

Executive Summary of Final Report

“Benchmarking Project of European Forensic Laboratories for strategic planning purposes”.

Benchmarking Project, Work Package 1.

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1 Executive summary

1.1 Project objective

The general objective of this project was to provide recommendations to make it possible to benchmark forensic laboratories in a comparable way:

- Objective 1. Develop and define indicators and the corresponding methodology to evaluate the efficiency of a forensic laboratory (e.g. direct costs, number of cases, and times of delivery of cases).
- Objective 2. Generating benchmarking data to allow comparison of efficiency between the participating laboratories through various indicators determined by objective one. The data must be harmonised so that comparisons can be performed.
- Objective 3. Identifying factors which impede or improve efficiency by a proper understanding of the origin of differences and similarities between laboratories.
- Objective 4. Propose strategies to improve efficiency of forensic laboratory casework in general, based on the determined indicators.

1.2 Genesis of the Project

A Group of Nine European Forensic Laboratories: Belgium [INCC-Brussels], Estonia [EFSI-Tallinn], Finland [NFIBL-Vantaa], France [INPS-Ecully], Ireland [FSI-Dublin], Latvia [SFSB-Riga], Portugal [LPC-Lisbon], Slovakia [IFS-Bratislava] and Sweden [NFC-Linköping]; came together to benchmark each other, with a view of finding common measures that allowed for the successful analysis of forensic casework processes to be compared across the European counterpart laboratories. A series of Group meetings was held over the length of the project of two years, hosted in each of the participating countries.

A first-stage data collection exercise took place as a starting mechanism within a two-month timeframe from the start of the Group project; expanding from data collected for the first quarter 2017; to include the whole of 2017. Considerable discussions took place over the definitions of key terminology so as to have clearly defined and understood data points that had the same meaning for each of the participant laboratories. An Initial Data Set was generated by each forensic laboratory: (1) Number of crimes, (2) Number of institute cases, (3) Number of items, (4) Turnaround time, (5) Casework time allocation; (6) Payroll cost casework. From this key ratios were calculated: Case time/institute case; Payroll cost /institute case; Items/ institute case; Institute case/Full Time Equivalent; and Payroll cost/FTE.

A second-stage data collection exercise took place: a re-iterative exercise on fine-tuning the data collection of 2017, where each laboratory captured the data in exactly the same way; and additionally, collecting a deeper sub-layer – the number of samples analysed from each of the items.

After a full understanding by all the participants, data for the year 2018 was collected using the agreed steps as formed in the collection exercise of 2017.

2 PROJECT ELEMENTS

The various elements of the project are summarised as follows:

- a. To describe the background of the project
- b. To show Measures decided and their Definitions
- c. To describe the consensus building process for the final results of the project
- d. To outline problems and perspectives for the implementation of the project
- e. A summary of project results

2.1 **Background**

The European Commission (EC) recognizes the European Network of Forensic Science Institutes (ENFSI) as the monopoly position concerning forensics in Europe. The EC provided a Direct Grant to ENFSI (2016) for a two year programme: “Steps towards a European Forensic Science Area (STEFA)” - ISF Police-2016-AG-IBA-ENFSI-Project No 779485.

This programme is viewed as an important stepping stone in the realization of the 2020 European Forensic Science Area. There are ten specific activities within the project: G1 project- *Benchmarking forensic laboratories for strategic planning purposes*, being one of the ten.

In developing and defining indicators and the corresponding methodology to evaluate the efficiency of a forensic laboratory; the Group agreed to learn from previous Benchmarking exercises, so as to create an actioned project plan in deciding important issues, using nomenclature that had been painstakingly agreed in prior international benchmarking exercises – Project Quadrupol, Europe, and Project Foresight, USA.

2.2 **Measures decided and their Definitions**

The CASE and the component parts:

It was very apparent from the previous published benchmarking studies, that the key data for this Group to be able to make laboratory comparisons, was all around the CASE, and subsequently how a Case is made up - by the amount of ITEMS in a Case. However, the number of Items in a case may not be a truly necessarily accurate measure, as one is dependent on the crime scene investigator or the managing member of the police deciding on how many items were to be submitted within each case. Hence, to be able to reasonably accurately measure the work of a laboratory, the Group decided to measure the number of SAMPLES generated from within the case, those Samples being generated singly or in multiples from the various Items present in the submitted Case. It was decided by the Group not to dig any deeper into a case which would be by measuring the number of TESTs that each laboratory carried out on each of the Samples tested. Not all of the laboratories had the necessary Information Technology [IT] available to make such measures, and it reflected how the individual laboratories had or had not specialized Laboratory Information Management Systems [LIMS].

The Group found that even with these relatively simple data measure points - Case, Item and Sample, that there were problems for each of the participating laboratories in their actual strict definitions. The group came to an agreement on their understanding of the definitions for Items and Samples, to be able to exactly compare each of the laboratories. Explicit tables in Excel format were designed per case type on how to count items and samples [see appendices]. Key case types were chosen by the Group to be able to make laboratory to laboratory comparisons, in the areas of: DNA, Drugs, Fingerprints, and Handwriting.

The TURNAROUND TIME of a Case:

In being able to make some comparisons on the level of service to the customer, the Group decided that a key measure was the TURNAROUND TIME [TaT] - the period of time from the first date of entry of a case into a laboratory, and its subsequent date of when a Case was first reported. In order to capture a comparative figure, the Group decided that the MEDIAN [m] TaT was more reflective of the laboratory work as there are times when urgent cases or larger than average cases caused a temporary time resource problem for the individual laboratory. There was much debate by the Group as to how to directly measure the actual mTaT, as it was found there were variances as to when a Case actually originates - at the time of when the police make the Case, or as to when the Case actually enters the laboratory; and at what moment does the Case become a case - at the time when the first item enters the laboratory, or when the majority of the case has been submitted to the laboratory. The Group had to make a decision as to when the date/time stamp began and when. It was decided that the date of a Case began on the first date of entry into the laboratory of the very first item, and not dependent on the other variances of a Case

The COST of a Case:

The overall COST of a Case was deemed to be an important factor for the Group to be able to make comparisons. But the whole domain of Costs was problematic for the Group as many financial activities can make up the Cost of a Case, and at what level are the Costs to be calculated - at a whole systems level, or at the actual cost of the individual Case. Since staff costs are a major part of the total cost (circa 70%), the Group decided to measure the actual time spent in CASEWORK by the members of laboratory staff; as an important parameter to report, known as the FULL TIME EQUIVALENT [FTE]. The Group decided that each laboratory needed to know or estimate how much of their time each person/staff member, spent on actual case workings. It was quickly identified, that a member of staff can have many other duties to perform outside of the actual casework spectrum. Such as: training, R&D, responsibility for the Quality Management System [QMS], Court preparation/ attendances, participating in ENFSI and international activities, and general administration and support services. Note: that these other areas outside of actual casework, was loosely categorised as ADMINISTRATION Costs. Debate by the Group was much deliberated on this whole area of costs. The Group felt strongly that the time spent on QMS could be included in the case sector, but that this should be examined in any future benchmarking, and for the moment anything to do with quality and the QMS was to be captured outside of the time resources required/spent in casework. Hence the Group's understanding of FTE included an ESTIMATION element of time spent in actual Casework by the member of staff. This proved a very difficult task for most of the participating laboratories, as they did not

have explicit calculations to be able to separate casework from non-casework/administration tasks. However, the participating Scandinavian participants - Sweden and Finland - did have such an explicit time recording tool, and hence were able to record accurately such splits of time resources in casework versus administration time resource costs.

The **WHOLE COSTS** of a case was very well debated amongst members of the Group, and it was strongly felt by those protecting the purposeful ethos of benchmarking that **ALL COSTS** should be included, in order for a proper and insightful benchmarking practice to take place. Hence, the following Costs were accepted as being needed to be elucidated; and was collectively given the moniker of **TOTAL COSTS**: the cost includes allocation for Capital, Salaries, Consumables, Travel, QMS, Servicing instruments, Utility costs, Subcontracting costs, etc.

Hence, from the point of view of Casework, the **COST METRICS** of Casework was a metric very much adopted by the Group. And the Cost Metrics were published in the format of: Total Cost per Case, and Total Cost per Item.

The Group very quickly realized that there were large variances in Costs respective to each of the participating laboratories, and it was established that it was a direct result of the substantive differences in the economic Cost of Living for each of the European countries participating. Hence the Group decided that a section of the Country COSTs - the **PERSONNEL EXPENDITURES COSTS** were to be normalized to each other, by incorporating the **COST OF LIVING INDEX** (excluding Rent) for each country. Hence the following Personnel Costs were recorded as being required by the Group for Benchmarking purposes: **PERSONNEL COST per CASE**, **per ITEM**, and **per TESTED SAMPLE**.

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The use of METRICS as a contribution to the analysis of Data:

The Group proposed the **DISTRIBUTION OF COSTS METRIC** for each of the laboratories; calculated by combining the personnel expenditures, investment costs, and running costs, divided by total expenditures.

The Group in trying to assess the forensic performance of a laboratory, decided to capture how the analytical work is done, in the context of Risk Analysis. Hence, the Group devised a collection of **RISK MANAGEMENT METRICS**: **Items per Case**, **Samples per Case**, and **Samples per Item**.

In trying to capture some form of how the actual staff member works, the Group established a collection of **PRODUCTIVITY MEASURES**. Giving rise to the following: **Cases per FTE**, **Items per FTE**, and **Samples per FTE**.

2.3 *The consensus building process*

In generating benchmarking data to allow comparison of efficiency between the participating laboratories; the project Group participants agreed not to collect too much irrelevant data:

On a trial and error pilot basis, data collection began within a defined timeline window, using the first quarter of the calendar year 2017 in forensic specialties common to the majority of participants within the project Group: DNA cases/casework; all Drugs cases; Fingerprints; Handwriting; and Gunshot Residues.

The Group learned of much needed refinement in their Data Collection exercises during two periods of reiteration around laboratory data collected for Q1 2017. Most of the laboratories had to estimate the time spent on actual casework, and it was found that this was rather subjective, and really for such a robust result to be expected from these casework estimates there should be extensive use of time-based calculation software that both Sweden and Finland reliably use. Members of the Group were reminded that the time attributed to non-casework was labelled as Administration.

The Q1 2017 pilot was quickly spread to the whole year 2017, on foot of a clearer understanding of how to collect the proper data points. Each member of the Group learned from each other, in order to get the most objective data set for the year 2017.

On the project Group having worked together for the year since the start of the project in January 2017, it was agreed the same data collection exercise should occur for the calendar year 2018 [in addition to 2017]. It was agreed that direct comparisons could be made year on year across five disciplines mentioned above.

The Group realised that the whole area of DNA was vast, and it was better to actually split this discipline into DNA Casework and DNA Database.

2.4 *Problems and perspectives for the implementation of the project*

It was agreed by the Group that ALL DATA Collection was to be carried out over two calendar years 2017 and 2018.

The measures mentioned above were utilized by the Group, and the data gathered was interpreted within laboratory disciplines common to the majority; in the areas of: DNA CASEWORK, DNA DATABASE, DRUGS, FINGERPRINTS, and HANDWRITING.

Even the generation of details to each case was found to be based upon estimations for many of the participating laboratories. Because of the patchy use of various LIMS systems, members of the Group found that the expected simple exercise of calculating number of samples proved difficult for some. The robustness on the calculations of number of samples was only as good as a well-designed LIMS system, and the understanding that all eventualities were accurately recorded.

2.5 *A summary of project results*

The following Results are from the Group, having generated benchmarking data to allow comparison of efficiency between the participating laboratories, through the various indicators decided previously.

Cogent data sets encompassing years 2017 and 2018 were produced by the Group with contributions from all of the nine laboratory participants. The data was tested robustly by reiterative group meetings, and the datasets were made final, so that graphical interpretation in the form of results could be then carried out by the Group participants.

A series of graphs have been extrapolated from the 2017 and 2018 data sets [*see appendix*]; covering all of the metrics: Cost metrics, Market metrics, Risk Management metrics, Productivity metrics, and Time allocations to Casework and subsequent balance in Administration and Support. A summary global graphical overview was produced in order for the Group to be able to interpret the data sets.

2.5.1 The Case of Casework - Differences in Time Allocation

It was quite clear and significantly showed when plotted, that each laboratory could only attribute casework time as a relatively small percentage of total available time to the members of staff across the laboratories [Table 2 and Chart 1 see appendix]. Broadly, the range of casework time in each of the laboratories was between 40% and 60%, where the average hovered around the 50% mark. This does show that a modern forensic science laboratory does require significant administrative support including the areas of Quality Management, R&D, and training, etc.

The Group declared that a very important part of the work of a forensic laboratory is the Quality Management, and some participant laboratories had much difficulty in seeing the Quality area being categorized into the non-casework area. In some of the laboratories which are smaller, specialists are tied up in ENFSI Working Group exercises and not necessarily research related, where a small number of those staff are resource stretched and are pulled away from casework.

A common complaint from scientist Head of groups or Team Leaders that the percentage of time given to non-casework is high as there are many extra activities required to carry out around a laboratory - training of new personnel, validation / servicing of instruments, and quality management paperwork.

Training of forensic scientists is mostly totally in-house; taking up much casework resources.

2.5.2 The Differing Costs of Casework

In looking at the distribution of personnel costs for both scientific and administrative staff together, it is quite clear that different parts of the European Union have differing macro cost basis [Chart 4]. However, there are added complexities to these costs, when the make-up of the various staff members within each laboratory are analysed - with respect to average age profile of staff, their level of educational qualifications, and average total time served [Table Staff stats].

Additionally, there are other reasons as to why there are variances in personnel costs between countries, when drilling down into the cost of doing the forensic analyses; represented by the graphical interpretations of Personnel Cost per Tested Sample [Chart6] and the Personnel Cost per Item [Chart 7]. Levels of automation within the laboratories can account for the differences in tested sample costs.

2.5.3 Fundamental Case Origin - Differences amongst Laboratories

As the Group is beginning to identify factors which contribute to laboratory efficiencies, it was established that cases in some of the laboratories start off in regional crime scene units, and enter the laboratory as pre-samples.

2.5.4 Laboratory Samples per Case / Submission Policies

A personnel cost per item are quite different from laboratory to laboratory [Chart 7]; and is based on the actual item submission policy of each police force in conjunction with laboratory policies. There are differences in submission policies between laboratories, e.g. some laboratories limit the number of submitted items per case but other laboratories don't limit this number. Laboratories with a larger balance of volume DNA cases when compared to the bigger more complex cases; gives a skewed result in the area of risk management, quenching the average number of samples processed in a case.

2.5.5 Automation within Laboratories

The automation policies and the submissions policies of the various laboratories can skew the Productivity metrics; where the Cases per FTE [Chart 13] and the Samples per FTE [Chart 15] show very big differences.

2.5.6 Educational Levels of Staff

In the casework DNA discipline there is a notable range of educational levels between each of the laboratories. The group has discussed the implications of hiring too highly qualified individuals to the fit of the majority of forensic science work.

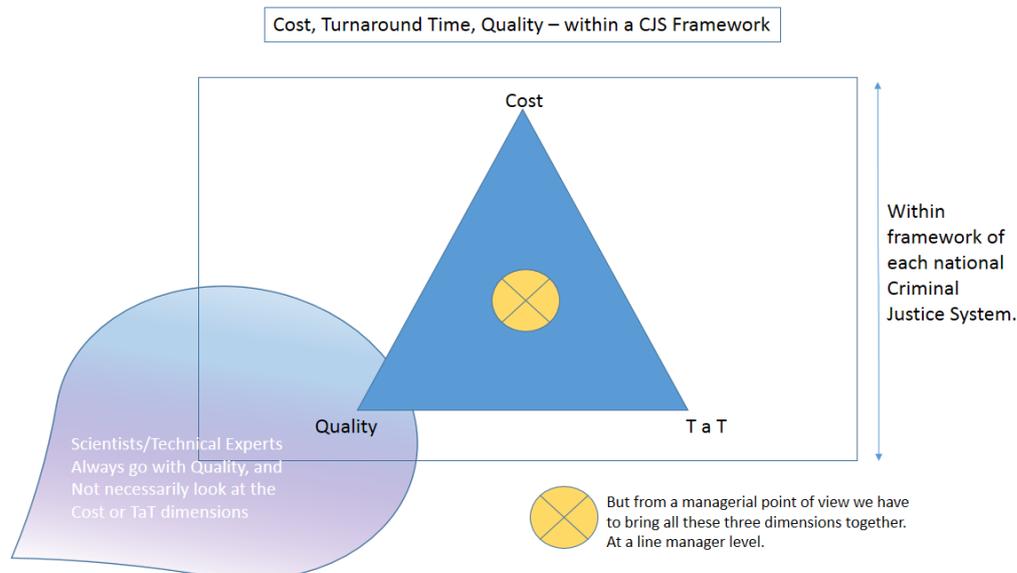
Other areas discussed were Process and Lab design – fit for purpose, LIMS information technology systems, and staffing duties such as court testimony.

3 Next Steps

The managerial mind-set of the organisation(s) is the central theme that needs to be considered if Benchmarking is to be taken seriously by the European Forensic Institutions. When examining the workings of forensic science in Europe, immediately the ENFSI Board and the Working Groups comes to mind. But the Benchmarking Group has discussed the direction of the collective ENSFI thinking, and have come to the opinion that forensic developments come predominantly within a technical solution backdrop – the collection of working groups within ENFSI are robust technical expert groups focused only within their specialisms. There is a notable absence from any sort of organisational managerial perspective. Even at ENFSI Secretariat Board level there is an absence of corporate operational level discussions. In itself, the whole genesis of this Benchmarking project was as a result of this notable gap, bringing the management of these forensic institutes to a strategic level of discussion.

Therefore, with such an absence of strategic management at a cross-organisational level, the Benchmarking Group recommends, that there should at least be a steering group comprising members with a management perspective from each of the European Forensic Institutes, to interact with the ENFSI Secretariat Board. The current Benchmarking Project could be used as a starting basis for such management developments.

Even at a local institute/laboratory level there is evidence of a disconnect / gap of the management of the whole of the institute versus the direction of the technical groups within the organisation. This is an observation made by the Benchmarking Group, who recommend to discuss and address the understanding of this gap with the forensic community, which would help minimise the effect of this gap.



Ideally this report should be a stepping stone into progressing a Working Group modelled on the existing scientific working groups within ENFSI. Members of this Group feel there is a strong need for a Best Practice Guide in the Management of laboratories.

Directorial input from one of the labs proposes to introduce “fostering of good forensic management practice” as one of the new strategic development directions of ENFSI and benchmarking as the best tool for it.

There is a willingness to undertake a continuation of the data collection after the termination of this project. They state that there is a need to generate a European (ENFSI) Benchmarking Model. And have suggested using the ENFSI Working Groups who should use some of the Benchmarking metrics in their own standing committees.

However, for benchmarking to happen smoothly, there needs to be a way to extract the data from the different LIMS systems. Most of the participating laboratories had to do much manual work to get the correct data.

A standardized model of data collection is required. It has to be done for several years as it automatically improves the quality, when one can compare with several years back in time. There has to be someone that is responsible for doing this work.

4 Appendix

4.1 *List of participants*

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4.2 Charts and tables

Table 2. Differences in time allocation.

	2017		2018	
	Casework	Non casework	Casework	Non casework
Lab 1	57 %	43 %	59 %	41 %
Lab 2	61 %	39 %	60 %	40 %
Lab 3	44 %	56 %	42 %	58 %
Lab 4	38 %	62 %	39 %	61 %
Lab 5	64 %	36 %	44 %	56 %
Lab 6	56 %	44 %	57 %	43 %
Lab 7	61 %	39 %	59 %	41 %
Lab 8	47 %	53 %	55 %	45 %
Lab 9	52 %	48 %	50 %	50 %

Chart 1. Distribution of time allocation, casework per country.

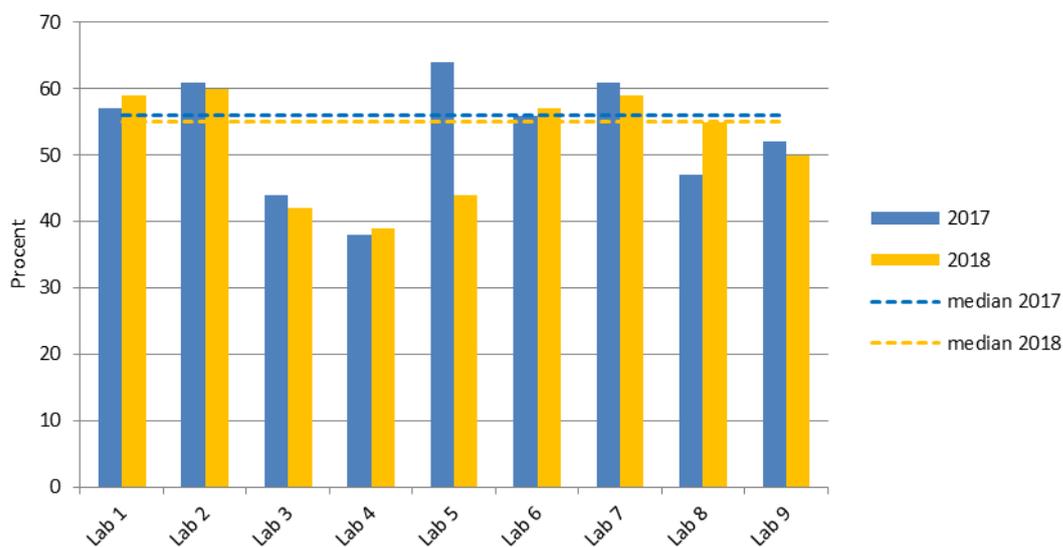


Chart 4. Salary per year (EUR), total for all areas and administration.

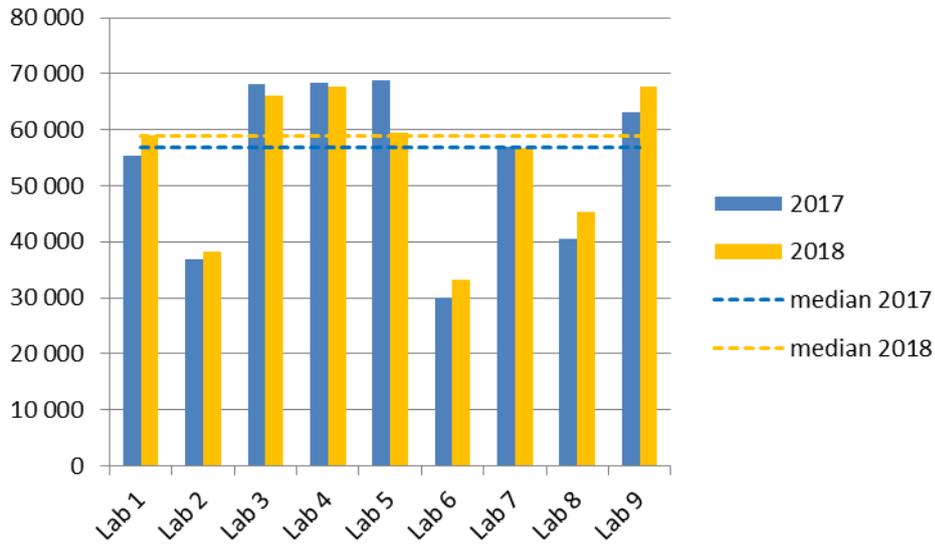


Chart 7. Personnel cost (EUR) per item.

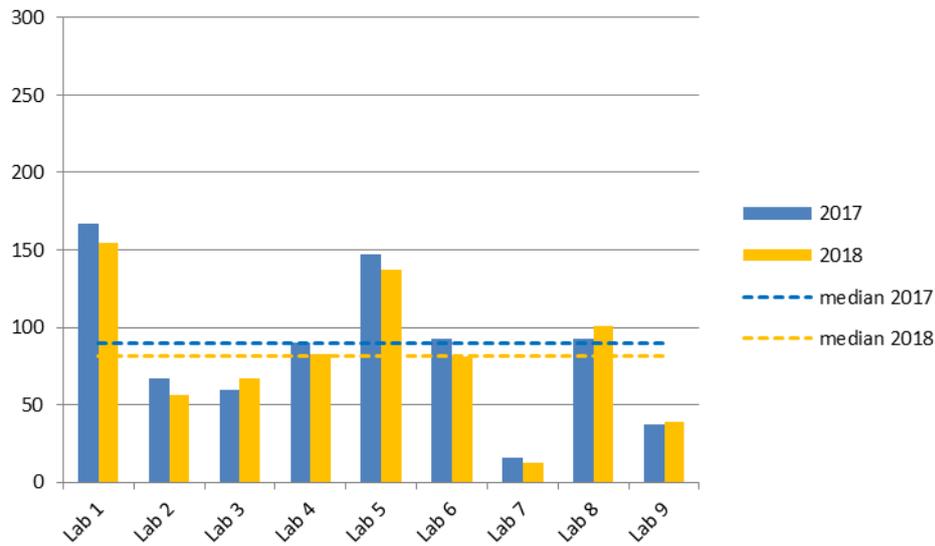


Chart 13. Cases per FTE.

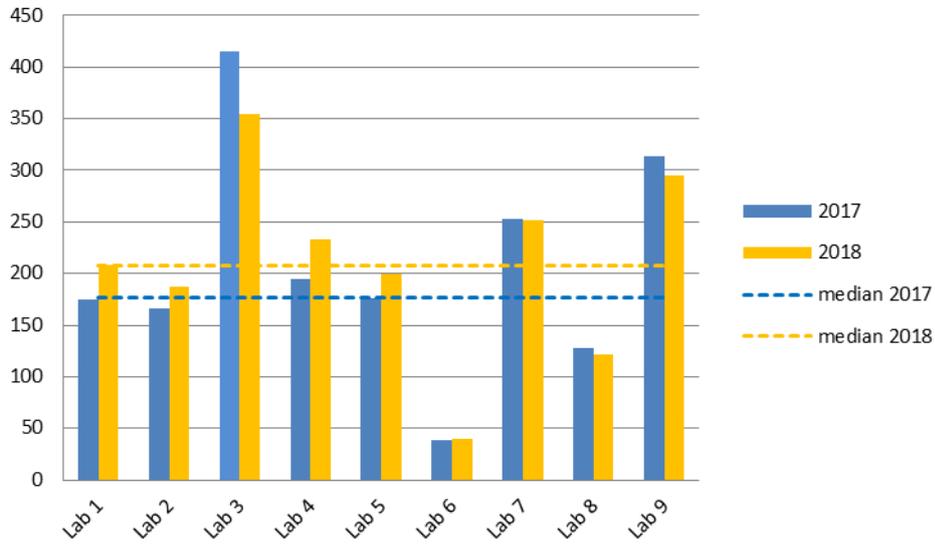


Chart 15. Samples per FTE.

