Setting standards in analytical science

Educational aspects of Proficiency Testing

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Introduction

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- PT as a learning exercise
- Who learns from PT?
- How do they learn?
- What do they learn?
- Does it work?

PT as a learning exercise

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- IUPAC Harmonized Protocol:

"...the first consideration of proficiency testing is to provide a basis for self-help for each participant"

Who learns from PT?

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- Laboratories and their staff
  - Feedback on performance
  - Identification of local quality problems
  - Corrective actions....
- Accreditation bodies
  - May inspect an individual laboratory's PT records
- Scheme providers and sponsors*
  - Overviews of performance
  - Identification of general issues affecting many labs

**For example, regulators or laboratory clients*

How do they learn? - Laboratories

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- Is a bad PT score a teaching aid?
  - or simply a bad score?
- Objective feedback assists improvement
  - PT scores tell labs how they are performing
  - Monitoring and investigating performance lead to improvement
- Directed advice and information lead to faster improvement
  - User meetings
  - Communication with the ‘intelligent’ PT provider
  - Access to follow-up research

How do they learn? – Providers and sponsors

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- Review of scores
  - Trends with time
  - Anomalous distribution or dispersion
  - Differences between different methods
  - Differences between groups of participants
- Collection of measurement system information
  - Methods
  - Reference standards and reagent sets used
  - Equipment details...
- Communication with participants
  - User meetings etc.

What do they learn?

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From the results:

- How good performance is on real test items

From follow-up investigation:

- What went wrong
- What may have caused it
- What makes it better

From further rounds:

- Whether performance improves

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How good is performance?

Some examples

Example: Lead in foods (c. 1980)

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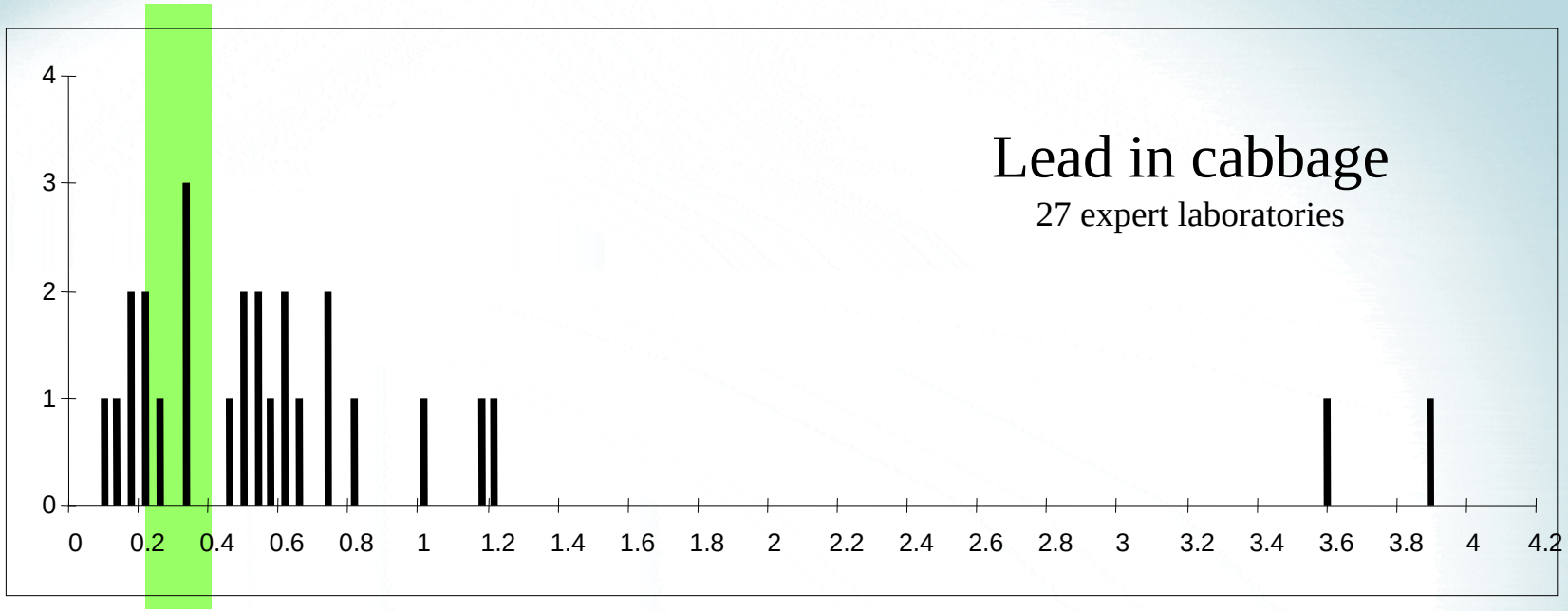

- Mean results from 27 expert laboratories
- Acceptable range 0.23 - 0.41 $mg.kg^{-1}$
- 4 laboratories within acceptable range

Example 2: 2002 GMO PT data

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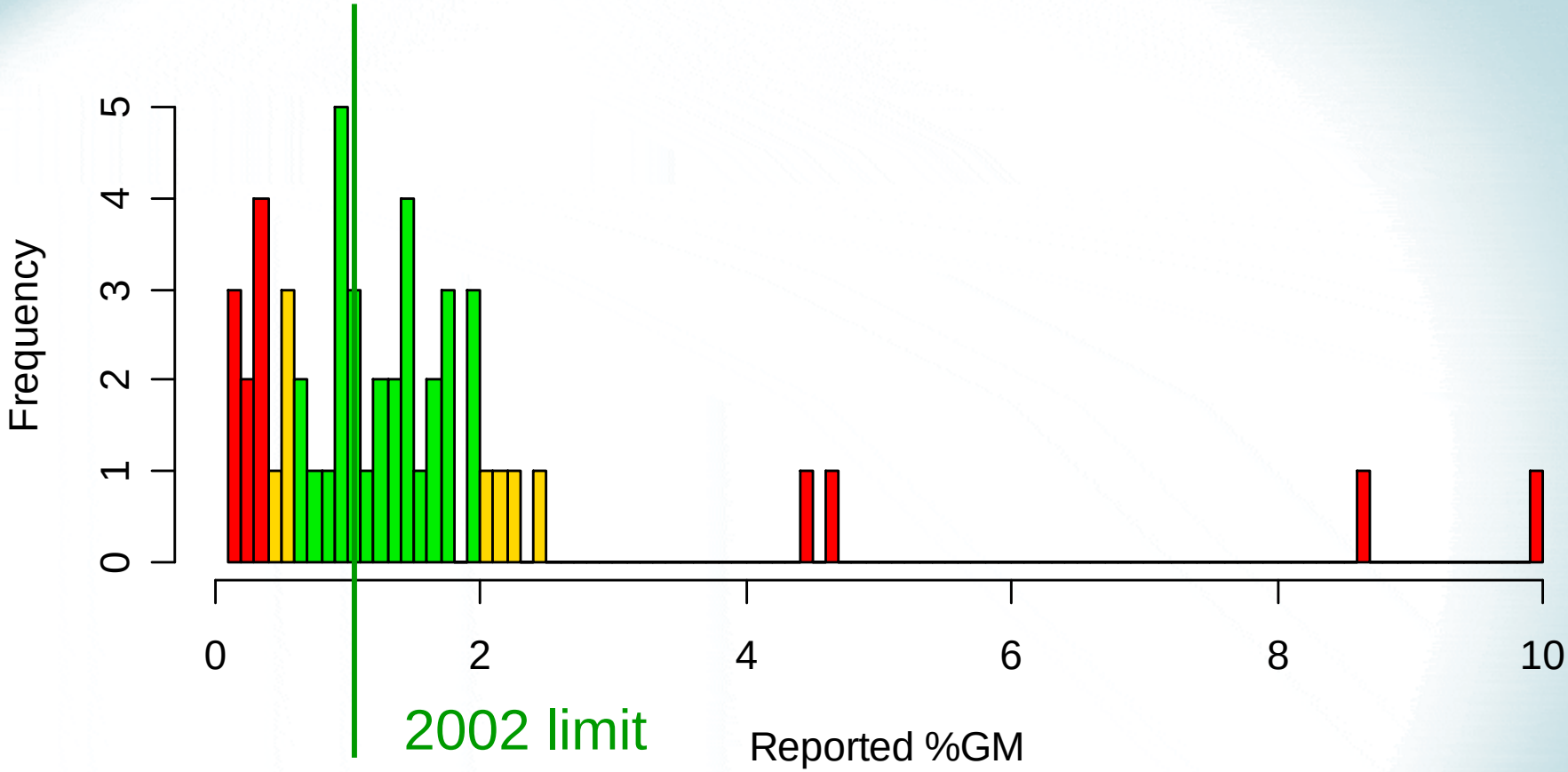
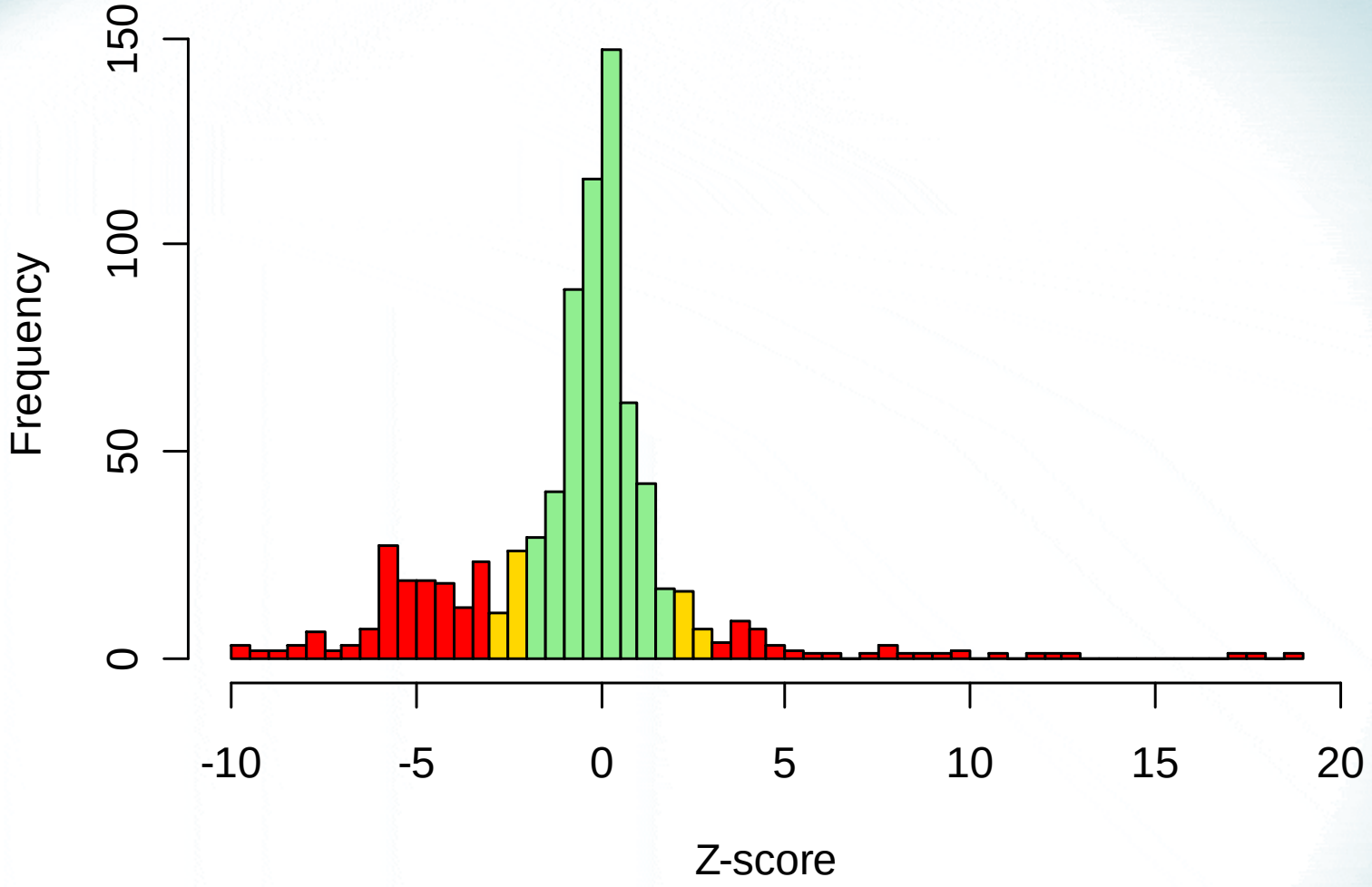


A Problem analyte: Arsenic

Basis: All participants



Source: FAPAS reports rounds 0735-0753

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What went wrong?

Some answers from a Web-based survey

Study details

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- Aim:

  Study "…the principal causes of poor performance in laboratories and ... the effectiveness of the steps taken by Participants in PT to improve the reliability of their results"
- Methodology
  - Web-based questionnaire
  - Focussed on documented problems identified via PT scores
  - Lead questions with follow-up for positive responses

Top causes of poor scores

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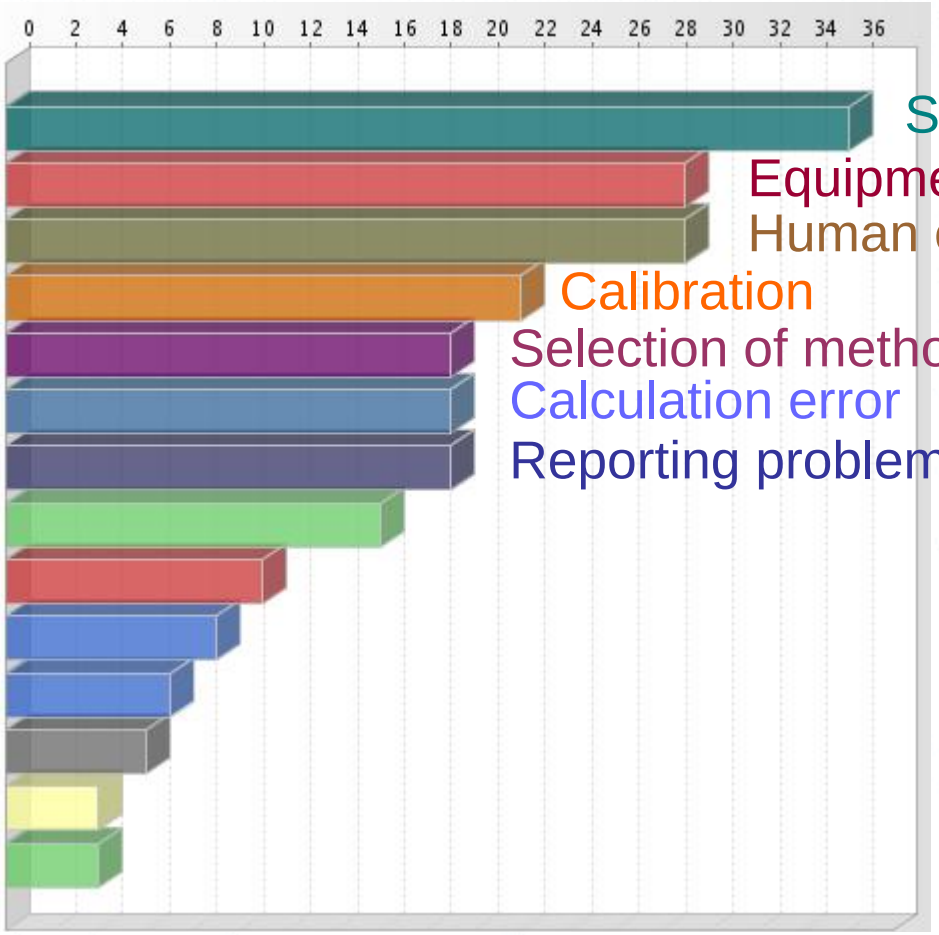

111 respondents
230 causes

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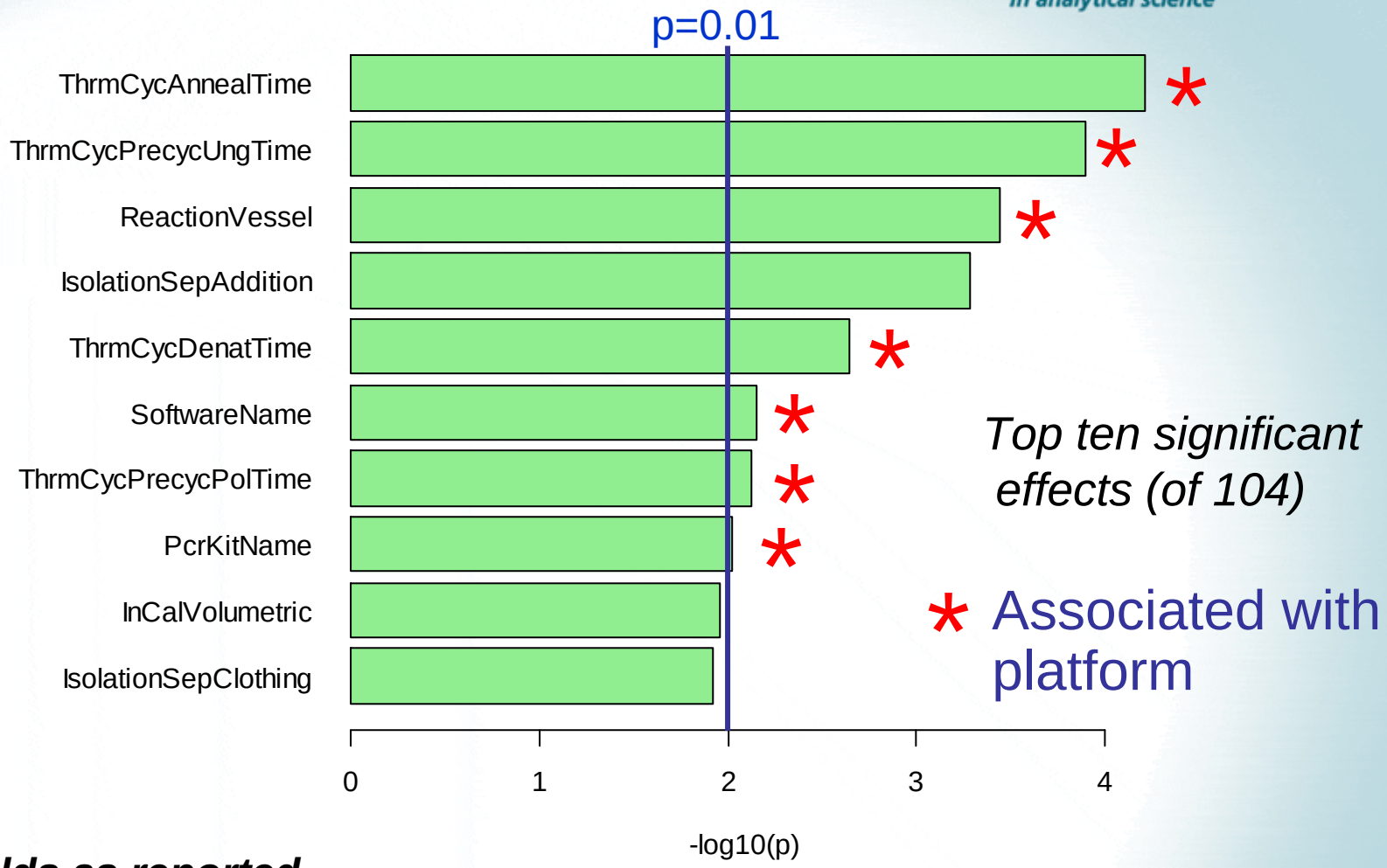
Technical causes of poor scores

Methodology questionnaire in a GMO PT study

Effects on z-score location*



Top ten significant effects (of 104)

* Associated with platform

***Fields as reported**

Platform Dependence: Annealing time

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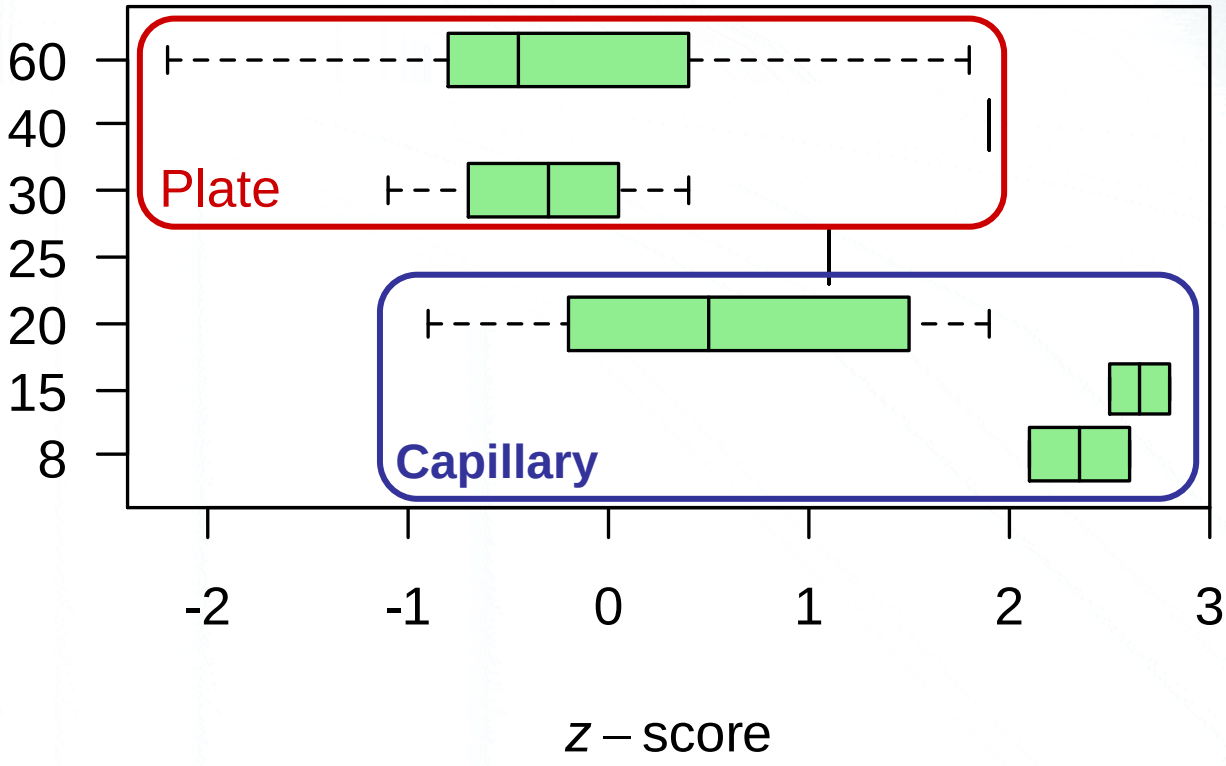
Thermal cycler annealing time



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What makes it better?

What made it better?
Corrective actions

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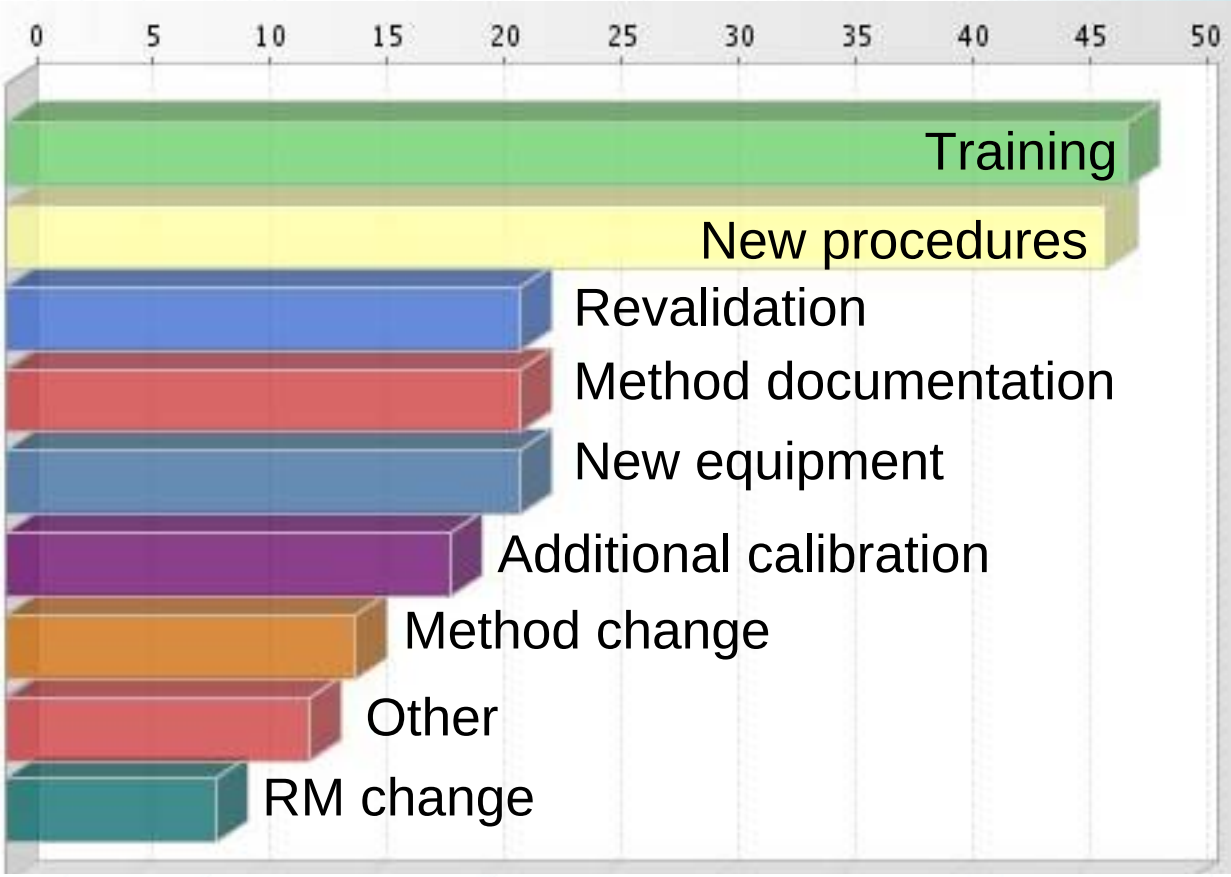

Detailed information showed problem-specific responses

Corrective action - efficacy

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- No significant difference in efficacy across different corrective actions
- Only 50% of actions were marked as ‘fully effective’

- Monitoring of efficacy tended to use local/immediate methods
  - Monitor QC results
  - Internal audit

Quality control methods

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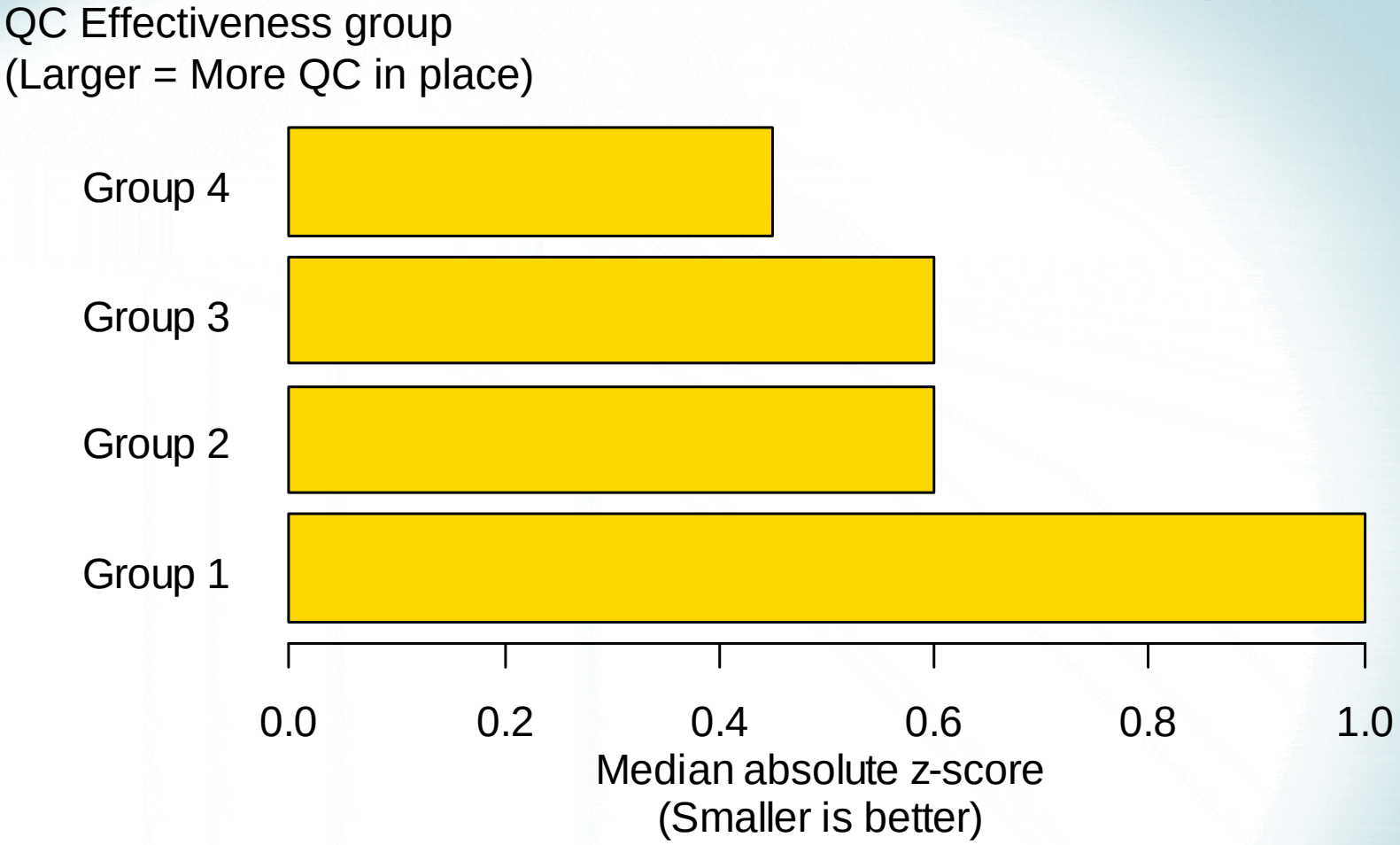

Source: Thompson M, Lowthian P (1993): Analyst 118:1495ff

Principal QC differences between groups

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- Use of certified or in-house reference materials as control materials (to control bias)
- Use of control charts or scoring system for assessing QC results
- Routine use of duplicate measurement to control precision

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Does performance improve?

Does performance improve?

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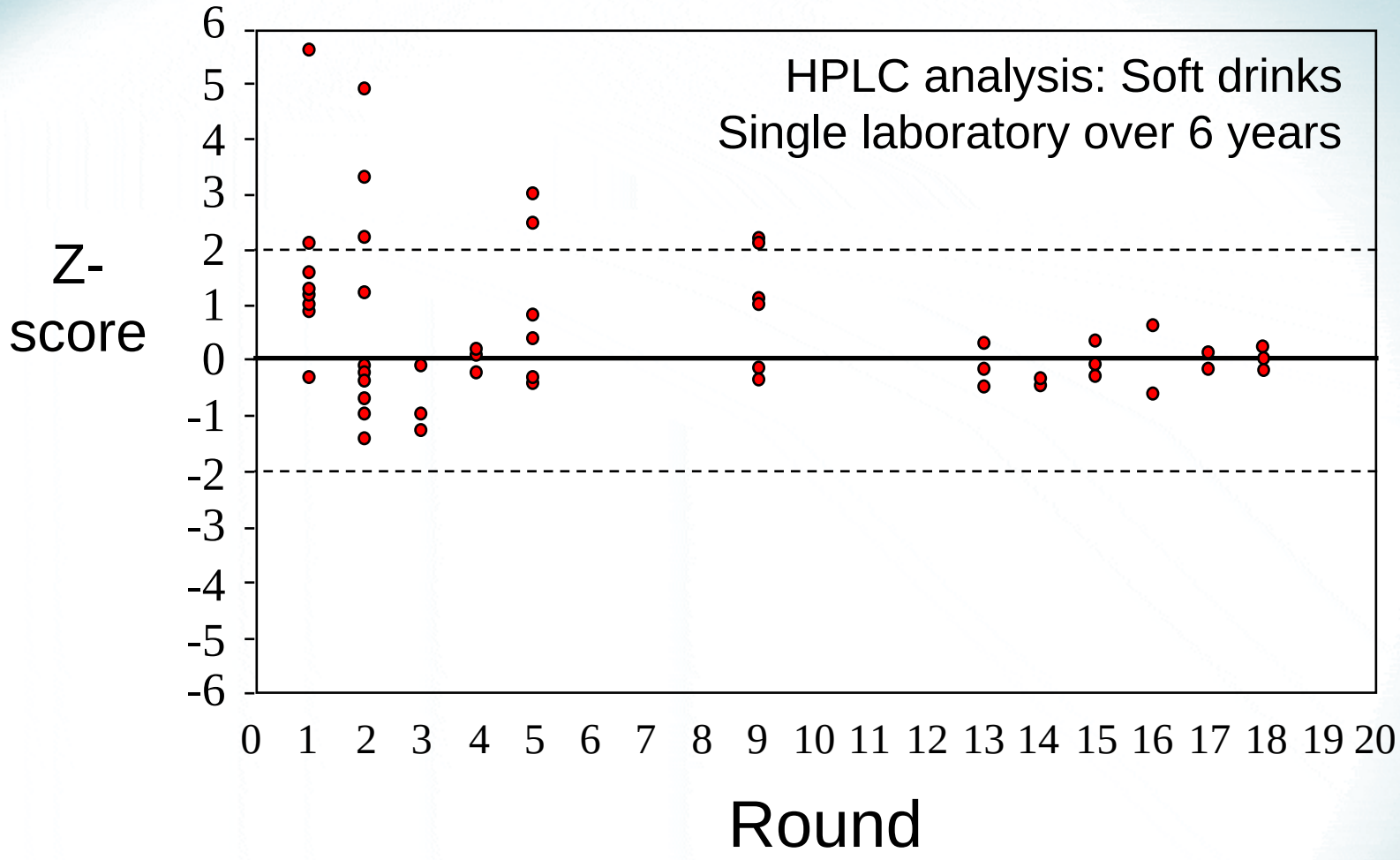

Conclusions

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- Proficiency Testing is a powerful tool for quality monitoring and improvement
- Education and improvement rely on feedback and follow-up action