Touch DNA: A National Survey of Submission Policies and Laboratory Procedures

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Introduction

In July of 2011, the Biology section of the Nebraska State Patrol Crime Laboratory (NSPCL) conducted a study to determine the success rates of obtaining DNA profiles on 500 casework samples containing 'touch' DNA. The study results are being utilized to educate law enforcement on the collection, submission, and success rates of this type of evidence. In addition, the NSPCL is using this information to formulate evidence submission policies and re-evaluate current laboratory standard operating procedures. As the initial development of these new policies and procedures began, the lack of knowledge about current laboratory practices regarding touch DNA in the United States became apparent.

Currently, only one publication from the Australia/New Zealand area exists regarding a survey on touch DNA analysis.[1] This study consists of topics ranging from collection, training, education, management, crime scene investigation, and fingerprint processing of touch DNA samples. While laboratory procedures were discussed, there is no information regarding current laboratory policies on the acceptance of cases containing touch DNA evidence.

A survey regarding existing touch DNA practices in the United States would provide insight into current trends of the acceptance and laboratory analysis of these types of samples. The survey results can also serve as a resource for other crime laboratories that are looking to formulate policies due to an increase in these types of requests.

Methods

A survey was developed and sent to city, county, regional, and state forensic laboratories in April-June of 2012. The survey contained "check box" or short answer type questions regarding submission and prioritization policies regarding fired casings and other touch DNA items, collection techniques, extraction and amplification technologies, required minimum quantitation values, and the utilization of low template techniques. Surveys were disseminated both electronically and in paper format.

Results

A total of 96 completed surveys were received. Responding laboratories were from all regions of the United States (Figure 1). Data was also compiled based on the type of laboratory (Figure 2). Three private laboratories responded to the survey. These three private laboratories were included in the laboratory methods questions (Questions 5-9), but not in the submission policy questions (Questions 1-4).

Question 1 – Does your laboratory perform DNA testing for 'Touch' DNA samples? (N=93)

The majority of the respondents performed touch DNA analysis, with 90 affirmative responses. The extent to which the laboratories performed this type of analysis is explored in the policy based questions. Three laboratories did not perform this type of analysis, with one laboratory stating that they recently ceased analysis. This laboratory filled out the survey using methods previously utilized and is included in the affirmative responses.

Question 2 – Does your laboratory have a policy regarding the submission of cartridges/fired casings? If yes, please describe/summarize your policy. (N=91)

Fifty-one laboratories responded that they have a policy regarding this type of evidence. Forty laboratories did not, although three laboratories stated that they have one in progress. Five of the negative responses indicated that they have no official policy but will only test fired casings for violent crimes, by special request, or in a homicide with no other evidence. One laboratory stated they process casings by swabbing them in groups of three or more and amplifying with the Minifiler© amplification kit from Applied Biosystems (AB).

Those participants that submitted the 51 affirmative responses were then asked to describe their policy. Table 1 summarizes the number of laboratories with specific types of policies. The policies were grouped into four main categories. The first category, which was the most prevalent, does not perform testing on casings and/or cartridges, although five of the 19 laboratories stated they would test shotgun shells. The second category will analyze casings/cartridges with different kinds of exceptions, such as homicide cases or if handled after firing. The third category will not test fired casings, but will test unfired cartridges (some by special request). The fourth category consists of four policies that did not fall into the other three groups. Three of these four policies take latent prints into account, depending on the caliber and number of casings. The last policy in the fourth category heavily discourages submission of casings/cartridges.

Question 3 – Are there certain kinds of cases/items that your laboratory does not examine that contain 'Touch' items (i.e. property crimes, felon in possession)? If yes, what types of cases/items? (N = 90)

Forty-nine laboratories stated they have policies regarding these types of cases. Forty-one replied they did not. Of these 41 laboratories, two currently have policies in progress, one for "one touch" items and the other for concealed weapons cases. One laboratory has no official policy, but requires reference and/or elimination samples upon submission for most cases. One survey provided no answer (having filled out the rest of the survey).

Due to the open-ended nature of the sub-question, responses were calculated by counting each time a type of policy was mentioned, instead of attempting to compile all the different combinations of policy types. For example, if a laboratory mentioned they do not accept property crimes and require a reference upon submission for felon in possession cases, each type of policy was counted once.

The responses regarding different types of submission policies gravitated toward listing out specific items or cases that would not be examined or requiring reference samples and/or elimination samples upon submission. The different types of policies are summarized in Tables 2-4.

Question 4 – If you have a large number of 'Touch' DNA samples in a case, how does your laboratory determine which items to test? (N = 91)

Responses to this survey question were calculated using the same method described in Question 3. Table 5 summarizes the different approaches utilized by laboratories for sample selection. The top three responses were probativeness, consultation with attorneys or law enforcement, and analyst/laboratory experience with success rates.

Question 5 – How does your laboratory collect 'Touch' DNA samples? (N= 94)

Question five was a "check box" question where respondents could select their preferred method of touch DNA sample collection. There was some confusion in the responses for this question, as some laboratories checked multiple boxes for different collection types, rather than the "Multiple Techniques" answer. Prior to data calculations, the responses were re-categorized. If only one collection type was selected, this was counted as their primary answer, if multiple check boxes were selected, it was changed to the "Multiple Techniques" category. Table

6 summarizes the various collection methods. There were several methods (tape lifting, item scraping, and placing the item directly in extraction buffer) that were not listed as any laboratory's primary collection technique. However, the techniques were mentioned as part of a laboratory's multiple techniques prior to re-categorization. These responses were counted (as in Question 3) and were selected four, 10, and 12 times each, respectively.

Question 6 – What extraction method does your laboratory use for 'Touch' DNA samples? (N = 94)

The most common extraction method was organic extraction, followed by the EZ1 DNA Investigator Kit© from Qiagen, and then a combination of the two. Figure 3 illustrates the compiled data for the different types of extraction methods (or combination of methods) utilized by laboratories for touch DNA samples. Extraction methods mentioned once were placed in the "Other" category and are listed in Table 7.

Question 7 – What PCR amplification kit does your laboratory use for amplification of 'Touch' DNA samples? (N = 94)

Figure 4 illustrates the compiled data for the different amplification kits (or combination of kits) utilized by laboratories for touch DNA samples. The top five responses used only one kit (Identifiler© (AB), Identifiler Plus© (AB), PowerPlex 16© (Promega Corporation), PowerPlex 16 HS© (Promega Corporation), and Profiler Plus/Cofiler© (AB)). The remaining responses were a combination of the above mentioned kits, or added in the Minifiler© (AB) or SGM© (AB) kit.

Question 8 – Does your laboratory amplify and perform capillary electrophoresis for every 'Touch' DNA sample, even if the total DNA quant results are below your target input DNA amount? If no, what is your minimum quantitation value required for amplification? (N = 94)

Fifty-five laboratories responded that they amplified and performed capillary electrophoresis for every sample, although three laboratories mentioned they were currently validating a quantitation cutoff value. One survey response indicated that they had a quantitation cutoff, but analysts could proceed with amplification and capillary electrophoresis at their discretion. Thirty-seven laboratories indicated they did not always proceed with amplification and capillary electrophoresis. Another participant stated they had a quantitation cutoff for property crimes only, but did not have one for violent crimes.

Each of the 38 negative responses was placed into a category based on the method the laboratory utilized to decide how to terminate analysis. Figure 5 illustrates the number of laboratories in each category. A quantitation cutoff with a minimum amount of total input DNA was by far the most utilized method. The final category of 'Other' includes unique approaches as described in Table 8. Figure 6 illustrates the number of laboratories with specific cutoff values in the minimum amount of input DNA category.

Question 9 – Does your laboratory employ low template DNA techniques or methods or have special interpretation guidelines for 'Touch' DNA samples? (N = 94)

Responses to this question varied as to what qualified as a 'low template' technique. To maintain continuity in answers, responses that indicated any sort of technique that went beyond the manufacturer's recommendations were considered 'low template.'

Seventy-eight laboratories indicated that they did not use low template DNA techniques. The 16 affirmative responses are summarized in Table 9.

Discussion

The NSPCL utilized the information garnered from this survey and the results of the laboratory's touch DNA study to develop new policies regarding touch DNA evidence. These new policies address fired casings and cartridges, felon in possession cases, samples from public use areas, and the need for elimination samples. A more detailed breakdown of the policies is outlined below.

Fired casings and cartridges are no longer accepted at the NSPCL for DNA analysis. Exceptions will be made for homicide cases by special request. The NSPCL touch study also indicated a lack of reference samples being submitted for felon in possession cases, even when interpretable results were obtained. A policy requiring a reference sample from the suspect in felon in possession cases was also implemented.

The new policy regarding touch DNA submissions also mentions the need for caution on the part of the submitting agency when requesting analysis on items from "public use areas." This policy allows latitude for analysts to consult with the submitting agency if items from public use areas are submitted to determine whether the item will be examined.

Lastly, the policy mentions the need for elimination samples if the owner of the item was not the suspect. These samples are not yet required prior to analysis, but this policy can be utilized as a "stepping stone" for a future policy revision. Policies regarding property crimes, "one touch" items, and requiring elimination samples may also be considered in the future.

The NSPCL is also relying heavily on education to disseminate information on the touch DNA study and the recently implemented "Tiered Approach" submission policy (September 2011). This "Tiered Approach" policy asks submitting agencies to submit a certain number of items based on case type in the first "tier" or layer. Currently, the NSPCL is the only crime lab serving over 320 agencies. These agencies are geographically located throughout the state and have varying degrees of evidence collection/submission experience. In order to better reach these agencies, the NSPCL recently embarked on a "Roadshow", which entailed traveling to six different locations throughout the state and educating agencies on the above mentioned topics. This training was free to attendees and will possibly become an annual event due to positive feedback. The NSPCL is presently starting to see the effects, if any, on evidence submission.

Evaluation of the NSPCL's current laboratory standard operating procedures (collection methods, extraction procedures, etc.) is ongoing, due to the recent implementation of a new DNA Technical Leader.

References:

1. J.J. Raymond, et al., *Trace DNA Analysis: Do you know what your neighbour is doing: A multi-jurisdictional survey*. Forensic Science International: Genetics 2 (1) (2008) 19-28.

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Figure 1. Geographical distribution of survey respondents.

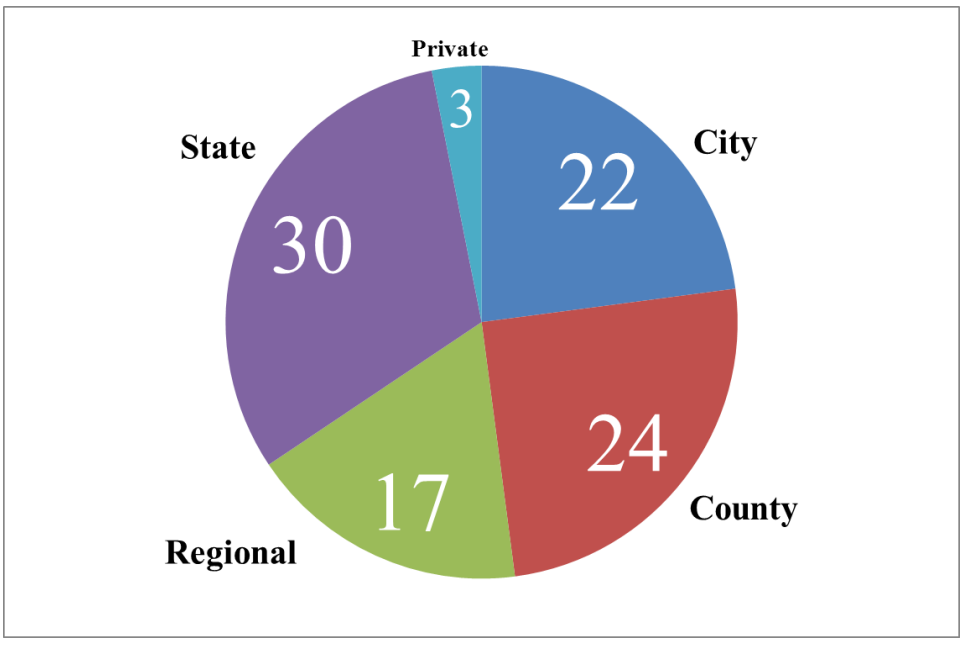

Figure 2. Crime laboratory type of survey respondents.

Table 1 - Summary of the different laboratory policies regarding fired casings/cartridges. *5 laboratories with this type of policy will do shotgun shells (Question 2) (LP = Latent prints).

Fired casings/cartridges policy	Number
NO, both fired/unfired	19*
NO, except…if all they have or by special request	7
NO, except…homicides with no other evidence	6
NO, except…if handled after firing	4
NO, except…violent crimes with no other evidence	2
Fired - no, unfired - yes/special request	9
Large caliber - do touch/LP; smaller - only DNA	1
<5 - LP does them; >5 all are swabbed together for DNA	1
Prioritized last; combine swabs; ask about LP	1
Heavily discourage submission	1

Table 2 - Summary of the different laboratory policies regarding certain types of cases/items containing touch DNA (Question 3) (FIP = Felon in Possession).

Policy	Number
No drug cases	11
No property crimes	10
No FIP	9
No public use areas	7
No misdemeanors	4
No "One Touch" items	4
Only do touch on violent crime with no other evidence	4
Must be from suspect/perpetrator	3
Car - do not accept doors/mirrors	2
Other	14

Table 3 - List of laboratory policies in "Other" category for Question 3 (PC = Property Crimes).

Other	Number
Car - only accept steering wheel/gear shifter	1
No gun possession crimes	1
No items previously handled (by other sections)	1
Analyst discretion	1
No tampering/harassment/shooting into dwelling/destruction of property cases	1
Must have consistent/intimate contact or visible smudge	1
No items removed from a person	1
Touch analysis is only done on murder weapons	1
Outsourcing most touch on PC	1
PC are prioritized after violent, so don't end up doing	1
PC - limit to tools/clothing from crime scene; point of entry swabs; steering wheels	1
PC - only do items that are foreign to the scene	1
Only do handled objects, wearer DNA, or steering wheel/shift for PC	1
Must have letter with permission for consumption	1

Table 4 - Summary of responses for laboratory policies regarding certain types of cases/items containing touch DNA where standards/elimination samples are required (FIP = Felon In Possession; PC = Property Crimes).

Must submit standard/elimination if…	Number
FIP	5
PC	4
No case distinction	2
Not CODIS eligible	1
Steering wheel/doorknobs	1

Table 5 - Summary of the different approaches to sample selection (Question 4).

Decision/Approach	Number
Probativeness	38
Consultation	26
Experience	23
Item Limitation Policy	13
Agency Chooses Top # (laboratory dependent)	8
Analyst Discretion	4
CODIS Eligibility	3
Test All	3
Number of Potential Contributors	2
Quantitation Data	2
Test all - but public lab charges fee /sample	1
Make slide of cellular material	1
Only get one sample (don't do often)	1
Prosecutability	1
Combine appropriate samples	1

Table 6 - Summary of touch DNA sample collection techniques (Question 5).

Collection Type	Number of labs
Cotton Swab	22
Double Swab (Wet/Dry)	9
Tape Lifts	0
Scraping Item	0
Placing Item in Extraction Buffer	0
Depends on Item	11
Multiple Techniques	52

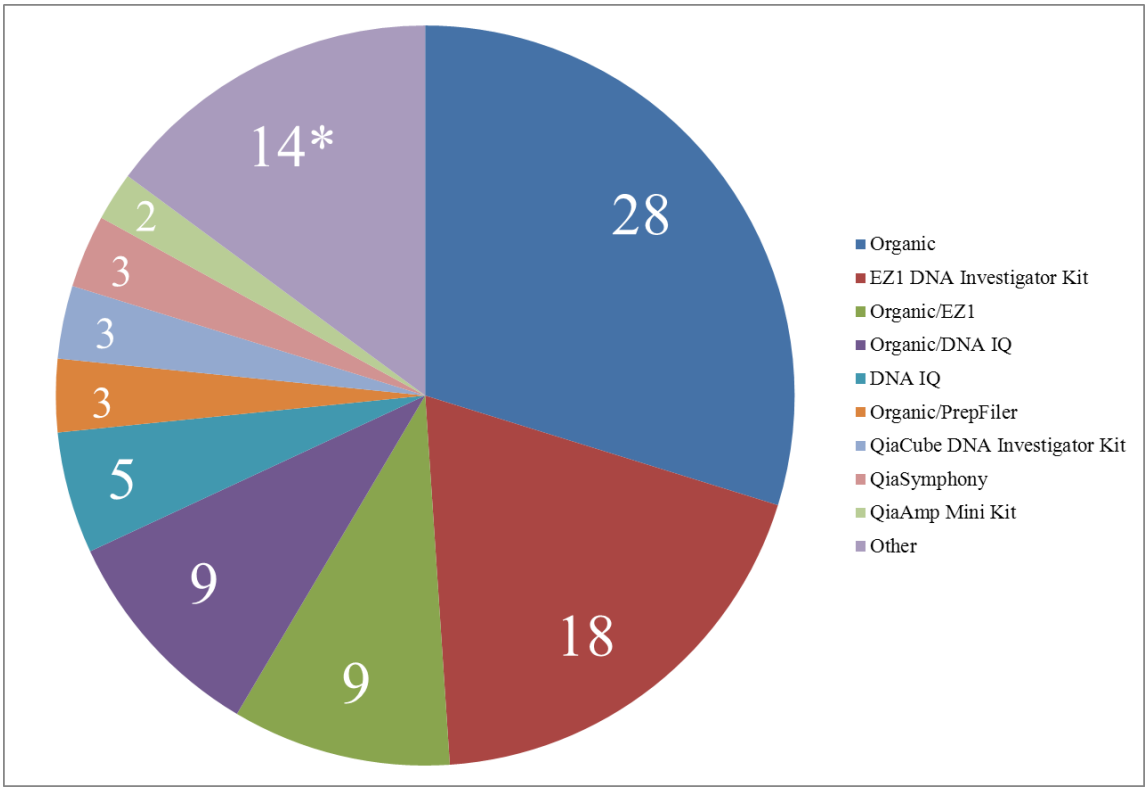

Figure 3. Extraction methods utilized for touch DNA samples (Question 6).

Table 7 - List of the different extraction methods in the "Other" category for Question 6.

Extraction Method
Chelex
Chelex/Microcon Cleanup
Chelex/Maxwell 16
EZ1/M48
EZ1/DNA IQ
EZ1/PrepFiler
M48/In-house (fish sperm)
Qiagen (manual)/Microcon
Organic/Chelex
Organic/EZ1/DNAIQ/Qiagen manual extraction
Organic/EZ1/Prepfiler
Organic/Maxwell 16
Organic/NaOH
PrepFiler

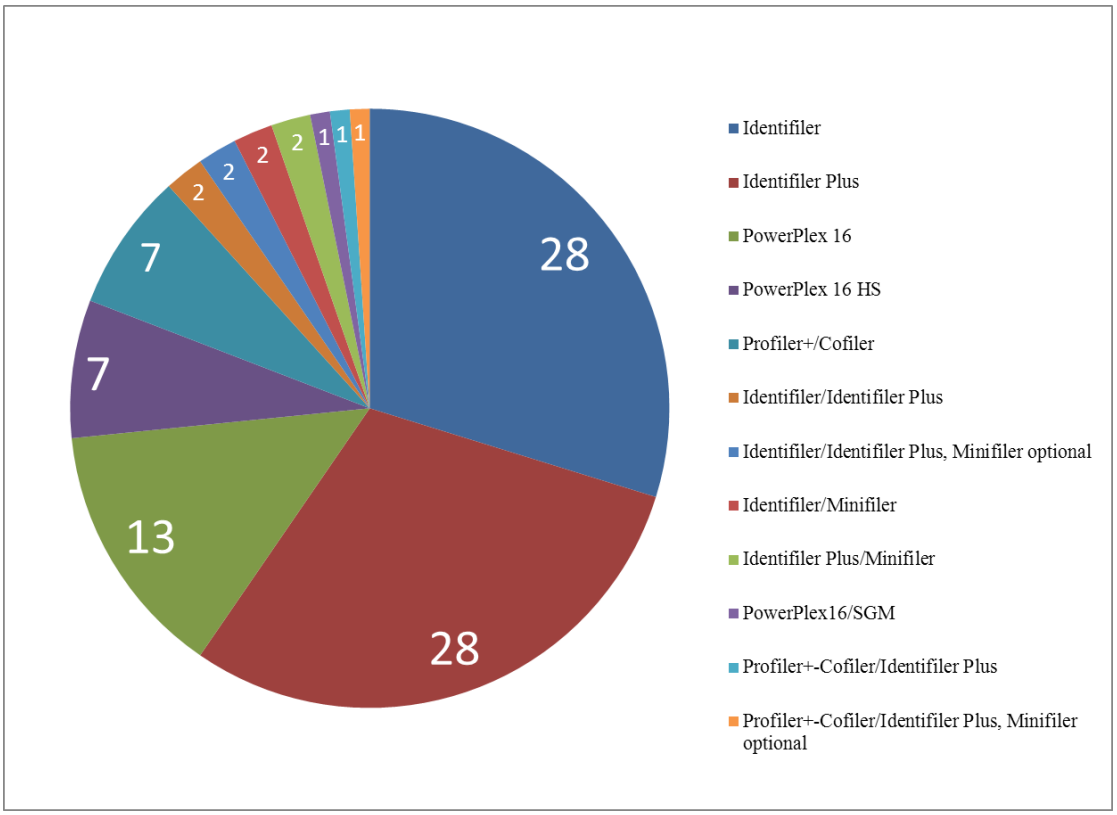

Figure 4. Different amplification kits utilized for touch DNA samples (Question 7).

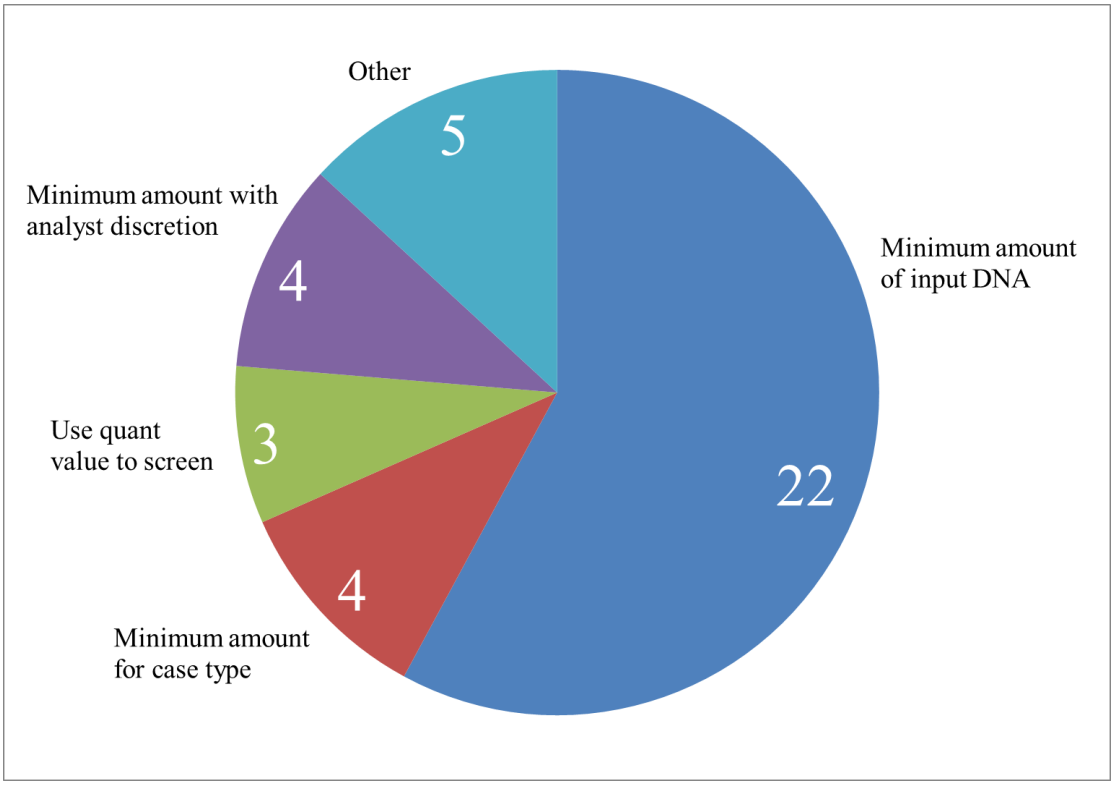

Figure 5. Different categories of quantitation cutoff decision types and the number of laboratories in each category (Question 8).

Table 8 - List of quantitation cutoff decision types in the "Other" category for Question 8.

Other
Non-Low Template samples - 0.200; Low Template samples - analyst discretion
Use Cycle # threshold
0.150 cutoff; if 0 requant after concentrating extract to 13 ul
0.080 cutoff; have option to perform double amp/add Taq
if 0 - consultation with DA

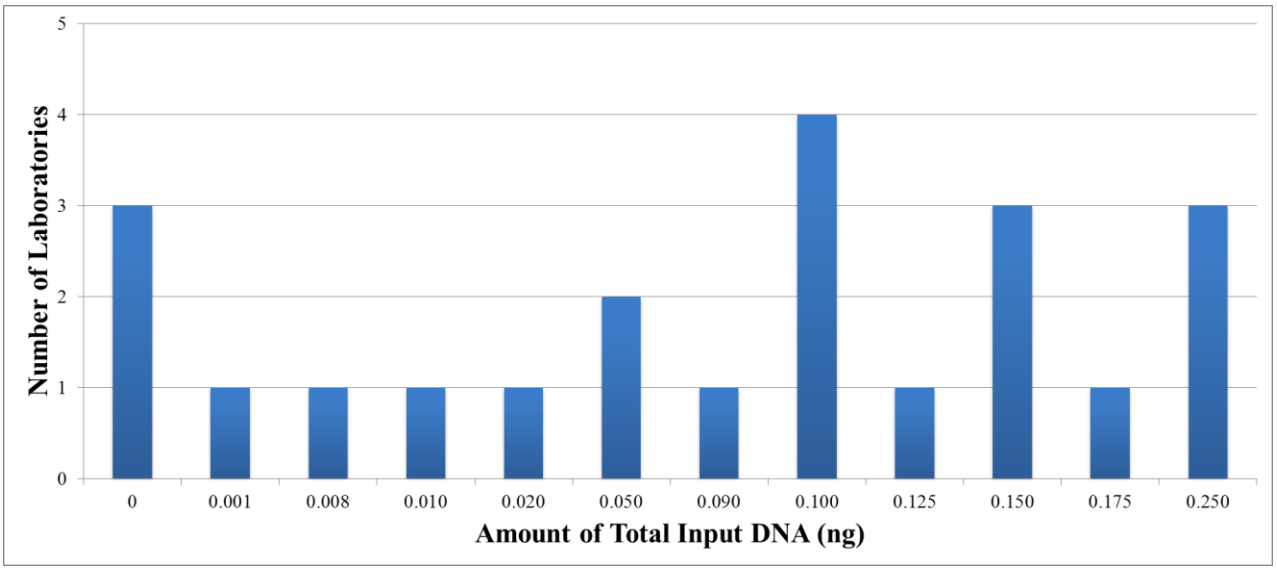

Figure 6. Number of laboratories with specific cutoff values in the minimum amount of input DNA category (Question 8).

Table 9 - Summary of techniques regarding the use of low template methods for touch DNA samples (Question 9).

Technique	Number
Increased Injection Time	4
Increased Amplification Cycles	3
Increased Injection Time & Increased Cycles	3
Special Interpretation Guidelines	2
Post-Amp Cleanup (MinElute)	2
Statistically Treated Differently	1
Special Interpretation Guidelines & Post Amp Cleanup (MinElute)	1