The Recovery of Houston

Peter Stout, Ph.D., F-ABFT
Objectives

Why HFSC?

What is HFSC?

How has it gone so far?

Tools that have been important?

The cost of wrong and the cost of late.
March 11, 2003

Worst Crime Lab in the Country
Or is Houston Typical?

By ADAM LIPTAK

When Josiah Sutton went on trial for rape in 1999, prosecutors in Houston had little to build a case on. There was the only eyewitness, and her recollection was faulty. But they did have the rapist's DNA, and the Houston police crime laboratory told the jury that it was a solid match.

That was enough to persuade the jurors to convict Mr. Sutton and send him to prison for 25 years.

But new testing has conclusively demonstrated that the DNA was not Mr. Sutton's, the Houston Police said yesterday.
What is HFSC

• 2012 -- formed a Local Government Corporation
  – A corporation “to aid and act on behalf of one or more local governments to accomplish any governmental purpose of those local governments.” Tex. Transportation Code §431.101(a).
What is HFSC

• Corporate structure
  – 9 member board of directors
  – Corporate officers
  – Forensic functions from HPD
  – Justice Agency
  – 501(c)(3)

• *April 2014* – Took management responsibility
Would a City-County Merger Jeopardize Progress at Houston's New and Improved Crime Lab?

BY MEAGAN FLYNN

THURSDAY, APRIL 7, 2016 AT 9 A.M.

“…the lab is focusing too much on quality control and in turn is just slowing things down, creating more backlog that prevents police from solving crimes.”

-- SPO Ray Hunt, President HPOU
"In the past, we had a problem with rape kits; we had a problem with processing of evidence — but we didn't have any problem with CSU,“
"I'm tired of every time they have a problem, they want to put the blame on a police officer," Hunt said Wednesday. "So let's let it lie where it belongs – on the management of the Houston Forensic Science Center."
What is so great about “independent”? 

- Control of procurement
- Control of HR
- Control of quality systems
- Control of message
- Control of being transparent
- Parity
From the start of HFSC

- 69% in backlogged requests
- 69% in Avg TOTAL turnaround time
- 57% in Avg PROCESS turnaround time
Requests received
HFSC at a glance:

July 21, 2017: Backlogs >30 days
Latents: 2,683 | Biology: 693
Changes in the labor pool

• HFSC more than 40% less per FTE
• In April of 2014
  – 5 HFSC employees & 131 COH
• In June of 2017
  – 161 HFSC
  – 35 COH
• Direct wage for HFSC 10% higher than COH
Information transparency
eDiscovery

• “Radical transparency”
  • Increased reporting
  • Increased access
  • Approximately 4,000 documents all public
Quality Tracking Events

- 2013: 1 Trace, 18 Toxicology
- 2014: 7 Trace, 3 Toxicology, 9 Quality, 14 Management, 5 Quality
- 2015: 3 Trace, 3 Toxicology, 4 Quality, 8 Management, 8 Quality
- 2016: 2 Trace, 8 Toxicology, 13 Quality, 8 Management, 10 Quality
- 2017: 7 Trace, 2 Toxicology, 2 Quality, 2 Management, 4 Quality, 14 Audio Video

- Total: 164 Events, 72 in 2016
Blind Quality Control
# Blind Chocolate Chip Cookie Project

## Method & Materials

- Four staff members each baked their favorite chocolate chip cookie recipe
- The cookies, labeled “A”, “B”, “C”, and “D”, were divided into three test groups
- Each cookie was baked with the same brand of chocolate morsels
- Each test group was the same size – 14 people

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control Group</strong></td>
<td><strong>Obvious Bias</strong></td>
<td><strong>Obvious Bias</strong></td>
</tr>
<tr>
<td>- Participants did not know any information about the cookies</td>
<td>- Participants were asked to look at the brand of chocolate chip morsel</td>
<td>- Each cookie was packaged with a different color ribbon</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- A = White</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- B = Yellow</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- C = Hot Pink</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- D = Royal Blue</td>
</tr>
</tbody>
</table>

Does chocolate chip morsel brand or color of packaging influence taste test?
Blind Chocolate Chip Cookie Project

Results and Conclusions

Which cookie was your favorite?

• Biased groups (2 and 3) did not vary from control group 1

• When intentional bias was introduced to Group 2 some analysts preferred to participate in the test first and then view brands so that their opinion would not be biased

Chocolate chip morsel brand and color of ribbon packaging did not influence the results for overall best cookie
Program Feedback

Anonymous survey
• 26 Participants
Sent to cookie project participants

Responses
• Added Quality Control
• Confidence in Performance
HFSC’s Program

Blind Testing
- Materials Purchased
- Tests made in-house
- Mimic actual casework
- Analysts do not know whether they are analyzing a real case or participating in blind test
- Evaluates entire Quality Management System
- Issued by Quality Division

Blind Verification
- Independent second review
- Case conclusions from 1st examiner masked
- 1st and 2nd examiner record conclusions
- Conclusions evaluated for consistency
- Issued by Section
Forensic Disciplines

- Toxicology
- Controlled Substances
- Firearms
- Biology
- Latent Prints
Toxicology

Blind Quality Control
Error rate determination
Toxicology blinds – 0.15 g/100mL

Levey Jennings of Reported Concentration

- Upper Certified Limit: UCL = 0.14913
- Average: Avg = 0.14355
- Lower Certified Limit: LCL = 0.13796

+- 3sd
Toxicology blinds – 0.20 g/100mL

Levey Jennings of Reported Concentration

UCL = 0.20006679
Avg = 0.19462791
LCL = 0.18918903

Upper Certified Limit

+/- 3sd
Toxicology blinds – 0.25 g/100mL
Instrument contribution
Analyst contribution
Methanol in Samples

### FID1A, Front Signal

<table>
<thead>
<tr>
<th>Compound</th>
<th>Peak Symmetry</th>
<th>Peak to Valley Ratio</th>
<th>RT [min]</th>
<th>Expected RT [min]</th>
<th>Area</th>
<th>Concentration [g/100 mL]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methanol</td>
<td>1.23236</td>
<td>10.1156369253626</td>
<td>0.892</td>
<td>0.891</td>
<td>1.8016</td>
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<tr>
<td>Ethanol</td>
<td>0.88666</td>
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<td>1.117</td>
<td>1.117</td>
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<tr>
<td>n-Propanol</td>
<td>0.85319</td>
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<td>1.665</td>
<td>1.884</td>
<td>244.9489</td>
<td>0.0100</td>
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</tbody>
</table>

### FID2B, Back Signal

<table>
<thead>
<tr>
<th>Compound</th>
<th>Peak Symmetry</th>
<th>Peak to Valley Ratio</th>
<th>RT [min]</th>
<th>Expected RT [min]</th>
<th>Area</th>
<th>Concentration [g/100 mL]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methanol</td>
<td>1.32738</td>
<td></td>
<td>0.852</td>
<td>0.853</td>
<td>2.0275</td>
<td>0.0007</td>
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<tr>
<td>Ethanol</td>
<td>0.93978</td>
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<td>1.008</td>
<td>1.008</td>
<td>204.0158</td>
<td>0.1216</td>
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<tr>
<td>n-Propanol</td>
<td>0.90283</td>
<td></td>
<td>1.568</td>
<td>1.568</td>
<td>257.4041</td>
<td>0.0100</td>
</tr>
</tbody>
</table>
Sample name: 2016-20951 1.1  Description: Alq 1  Vial Number: 13
Instrument: Headspace 2  Acq. method: VOLATILES.M  Injection date: 11/14/2016 1:38:47 PM
Data file: C:\Chem32\Data\20161114_AAJJ20161114_AAJ 2016-11-14 12-27-ZJ013F1301.D

<table>
<thead>
<tr>
<th>Compound</th>
<th>FID1A</th>
<th>Peak Symmetry</th>
<th>Peak to Valley Ratio</th>
<th>RT [min]</th>
<th>Area</th>
<th>Concentration [g/100 mL]</th>
</tr>
</thead>
<tbody>
<tr>
<td>n-Propanol</td>
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<td>0.72896</td>
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<td>1.921</td>
<td>240.4136</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Compound</th>
<th>FID2B</th>
<th>Peak Symmetry</th>
<th>Peak to Valley Ratio</th>
<th>RT [min]</th>
<th>Area</th>
<th>Concentration [g/100 mL]</th>
</tr>
</thead>
<tbody>
<tr>
<td>n-Propanol</td>
<td></td>
<td>0.88789</td>
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<td>1.669</td>
<td>230.5987</td>
<td>0.0100</td>
</tr>
</tbody>
</table>
Methanol at collection
Actual error rate determination

- 95% confidence, rate of error in positive samples is <3%
- 95% confidence, rate of error in negative sample is <9%
Firearms

Blind Quality Control
Blind Verification
Firearms Blind Testing v. Blind Verification

Blind Testing

Evidence varies by quantity and type

Scenario:

• Two firearms of same make and model as the source of fired bullets and casings
• One of the firearms is submitted as a known
• Examiner determines which, if any, of the fired evidence was fired in known gun
• 12 Cases submitted; 0 Consultations

Blind Verification

Evidence varies to account for what is seen in casework

Examples:

• Fired casings and bullet not fired in the firearm submitted
• Three groups of casings
• 6 fired casings fired in one gun. 8 fired casings from a second gun
• Comparisons between two cases
• 25 Cases submitted; 5 Consultations
Firearms: Independent Second Verification
Both examiners concluded in same region of evidence, exact same spot – 6 o’clock
Firearms: Consultation not due to experience level

Experience Level:
1 – Less than 2 years of experience
2 – 2-5 years of experience
3 – 5 years of experience
4 – 5+ years of experience
Firearms: Consultation not due to training program

Training Program:
1 – Trained at HFSC
10 – Training obtained at laboratory other than HFSC
Firearms: What causes consultation

Complexity of examination
- Firearms that mark fired bullets and casings poorly
- Brand of ammunition
## Challenges

<table>
<thead>
<tr>
<th>Toxicology</th>
<th>Controlled Substances</th>
<th>Firearms</th>
<th>Biology</th>
<th>Latent Prints</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Samples</td>
<td>• Street Drugs</td>
<td>• Firearms</td>
<td>• CODIS</td>
<td>• AFIS</td>
</tr>
<tr>
<td>• BAC Kit</td>
<td>• Customer Process</td>
<td>• Request for Testing</td>
<td>• SAKs</td>
<td>• Digital Comparison</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Section Size</td>
<td></td>
</tr>
</tbody>
</table>
Challenges

- Obtaining Samples
- Create test that mimics casework
- Internal logistics
- Analyst detection incentive
Lessons Learned

- Champion for project
- Collaborators needed
- Not all will be “Blind”
- Integrated LIMS
- Test your system
Statistical audit

Defect rate detection
Controlled Substances
Statistical audit

• Controlled substances record defect found on internal audit
• How often does this defect occur?
• Binomial power distribution analysis
  • 3000 records sampled allows for a 90%+ confidence the defect rate is < 0.4% (1 in 250)
• 3,061 records audited – 2 defects noted
  • 95% confidence that this defect occurs
    • >2 in 10,000
    • <2.4 in 1,000

• ~ 40 hours for audit or about $3,000
Defect analysis

Lean Six Sigma
Biology
Process Improvement
Control Chart: Major Number of Defects per Case Completed

Independent Data Tracking/Daily Success Action Plan

**Individual Measurement of Major/Case**

- Baseline Average
- Current Pilot Average

- Avg = 0.52
- UCL = 0.420
- Avg = 0.089
- LCL = -0.243
Control Chart: Minor Number of Defects per Case Completed
Independent Data Tracking/Daily Success Action Plan

Individual Measurement of Minor/Case

![Chart showing control chart for minor defects per case completed]

- Baseline Average
- Current Pilot Average

Avg = 2.69
Control Chart: Number of Evidence Processing Defects per Number of Items Processed

Independent Data Tracking/Daily Success Action Plan

Avg = 2.31
Quality Defects by Day per Team
Reported Independently in Daily Success Action Plan
NOT
THE END OF
THE ROAD
It ain’t what you don’t know that gets you in trouble. It’s what you know for sure that just ain’t so.

-- Mark Twain
Cost of poor quality

Cost of “wrong”
- The cost of one mistake = George Rodriguez ~$9M

Homicide = $5M-$14M
Rape = $448K
Burglary = $41K

The cost of “late”
- 4 homicides (~300 homicides/year)
- 50 sexual assaults (~1200 kits / year)
- 580 burglaries (~11,000 calls to B&T/ month)

Why should you care?

Cost of “wrong”

- 31,000 requests last CY
- Simple risk = $279B/year
- 1:10,000 is ~3 failures/year
  - $27M risk
- Statistically demonstrating a <1:5,000 error rate
  - Would require >150,000 tests to have a 95% power
  - ~$135M

2,000 blinds / year

- $500k - $1M
- 95% confidence that error rate is < 0.2%
Why should you care?

2,000 blinds / year
• $500k - $1M
• 95% confidence that error rate is < 0.2%