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Evidence-based policing research brief

EVIDENCE BASED POLICING CENTRE

Evaluating the ParaDNA® rapid DNA and body fluid identification instrument

Purpose

This brief provides information about ESR's assessment of the ParaDNA® field portable instrument. It summarises the evaluation of the instrument's suitability to help speed up analysis of samples and the potential to enable field testing.

Summary

The assessment looked at the ease of use of the instrument and sample-collector, the accuracy of the testing and the analysis software used for manual interpretation.

Results showed that there is unlikely to be any significant benefits from taking this instrument to a crime scene, and if one were taken to a crime scene additional resources and considerations would be required.

What is the ParaDNA® field instrument?

It is a portable machine that can be used in the laboratory or at a crime scene to identify:

- individuals, using a DNA intelligence kit that can detect five STRs (short tandem repeats) and a gender specific marker
- which, if any, of the following body fluids are present in a sample – saliva, blood, menstrual blood, vaginal fluid, seminal fluid and sperm cells.

Firstly, a sample-collector device is used to collect the evidence. This device has four nibs that collect samples in a similar way to swabbing and can be used directly on evidence or indirectly, such as using a swab taken at a scene.

Once the sample has been collected, the nibs are released into a special kit and placed into pre-loaded amplification plates that are then placed into the ParaDNA® instrument.

Each instrument can run four separate samples at a time, with any combination of DNA intelligence or body fluid identification, and are independent of each other, so can start at any time.

Once a run is complete, the results are shown on the screen of the ParaDNA® instrument. If further analysis of the results is required, this can be undertaken manually using specific ParaDNA® analysis software.

What was the approach?

The project looked at:

- the sensitivity, specificity and consistency of these tests compared to current analysis methods
- the instrument's performance when faced with forensic casework-type samples, which are often of low quantity and/or quality
- the ease of use, efficiency and robustness of the sample-collector, and best method of sample collection using the device
- the usability of the associated analysis software
- how portable and functional the instrument would be at a crime scene.

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What were the findings?

The instrument and sample-collector device

While the instrument was lightweight, portable and very easy to use, the sample-collector device was difficult to use and required a lot of experience to ensure consistent results.

Optimal sampling time varied depending on what was being sampled and all four nibs needed to collect a similar amount of sample.

Although both direct and indirect sampling is possible, the manufacture recommends that only direct sampling be used. Testing confirmed that direct sampling produced the best results; however, the physical pressure required to get samples can damage delicate items and spread materials, such as blood or fibres, leading to potential contamination.

DNA intelligence testing

The sensitivity, specificity and consistency results from the DNA intelligence test were reasonable, but not in all aspects.

The testing could not distinguish alleles (different versions of the same gene) that were one base pair apart, and only specific alleles were able to be identified at each location along the DNA, with micro-variants and alleles outside the programmed range reported to the closet match. This meant that results from different sources could not always be distinguished.

In addition, testing of samples with DNA from more than one person raised concerns about the instruments ability to detect and report mixtures.

Finally, as only five loci are included in the kit, even when the full DNA profile obtained contained results at all five sites, there is insufficient information for it to be entered the Crime sample Databank.

Body fluid identification testing

The sensitivity, specificity and consistency results from the body fluid identification testing were only adequate for some body fluids. This inability to consistently detect some or all fluids impacts usability of the kit on unknown samples.

ParaDNA® software

The ParaDNA® analysis software for manual interpretation of the data is fairly easy to use; however, it is difficult to manually interpret results other than those the software reports.

Throughout the assessment, there were instances of true-positive and true-negative results being indistinguishable – although highly experience people may be able to interpret the results.

The ParaDNA® instrument only reports confident calls; if a potential mixture is detected, the instrument won't report any results.

Further considerations

Lab-based results from this assessment showed that there are unlikely to be significant benefits from taking this instrument to a crime scene.

In addition, if the instrument was taken to a crime scene:

- field vehicles would need to be fitted with a freezer to store kits until use
- a laptop would be needed to run the analysis software
- the sampling location and risk of contamination, in the location or field vehicle, would need to assessed.

Where to from here?

The ParaDNA® instrument and sample-collection device were not easy to use and require a lot of experience to ensure consistent results.

Rapid DNA and body fluid identification devices are continually being upgraded and ESR will continue to test new kits and improvements.

Further information

Email dion.sheppard@esr.cri.nz

ESR Science for Communities