RAPIDLY PAVING THE WAY FOR RAPID DNA EXPERIENCES OF AN ACCREDITED LABORATORY

April 2018
Presentación outline:

- Local Databasing/BodeHITS™
- Supporting Law Enforcement use of Rapid DNA
- Bode Cellmark Internal Rapid DNA Validation
- Experiences, things to consider/learning curve
- Summary – role of crime lab
BODEHITS™

• BodeHITS™ Local DNA Databasing identifies investigative leads

• Reference samples
  • Samples collected from an individual (voluntary)
  • Arrestees, suspects, persons of interest, victims, pedestrian stops

• Evidence samples
  • Samples collected from any type of crime affecting local jurisdiction
  • Property crime, drug crime, firearms, vehicle crimes
  • Collect and submit any type and number of samples
    • Can effectively triage samples for best cost benefit
What is BodeHITS™?

30-day turnaround

Rush options available
LOCAL DNA DATABASES

• Effective complement to LDIS/SDIS/NDIS
• Local criminals commit local crimes
• Law Enforcement officers can identify individuals associated with crimes
  • Not always convicted offenders
  • Not always associated with felonies
  • Not always in CODIS
• Comparing local crime scene DNA evidence to these individuals can produce hits
Complement Services from Government Forensic Labs

Crimes reported (2015)
- 1,197,704 violent crimes
- 7,993,631 property crimes

NDIS
- ~16 million references
- ~837,000 unknowns
- Only 75,000 unknowns added/year

Sources:
https://www.fbi.gov/services/laboratory/biometric-analysis/codis/ndis-statistics
https://ucr.fbi.gov/crime-in-the-u.s
RAPID DNA

• From sample to answer in 90 minutes
• Intended for DNA at point of collection
• Provides law enforcement with immediate intelligence
• Rapid DNA Act passed Aug 2017
Use of rapid DNA instruments targeted towards law enforcement agencies, but...

Can they upload to CODIS?

What do officer’s need to know about DNA?

How much training is required?

Is the profile court eligible?

Who is going to testify to that DNA profile?

Can an accredited lab compare evidence to this profile generated in a police department?
WHAT CAN YOU DO WITH A RAPID DNA PROFILE?

• Currently cannot be uploaded into CODIS
• FBI issued Rapid addendum to QAS effective Dec 2014
  • applies to accredited labs
  • booking station standards in development
• Additional/revised standards included in new draft QAS document – pending approval
• SWGDAM & FBI QAS:
  • Reference samples ONLY
WHERE DOES THAT LEAVE LAW ENFORCEMENT AGENCIES?

• Wait???
• Investigative lead only?
• Technology ahead of policy
  • Establish best practices within the community ahead of developing laws and standards
Logical transition from the BodeHITS™ program to receiving profiles for Rapid DNA

1. Officer collects swab
2. Officer runs swab on Rapid DNA Instrument
3. Resulting STR profile electronically sent to Bode Cellmark
STEP 1: Create sample
STEP 2: Import xml file
STEP 3: Submit rapid hit profile
STEP 4: View RapidHIT profile and submit to the database for searching
- Wait 60-90 seconds
- HIT Alert in software
- Email alert as well
• Bensalem Township PD – IntegenX RapidHIT ID
• New Castle PD – ANDE (performed by ANDE)
• Validation overview
  • Sensitivity
  • Precision and Reproducibility
  • Accuracy
  • References
  • Mixtures
  • Casework Samples (single source)
• Produced accurate, reproducible, precise and sensitive results
• When analytical, stochastic and heterozygote balance thresholds were met, a CODIS-ready file with profile information was generated
  • Profile information was not generated from swabs that did not meet these thresholds or were mixed samples
• Inhibitors had no effect on ability to obtain a full profile
• No instances of contamination were observed
• Concordant profile results obtained for all reference and positive control samples compared to previously generated profiles
• 3 references required manual review
• First pass success rate in this validation was 82%
  • 14 of the 17 buccal swab samples could automatically be uploaded
  • 2 references generated full profiles when they were re-run on the instrument
VALIDATION AND TRAINING

• Establish what good and poor data looks like
• Ensure the expert system is working and flagging poor quality samples
• Determine what samples should and should not be processed with Rapid DNA instrument
Modified Rapid DNA Analysis requires human interpretation and review

- Develop SOPs/standards
- Should be performed in an accredited laboratory by trained DNA analyst
  - Verification of ILS, sample profile and allelic ladder meeting interpretation guidelines of laboratory prior to data being reported
- Training Program
  - Requires reading the validation of the instrument and other publications
  - Perform analysis on training samples of known profiles including samples requiring manual export of profile
- Proficiency Testing
  - Personnel performing modified rapid DNA analysis should participate in proficiency testing annually
RECOMMENDATIONS TO LAW ENFORCEMENT

• Documentation of Training Program
• Documentation of Validation of Rapid DNA Instrument/System/Modified Rapid
• Documentation of Instrument Maintenance
  • Performance check required upon installation and quarterly thereafter
  • Performance check required after repair or service
• Documentation of Service/Repair
• Documentation of Reagents
  • Evaluation of critical reagents prior to casework - Rapid DNA Cartridge is a critical reagent
• Documentation of Runs/Instrument Monitoring
• Proficiency Testing
  • Once a year (~3 samples) for Bode staff to stay proficient in modified rapid DNA analysis
WHAT ABOUT EVIDENCE SAMPLES?

• No clear “Rules” for processing of evidence samples
  • Vendors selling cartridges to run evidentiary items
  • NOT suitable per SWGDAM and FBI QAS
  • Court eligibility and risk of samples not being retained/usable for processing in an accredited laboratory

• Implement best practices
  • Evidence should be single source only – NO MIXTURES, must be validated
  • Only secondary evidence items should be processed via Rapid DNA
  • Preserve primary items to be processed by an accredited lab
  • Use rapid addendum to FBI QAS and draft standards as a guide
Bensalem – RapidHIT ID

- First Upload Date:
  - 5/20/2017
- 112 samples run as of September 2017
- 15 required modified Rapid DNA analysis
  - 11 passed, 4 failed
- 31 profiles generated exact hit matches

New Castle - ANDE

- First Upload Date:
  - 8/4/2017
- 24 samples run as of September 2017
- 4 profiles generated exact hit matches
BODE CELLMARK – RAPID SERVICE LAUNCH

- Starting in **April 2018**
- Same day comparisons, including stats, of single-source ref samples to other forensic samples
- Rush turnaround on confirmation testing for CODIS hits
- Rush turnaround on legal paternity cases
- Validation/Consultation
- Law Enforcement Support
• Phase 1: 20 knowns
  • Did not generate full profiles for all samples
  • 45% auto passing (9 out of 20)
  • 75% full profiles after modified rapid DNA analysis

• Phase 2: 10 knowns
  • All generated full profiles
  • 80% success rate auto passing (8 out of 10)
  • 20% required modified rapid analysis
### “Gold Standard”

<table>
<thead>
<tr>
<th>Sample Type</th>
<th>Samples Tested</th>
<th>First Pass Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bode Buccal Collectors</td>
<td>30,166</td>
<td>91%</td>
</tr>
<tr>
<td>Cotton-tipped swabs</td>
<td>55,175</td>
<td>89%</td>
</tr>
<tr>
<td>Saliva-stained treated cards</td>
<td>12,958</td>
<td>78%</td>
</tr>
</tbody>
</table>

*Based on field-collected samples processed over 12 months at Bode*

### RapidHIT ID

<table>
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<tr>
<th>Sample Type</th>
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<th>First Pass Rate – Auto Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid swabs - Bensalem</td>
<td>17</td>
<td>82%</td>
</tr>
<tr>
<td>Rapid swabs – BCF Phase 2</td>
<td>10</td>
<td>80%</td>
</tr>
</tbody>
</table>

*Based on samples collected during validation*
CONCERNS – FAILED RUNS

Expect at least 10-20% samples to be flagged
• **Option 1: Rerun sample**
  • Pros: self-sufficient, may be fastest option
  • Cons: expensive, issue may be trivial

• **Option 2: Ask IntegenX/ANDE for assistance**
  • Pros: companies know their instrument best
  • Cons: conflict of interest, not accredited lab/ proficient

• **Option 3: Ask lab for assistance**
  • Pros: expertise
  • Cons (LE): slow to respond, more likely to reject sample
  • Cons (crime lab): training requirements to interpret data
CONCERNS – LEARNING CURVE

• What data looks like
• Machine changes
• Software changes
• ILS difference b/w GMIDX/GeneMarker HID
• Elevated stutter - how much is too much?
• Ladders – Rapid ID relies on library of ladders
SUMMARY

- Rapid DNA is HERE!
- Law enforcement agencies have validated and are actively using Rapid DNA for investigative leads
- Bode Cellmark can support LE implementation of Rapid DNA and local databasing
- Bode Cellmark has a validated Rapid DNA service for references
RAPID DNA – WHAT IS THE CRIME LABORATORY ROLE?

- Advise on best practices - help law enforcement implement Rapid DNA responsibly to help solve crime
- Partner with Law Enforcement to establish roles and open communication
- Gain familiarity with instrument and data