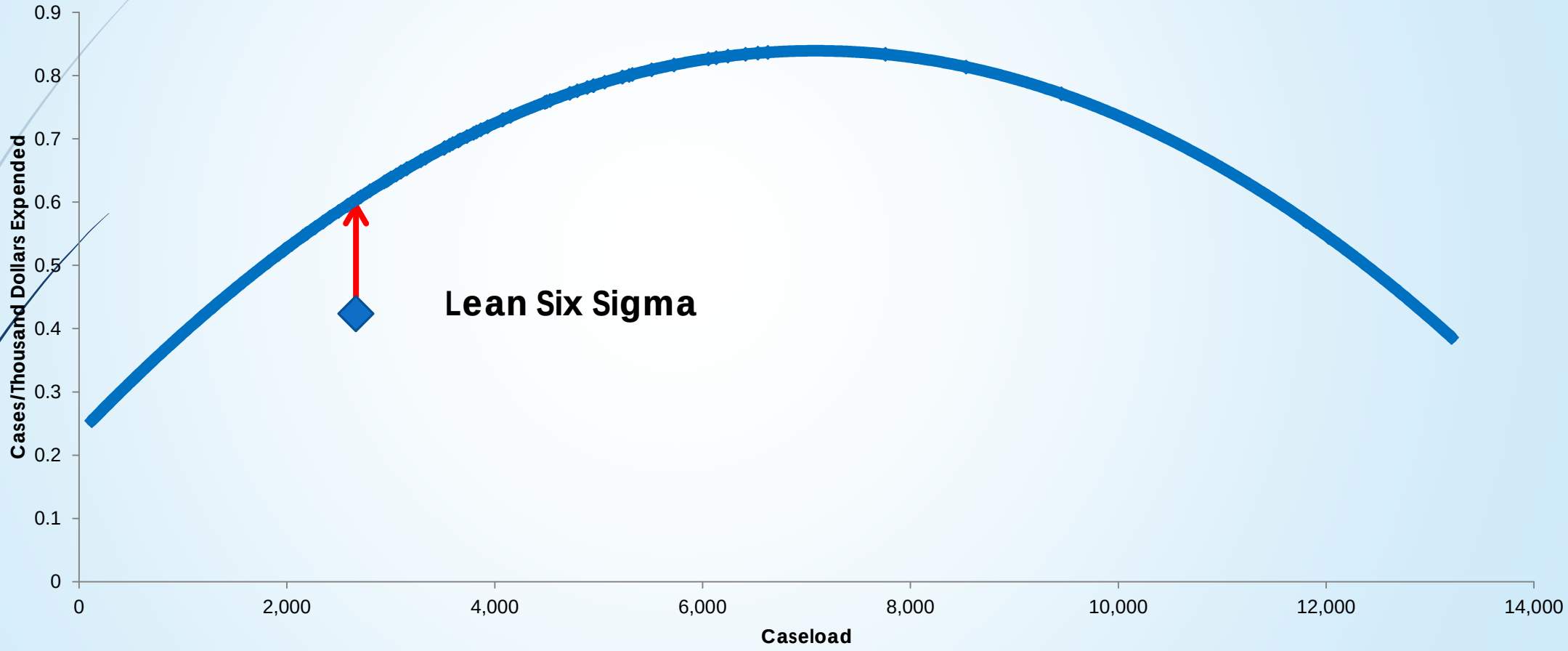
Lean Six Sigma and Potential Gains



Lean Six Sigma and Potential Gains



Lean Six Sigma and Potential Gains



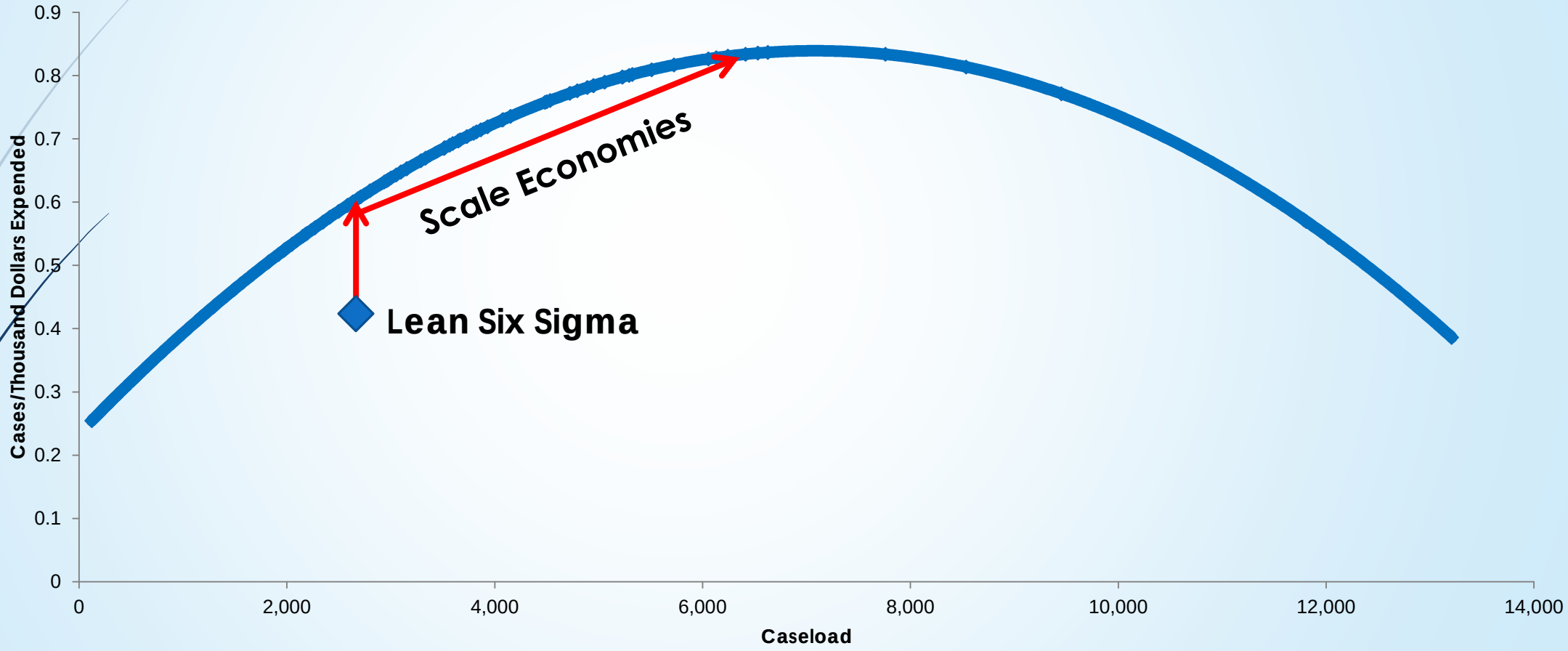
Lean Six Sigma and Potential Gains

Van Asten, Arian C. On the Added Value of Forensic Science and Grand Innovation Challenges for the Forensic Community. ***Science & Justice*** 54(2). March 2014, 170 - 179.

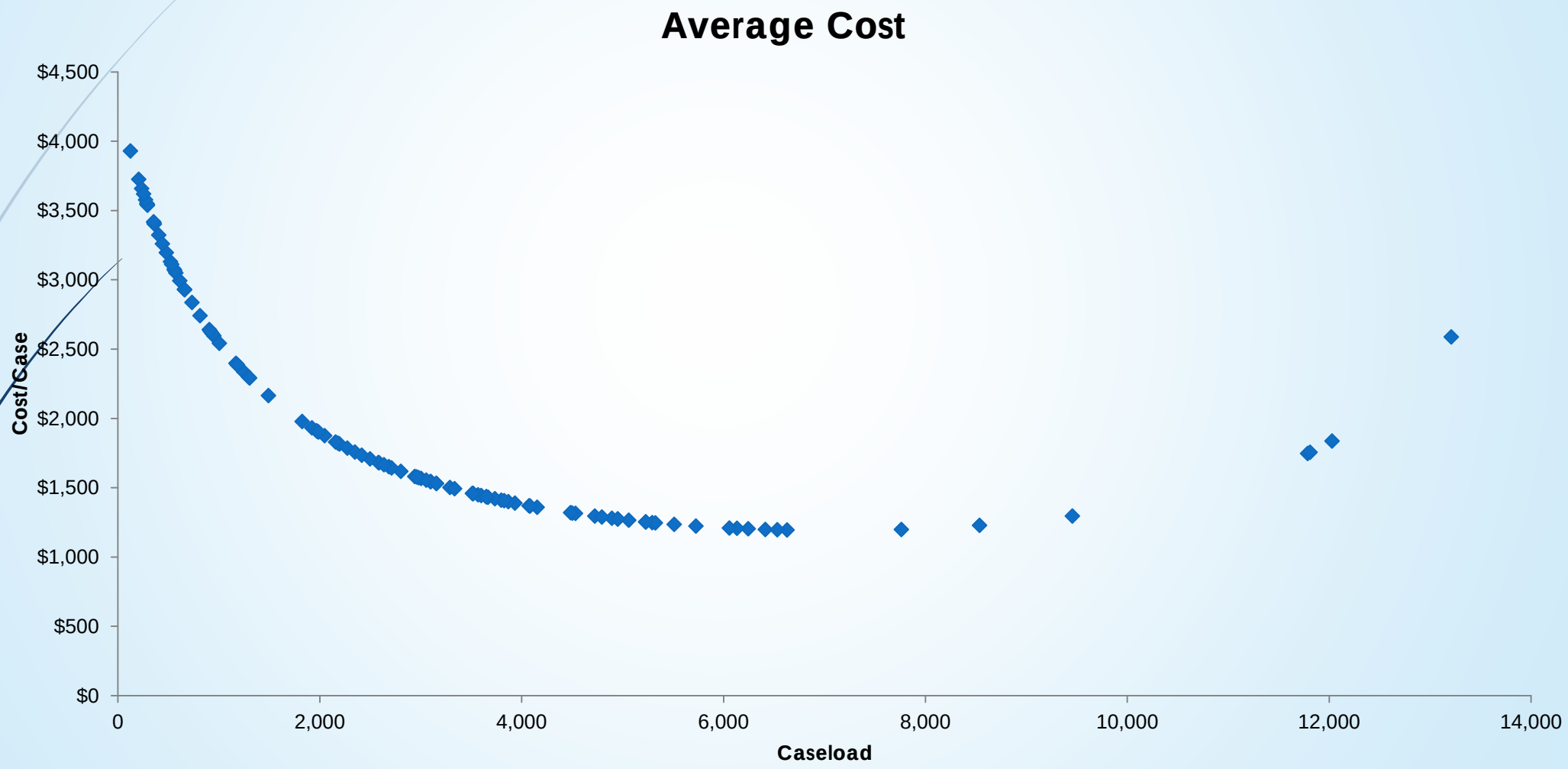
science&justice

JOURNAL OF THE CHARTERED SOCIETY OF FORENSIC SCIENCES

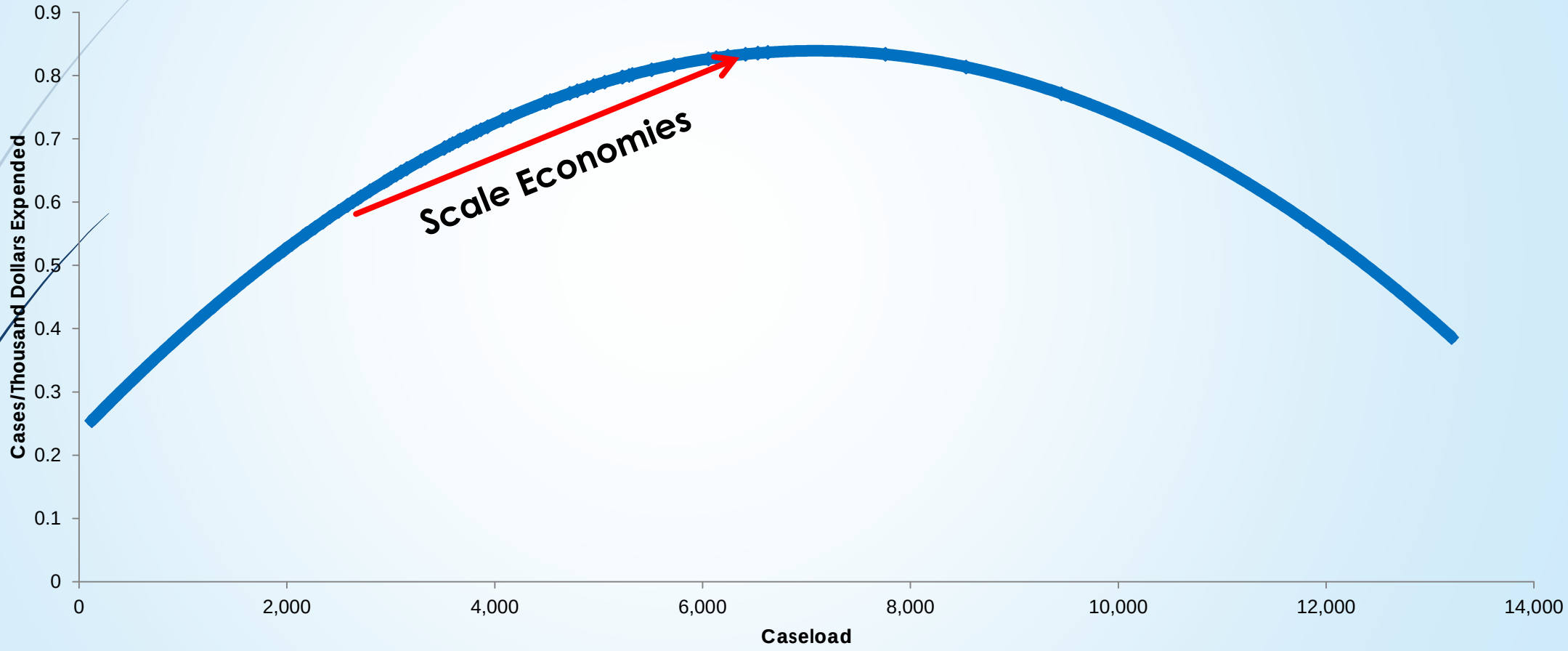
Lean Six Sigma and Potential Gains



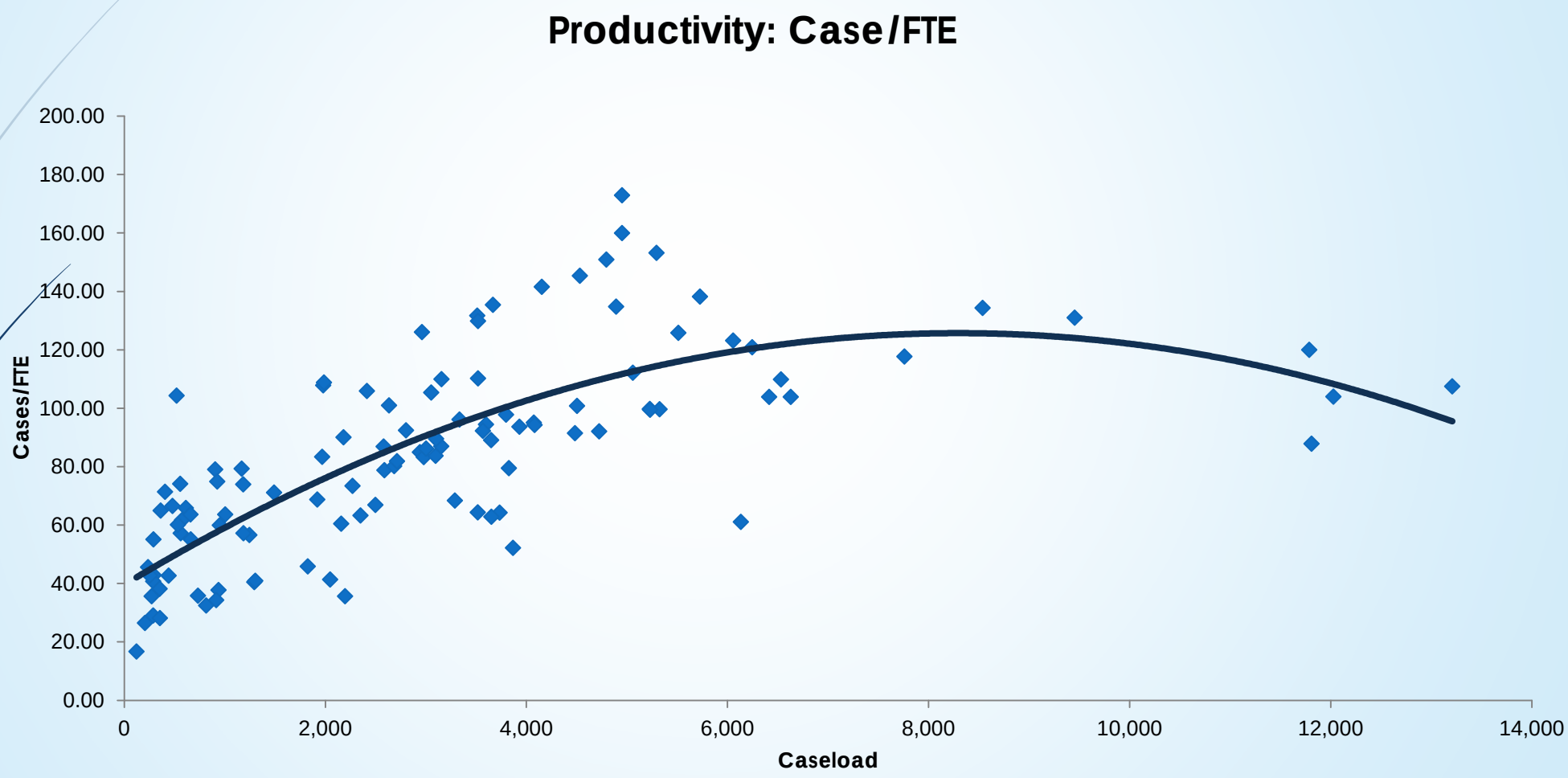
Economies of Scale



Economies of Scale—Size Matters



Economies of Scale—Productivity & Size



U.S. Forensic Science laboratories v. International laboratories and performance over time

- Do differences exist in the efficient frontier?
- Does knowledge of the performance metrics promote improvement?

Backlog, Turnaround Time, & Queuing Elasticity

- SAK Backlog Reduction Efforts
- TAT reduction
- Queuing elasticity less than -1
- Interpretation: for a 1% reduction in TAT, demand for services increases by more than 1%
- The metrics should accompany planning and resource allocation
- <u>Resource needs are a moving target</u>

The Queuing Elasticity of Demand for Forensic Science Services

- Efforts to reduce backlog have an unintended consequence; such programs reduce TAT which actually increases backlog
- Cases: $\eta_{TAT} = \frac{percentage\ change\ in\ cases}{percentage\ change\ in\ TAT}$ = -1.290

The Queuing Elasticity of Demand for Forensic Science Services

- Items: $\eta_{TAT} = \frac{percentage\ change\ in\ items}{percentage\ change\ in\ TAT}$ = -3.906
- This suggests that not only do more cases get submitted, more evidence is requested for review in existing cases.

The Queuing Elasticity of Demand for Forensic Science Services

- Samples: $\eta_{TAT} = \frac{percentage\ change\ in\ sampless}{percentage\ change\ in\ TAT}$ = -2.916
- And from the additional cases and additional items of evidence more samples are being tested as TAT falls.
- The demand for laboratory services is growing, the faster casework is processed.

The Queuing Elasticity of Demand for Forensic Science Services

- Permits anticipation of funding awards to systemic demands
- Permits measurement of program effectiveness towards capacity enhancement
- Policy implications on funding, return on investment, operational change, etc.
- FORESIGHT 2020 contribution offers the opportunity to even better track the market demand for lab services

Moving Forward

- Additional topics under research are either suggested by participating laboratories or uncovered in the data
- ASCLD 2017 will highlight several operational success stories from use of the FORESIGHT output
- FORESIGHT 2020 support continues through February 2018
- Future funding will be critical to continued analysis
  - Gains are forensic laboratory industry-wide
  - Societal returns suggest public funding

FORESIGHT Published Research Output

FORESIGHT Published Research Output

- FORESIGHT: A Business Approach to Improving Forensic Science Services, *Forensic Science Policy & Management: An International Journal* Volume 1, Issue 2, 2009, Max M. Houck, Richard A. Riley, Paul J. Speaker, & Tom S. Witt, pages 85-95.
- Key Performance Indicators and Managerial Analysis for Forensic Laboratories, *Forensic Science Policy & Management: An International Journal* Volume 1, Issue 1, 2009, Paul J. Speaker, pages 32-42.
- The Decomposition of Return on Investment for Forensic Laboratories, *Forensic Science Policy & Management: An International Journal* Volume 1, Issue 2, 2009, Paul J. Speaker, pages 96-102.
- Monitoring Financial Performance, *The CPA Journal* Volume 79, Issue 8, 2009, Paul J. Speaker & Arron Scott Fleming, pages 60-65.
- The KPI of CSI: A Business Application in the Public Sector, *Journal of the Academy of Business Education, Proceedings*, 2010, Paul J. Speaker, pages 1-12.
- Benchmarking and Budgeting Techniques for Improved Forensic Laboratory Management, *Forensic Science Policy & Management: An International Journal* Volume 1, Issue 4, 2010, Paul J. Speaker & A. Scott Fleming, pages 199-208.

FORESIGHT Published Research Output

- A New Twist on Old Tricks: DuPont Expansions for Public Entities, *Journal of the Academy of Business Education, Proceedings*, 2010, Paul J. Speaker, pages 1-7.
- Managing Performance in the Forensic Sciences: Expectations in Light of Limited Budgets , *Forensic Science Policy & Management: An International Journal* Volume 2, Issue 1, 2011, Hilton Kobus, Max Houck, Paul J. Speaker & Richard Riley, pages 36-43.
- Strategic Management of Forensic Laboratory Resources: From Project FORESIGHT Metrics to the Development of Action Plans, *Forensic Science Policy & Management: An International Journal* Volume 2, Issue 4, 2011, Jonathan Newman, David Dawley, & Paul J. Speaker, pages 164-174.
- The Power of Information, *Forensic Magazine* April 10, 2012, Tom S. Witt & Paul J. Speaker.
- Is Privatization Inevitable for Forensic Science Laboratories?, *Forensic Science Policy & Management: An International Journal* Volume 3, Issue 1, 2012, William McAndrew, pages 42-52.

FORESIGHT Published Research Output

- The Balanced Scorecard: Sustainable Performance Assessment for Forensic Laboratories, *Science and Justice* Volume 52, 2012, Max Houck, Paul J. Speaker, Richard Riley, & A. Scott Fleming, pages 209-216.
- Efficiency and the Cost Effective Delivery of Forensic Science Services: In-Sourcing, Out-Sourcing, and Privatization, *Forensic Science Policy & Management: An International Journal* Volume 3, Issue 2, Chris Maguire, Max Houck, Robin Williams, & Paul J. Speaker, pages 62-69.
- Forensic Science Service Provider Models: Data-Driven Support for Better Delivery Options , *Australian Journal of Forensic Sciences* Volume 45, Issue 4, 2013, Paul J. Speaker, pages 398-406.
- Improving the Effectiveness of Forensic Service: Using the Foresight Project as a Platform for Quality, *Proceedings of the American Academy of Forensic Sciences,* Volume XIX, Max M. Houck, Jay W. Henry, and Paul J. Speaker, February 2013, p.21.
- Are Forensic Science Services Club Goods? An Analysis of the Optimal Forensic Science Service Delivery Model, *Forensic Science Policy and Management: An International Journal* Volume 3, Issue 4, 2012, William P. McAndrew, pages 151 – 158.

FORESIGHT Published Research Output

- Developing New Business Models for Forensic Laboratories, Chapter 13 in *Forensic Science and the Administration of Justice*, Kevin J. Strom & Matthew J. Hickman editors, Max M. Houck & Paul J. Speaker, April 2014, pages 221-233.
- Expanding Budgets via Strategic Use of Leasing, *Forensic Science Policy and Management: An International Journal*, William P. McAndrew & Paul J. Speaker, pages 169-179.
- A Novel Approach to Forensic Molecular Biology Education and Training: It's Impact on the Criminal Justice System, *Australian Journal of Forensic Sciences*, 47 (2), 2015, Khalid M. Lodhi, Robert L. Grier, and Paul J. Speaker, pages182 – 193,.
- A Review of Forensic Science Management Literature, *Forensic Science Review 27*, 2015, Max M. Houck, William P McAndrew & B. Daview, pages 53-68.
- Forensic Laboratory Financial Management, *ASCLD Crime Lab Minute*, Paul J. Speaker, July 2015.

FORESIGHT Published Research Output

- Financial Management of Forensic Science Laboratories: Lessons from Project FORESIGHT 2011-2012 , *Forensic Science Policy and Management: An International Journal 6(1-2)*, 2015, Paul J Speaker, pages 7 – 29.
- Project FORESIGHT and Return on Investment: Forensic Science Laboratories and Public Health Laboratories, *Forensic Science Policy and Management: An International Journal*, Paul J. Speaker, 2017.
- National versus Local Production: Finding the Balance between Fiscal Federalism and Economies of Scale, *Public Finance Review*, forthcoming 2017.