Getting More from Less: Information Yield Increases from STR Data when using TrueAllele® Technology

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Abstract

As those in the criminal justice field become more aware of DNA evidence, crime labs are receiving an increased number of low level and touch samples. These types of samples prove challenging to interpret using manual methods. Toward this end, many DNA labs have started to use technology, such as probabilistic genotyping (PG) software, to assist in data interpretation. What impact does using a PG interpretation tool have for a typical lab?

The DNA lab of the Greenville County DPS Forensics Division started using the GlobalFiler™ STR kit in 2017. As they processed cases, they recorded, by case, the success rate when samples produced an interpretable result relevant to the case. During the period from 2017 to 2020, they had an initial quantitation threshold of 60 picograms (pg). The success rates of touch/ownership samples from guns/knives, clothing, cars, cartridge cases (fired and unfired), and other miscellaneous items were tracked.

The lab began to explore PG solutions in 2020 and chose to use TrueAllele® Technology. They internally validated TrueAllele for up to four unknown contributors, and began using this PG technology in casework in August 2020.

After the introduction of TrueAllele, the lab observed increases in success rates across sample types:

- Guns/knives: 154% increase
- Clothing: 87.9% increase
- Cars: 437% increase
- Cartridge cases (fired and unfired): 223% increase
- Other miscellaneous items: 106% increase

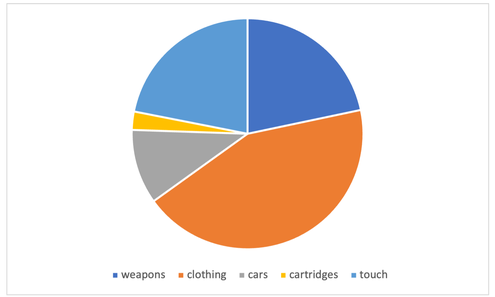
In the nearly 3 years since deploying PG DNA interpretation, the Greenville lab continued to measure the success rate for sample amplification and interpretation. Using PG for low-level and complex mixture interpretation resulted in changes to the quantitation threshold and probative result recovery rates. This talk will summarize the Greenville DNA lab's journey and discuss their success and future plans.

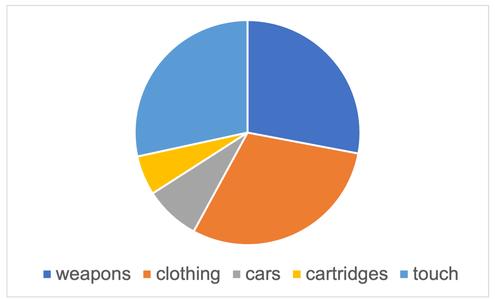
Materials and Methods

- More than 1300 samples were quantitated using Quantifiler Trio and amplified using the GlobalFiler™ kit.
- The initial quantitation threshold was 60 pg.
- Samples were separated on the Applied Biosystems 3500 Genetic Analyzer.
- Analysts used TrueAllele Casework VUIer™ version 3.3.7013.1 (04-Jan-2019) to infer genotypes and calculate match statistics.

Sample source

Five different sample types were examined.

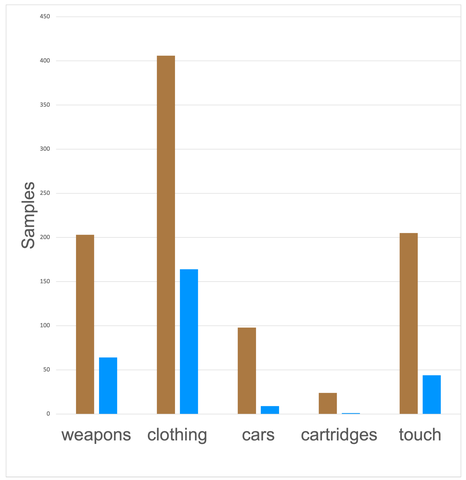




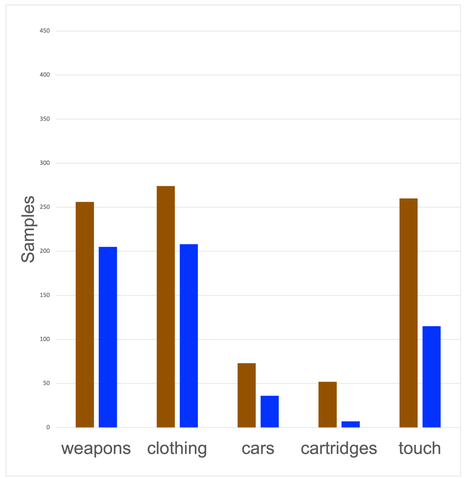
These pie charts show the sample source distribution BEFORE (top) and AFTER (bottom) using TrueAllele.

Results

Samples before and after using TrueAllele were tracked for producing interpretable results (i.e. producing informative genotypes).



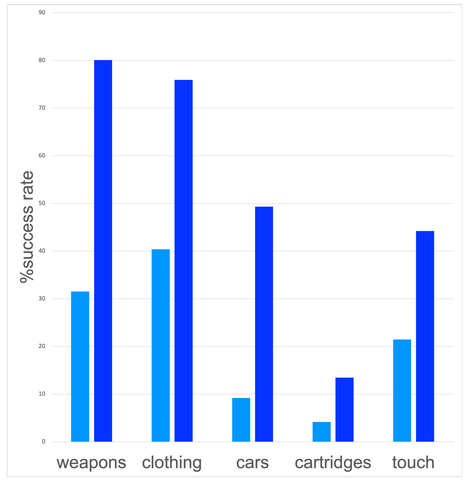
This graph shows the number of samples amplified (light brown) and those resulting in data (light blue) BEFORE to using TrueAllele.



This graph shows the number of samples amplified (dark brown) and those resulting in data (dark blue) AFTER to using TrueAllele.

Comparative Success Rates

TrueAllele use resulted in a marked improvement in samples which produced interpretable results. In particular, samples which are typically challenging to interpret, such as cars and cartridges, showed large percentage increases. Cars increased 437% and cartridges increased 223%.



This graph shows the success rate (number of samples resulting in an interpretable result) before (light blue) and after (dark blue) using TrueAllele.

CODIS Profile Statistics

Usage of TrueAllele also resulted in an increase in the production of CODIS profile from samples. A 25% increase in the number of CODIS profiles produced was observed.

	Cases	Profiles	Hits	Average CODIS profiles/case
Before	649	329	199	0.51
After	590	376	221	0.64
			% increase	**25.71**

This table CODIS profiles statistics before and after the implementation of TrueAllele.

Conclusions

Once TrueAllele was online, Greenville County was able to lower their quantitation threshold to 50 pg. Currently, 78.8% of touch/ownership samples collected in the lab moved forward to amplification (a 11.7% increase), and 79.6% of samples collected by officers moved forward to amplification (a 34.8% increase). Overall, lowering the amplification threshold resulted in 19.5% more samples being amped.

Percentage of amped samples that gave probative results increased by 71.8%.

Every touch/ownership category (except clothing) more than doubled recovery rate of probative results. The categories that showed the greatest increases were the ones that consistently have the lowest amount of DNA.

The average number of CODIS profiles per case increased more than 25%.

Most of the amped samples that still do not produce probative results are due to there being 5 or more contributors. Greenville County is currently validating 5-6 contributors with TrueAllele. Once completed they plan on expanding TrueAllele usage to include samples of 5-6 contributors.

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