Collusion and Falsification in PT: why does it happen and how can it be prevented?

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Introduction

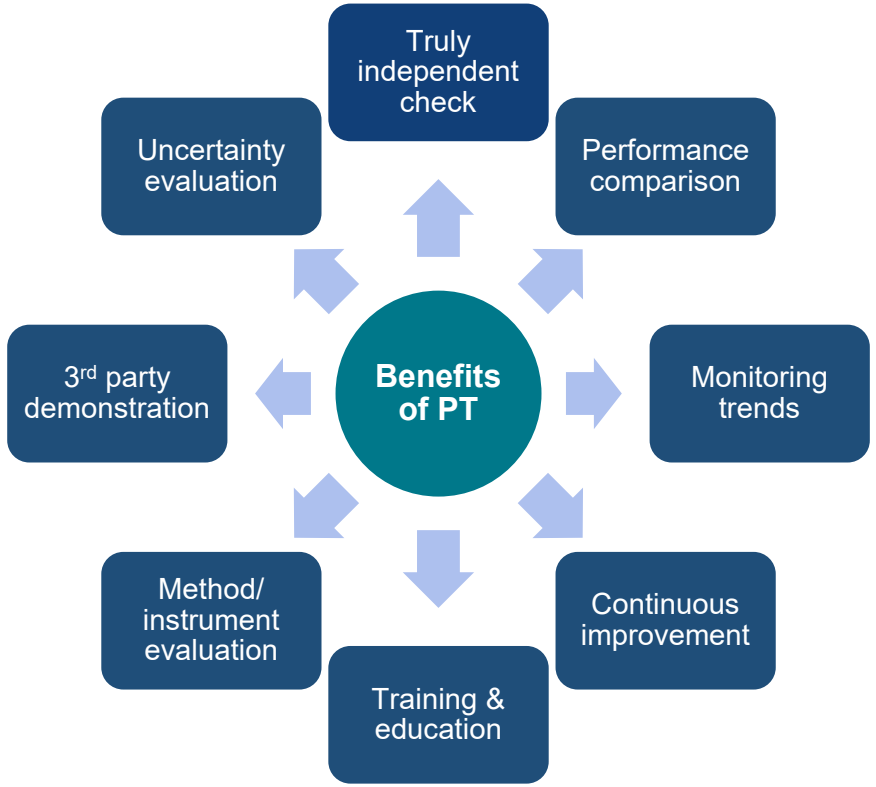
Introduction	• Role and benefits of PT
Collusion and Falsification	• Definitions
Collusion and Falsification	• How prevalent is collusion • Responsibilities of Participants and PT providers
Detection of collusion	• Challenges and difficulties of detecting collusion
Prevention of collusion	• Managerial/evidential methods • Scheme design for collusion prevention

Role and Benefits of PT

PT provides objective evidence of the competence of the participant laboratories.

This evidence can be used to improve the performance of the participant and/or give confidence in the participant's ability to perform a specific measurement.

Although the main aim of a PT scheme is to evaluate the performance of participants, there are many other benefits.



Collusion with others or falsification of data undermines all of the benefits of PT

Collusion

Definition

Collusion:
agreement between people to act together secretly or illegally in order to deceive or cheat

In Proficiency Testing several different behaviours may fall under this definition:

Collusion between participants and PT providers

Collusion between participant laboratories

- Within the same company or group
- With no formal relationship

Collusion between staff within the same laboratory

Falsification

Definition

Falsification:
The act of deliberately lying about or misrepresenting something

Within Proficiency Testing, falsification may be inextricably linked with collusion:

The falsification of data or results returned, by using data from another lab

Either knowingly or unknowingly (as a sub-contractor)

The falsification of reports or certificates from the PT provider

Sample: 01L - Level 1 Lager
Analyte: Original Gravity

Lab ID	Method	Result (°Sacc)	z score
ID0030	Distillation/Density Meter	1029.45	0.13
ID0080	Distillation/Density Meter	1029.28	-0.43
ID0081	NIR/density meter	1029.21	-0.67
ID0102	Distillation/Density Meter	1029.37	-0.13
ID0115	NIR/density meter	1029.65	0.80
ID0116	NIR/density meter	1029.70	0.97
ID0125	NIR/density meter	1029.26	-0.50

Why take the risk?

Labs may feel compelled to take part in PT, however the price of being caught 'cheating' can be severe

Labs can lose the authorisation to return results – source of income

In some fields directors can be excluded, labs can be fined or even shut down

National accreditation bodies can remove accreditation

PT should also be about education and improvement

Unsatisfactory performance, correctly addressed, is regarded as positive participation
As a result the minimum criteria for many schemes is <100%

'There is no reason to play the system' however this is not always understood

How prevalent is it?

- Precise data is difficult to obtain
- Estimates differ according to the country of operation or field of testing

"Isolated cases over the last ten years"

"We have concerns"

"Concerns have led to the implementation of processes for prevention"

"Low risk, participants would not be deemed to have failed on a single set of results"

"Concerns, but minor concern"

"No evidence or suspicious behaviour"

"No direct concerns, but we are aware of it"

"Seen as low risk"

"Extremely rare occurrence"

Requirements for PT providers

ISO 17043: 2023

7.2 Design and planning of a PT scheme

7.2.1 General

7.2.1.3 The PT provider shall develop a documented plan before commencement of the PT scheme that addresses the objectives, purpose and basic design of the PT scheme. The plan shall include the following information and, where appropriate, reasons for the selection or exclusion of the specific information:

i) arrangements to prevent collusion between participants or falsification of results and procedures to be employed if collusion or falsification of results is suspected;

"Collusion is to be strongly discouraged"

Requirements for PT participants

Ultimately it is the responsibility of the participants for their conduct during PT participation

Participants are often required to declare that:

- Results were obtained using routine testing procedures and regular personnel
- Samples were tested the same number of times as patient tests
- Results were obtained without communication with other laboratories
- Testing was not sub-contracted
- The testing was adequately documented throughout the testing process

Detection of collusion or falsification

Cases of collusion or falsification may not be easy to detect amongst legitimate data

- **Falsification may not produce suspicious data**
- **Text or interpretative responses allow a more rigorous comparison**
- **PT providers**
  - Attempt to identify collusion manually during data reviews
  - Review the dispersion of results compared to historical performance
  - Compare ‘participants with identical results’

Detection of collusion or falsification

A thorough comparison may be possible with small datasets

Large datasets provide a huge number of potential participant comparisons

AXIO BAPS scheme

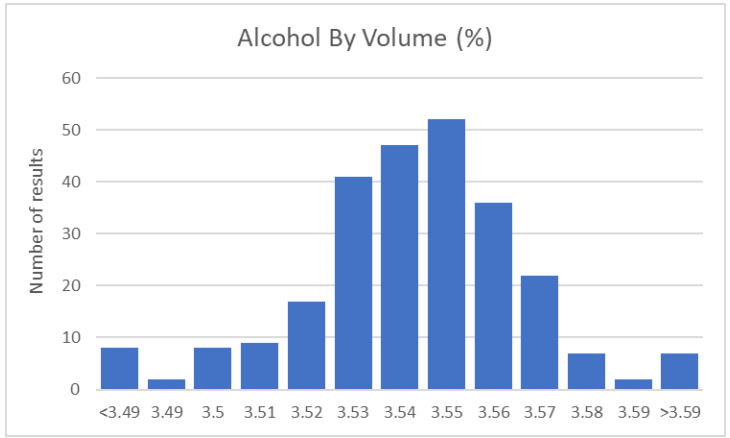
601 labs from 120 countries

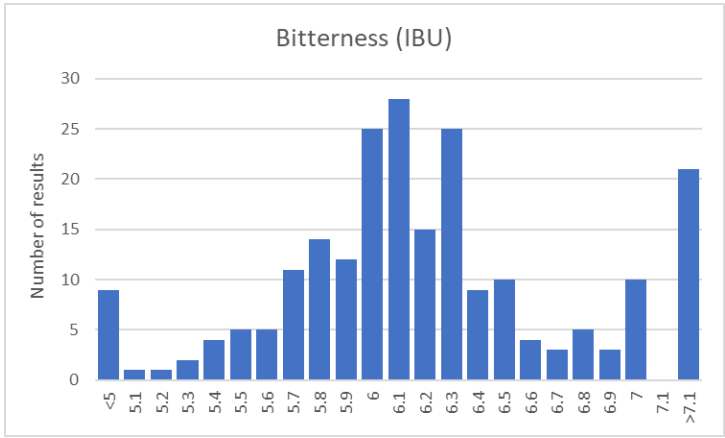
12 rounds per year

>30 analytes per round

Up to 258 results per analyte

'Granular' data leads to the expectation of multiple identical results





Detection of collusion or falsification

Suspect data then needs further investigation

Scheme: Brewing Analytes (BAPS) BA358 - (Chemistry Round 358) 02 May 2023

Sample: 01L - Level 1 Lager

Analyte: Bitterness

Lab ID	Method	Result (Bitterness Units)	z score
PT31046	Extract/Spectrophotometer	6.1	0.00
PT31048	Extract/Spectrophotometer	6.0	-0.10
PT31049	Extract/Spectrophotometer	6.0	-0.10
PT31050	Extract/Spectrophotometer	6.0	-0.10
PT31051	Extract/Spectrophotometer	6.1	0.00
PT31052	Extract/Spectrophotometer	5.8	-0.30
PT31053	Extract/Spectrophotometer	6.1	0.00
PT31054	Extract/Spectrophotometer	5.9	-0.20
PT31055	Extract/Spectrophotometer	15.6	9.50
PT31057	Extract/Spectrophotometer	16.4	10.30
PT31058	Extract/Spectrophotometer	6.9	0.80
PT31059	Extract/Spectrophotometer	6.1	0.00
PT31062	Extract/Spectrophotometer	6.1	0.00
PT31063	Extract/Spectrophotometer	6.5	0.40
PT31064	Extract/Spectrophotometer	5.8	-0.30
PT31065	Extract/Spectrophotometer	6.7	0.60
PT31066	Extract/Spectrophotometer	6.2	0.10
PT31069	Extract/Spectrophotometer	7.3	1.20
PT31071	Extract/Spectrophotometer	6.1	0.00
PT31072	Extract/Spectrophotometer	6.1	0.00
PT31079	Extract/Spectrophotometer	6.2	0.10
PT31080	Extract/Spectrophotometer	7.3	1.20
PT31080	Other	6.3	0.20
PT31081	Extract/Spectrophotometer	6.0	-0.10
PT31082	Extract/Spectrophotometer	6.1	0.00
PT31083	Extract/Spectrophotometer	5.9	-0.20
PT31084	Extract/Spectrophotometer	6.6	0.50
PT31086	Extract/Spectrophotometer	6.3	0.20
PT31088	Extract/Spectrophotometer	6.1	0.00
PT31089	Extract/Spectrophotometer	7.2	1.10
PT31090	Extract/Spectrophotometer	6.9	0.80
PT31091	Extract/Spectrophotometer	5.7	-0.40
PT31092	Extract/Spectrophotometer	7.5	1.40
PT31093	Other	6.2	0.10
PT31095	Extract/Spectrophotometer	5.9	-0.20
PT31096	Extract/Spectrophotometer	4.4	-1.70
PT31097	Extract/Spectrophotometer	7.6	1.50
PT31098	Extract/Spectrophotometer	7.2	1.10
PT31099	Extract/Spectrophotometer	6.1	0.00
PT31100	Extract/Spectrophotometer	6.3	0.20
PT31101	Extract/Spectrophotometer	6.7	0.60
PT31103	Extract/Spectrophotometer	5.7	-0.40
PT31104	Extract/Spectrophotometer	6.5	0.40
PT31106	Extract/Spectrophotometer	6.1	0.00
PT31107	Extract/Spectrophotometer	6.3	0.20
PT31149	Extract/Spectrophotometer	5.7	-0.40
PT31159	Extract/Spectrophotometer	6.2	0.10
PT31165	Extract/Spectrophotometer	7.8	1.70
PT31166	Beer-Gallery	6.5	0.40
PT31176	Extract/Spectrophotometer	6.8	0.70
PT31177	Extract/Spectrophotometer	5.9	-0.20

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Considering all data from the PT round

Sample: 01L - Level 1 Lager

Analyte	Units	Method 1	Result 1	z score 1	Method 2	Result 2	z score 2
Alcohol by Volume	% ABV	Other	3.79	5.00	Distillation/Density meter	3.82	5.60
Original Extract	°Plato	Other	9.29	18.90	Distillation/Density meter	9.29	18.90
Apparent Gravity	°Plato	Other	2.04	51.00	Density meter	1.99	49.33
Bitterness	IBU	Extract/Spectrophotometer	15.6	9.50	Extract/Spectrophotometer	16.4	10.30
Colour @ 430nm	°EBC	Spectrophotometry	8.5	7.33	Spectrophotometry	8.5	7.33
pH		pH Meter	4.38	-2.60	pH Meter	4.38	-2.60
Haze @ 0°C	°EBC	Haffmans/VOS	2.32	20.60	Haffmans/VOS	1.67	14.10
Haze @ 20°C	°EBC	Haffmans/VOS	1.09	8.50	Haffmans/VOS	1.59	13.50
Carbon Dioxide	g/L	Volume expansion	4.92	-2.19	Volume expansion	4.76	-3.23
Sulfur Dioxide	mg/L	Para-Rosaniline	1	-1.00	Para-Rosaniline	1	-1.00

Based on geographical location

And/or company identity

WEYLAND-YUTANI CORP

"BUILDING BETTER WORLDS"

Until a reliable decision can be made

Prevention through ‘managerial’ or ‘evidential’ methods

Many steps can be taken to make the PT process less susceptible to collusion or to remind participants of their responsibilities

Education by PT providers on allowable practices

PT providers requiring statements of compliance by participants

At various levels and covering all parts of the process

Timescales may be shortened for parts of the process

Submission of accompanying method information

Submission of raw data and/or chromatograms

The use of electronic reporting systems, including data uploaded directly from instruments

Prevention is better than cure: Desiderius Erasmus

Sample ‘encryption’: Use of multiple samples

Where the PT scheme has sufficient participants

A multi-sample approach can be taken

Participant	Sample
PT001	Sample C
PT002	Sample B
PT003	Sample B
PT004	Sample B
PT005	Sample B
PT006	Sample A
PT007	Sample A
PT008	Sample A
PT009	Sample C
PT010	Sample C
PT011	Sample A
PT012	Sample B
PT013	Sample C
PT014	Sample B
PT015	Sample B
PT016	Sample B
……	

Samples need to be otherwise identical

Analyte levels realistic

Differences relevant to the σ_{PT} being used for participant evaluation

Participant	Sample
PT006	0.511
PT007	0.519
PT008	0.508
PT011	0.522

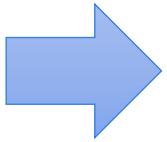
Participant	Sample
PT002	0.672
PT003	0.653
PT004	0.666
PT005	0.665
PT012	0.651

Participant	Sample
PT001	0.794
PT009	0.783
PT010	0.790
PT013	0.791

More complex designs

Samples
Sample A
Sample B
Sample C
Sample D
Sample E
Sample F

Participant	Sample 1	Sample 2	Sample 3
PT001	Sample A	Sample B	Sample C
PT002	Sample B	Sample C	Sample D
PT003	Sample C	Sample D	Sample E
PT004	Sample D	Sample E	Sample F
PT005	Sample E	Sample F	Sample A
PT006	Sample F	Sample A	Sample B
PT007	Sample A	Sample B	Sample C
PT008	Sample B	Sample C	Sample D
PT009	Sample C	Sample D	Sample E
PT010	Sample D	Sample E	Sample F
PT011	Sample E	Sample F	Sample A
PT012	Sample F	Sample A	Sample B
PT013	Sample A	Sample B	Sample C
PT014	Sample B	Sample C	Sample D
PT015	Sample C	Sample D	Sample E
PT016	Sample D	Sample E	Sample F
……			



Participant	Sample A
PT001	0.511
PT005	0.519
PT006	0.508
PT007	0.522
….	

Participant	Sample B
PT001	0.511
PT002	0.519
PT006	0.508
PT007	0.522
….	

Participant	Sample C
PT001	0.511
PT002	0.519
PT003	0.508
PT007	0.522
….	

Participant	Sample D
PT002	0.511
PT003	0.519
PT004	0.508
PT008	0.522
….	

Participant	Sample E
PT003	0.511
PT004	0.519
PT005	0.508
PT009	0.522
….	

Participant	Sample F
PT004	0.511
PT005	0.519
PT006	0.508
PT010	0.522
….	

If a large number of participants are available

Multiple samples, selected from many options, may be provided

Successful collusion becomes very, very hard

Split-level sample designs

Participant	Sample 1	Sample 2
PT001	Sample A	Sample B
PT002	Sample B	Sample A
PT003	Sample B	Sample A
PT004	Sample B	Sample A
PT005	Sample B	Sample A
PT006	Sample B	Sample A
PT007	Sample A	Sample B
PT008	Sample A	Sample B
PT009	Sample B	Sample A
PT010	Sample A	Sample B
PT011	Sample A	Sample B
PT012	Sample A	Sample B
PT013	Sample B	Sample A
PT014	Sample A	Sample B
PT015	Sample A	Sample B
PT016	Sample A	Sample B
……		

Using multiple samples, a strategy can be implemented to discourage collusion, by improving detectability

Split – level, two similar materials with different analyte concentrations

Analyte differences need to be of an appropriate magnitude to enable 'detection' of collusion

Too small and 'correct' results could be returned by a lab using another lab's data

Wang, W., Zheng, J., Tholen, D.W. *et al.* A statistical strategy for discouraging collusion in split-level proficiency testing schemes. *Accred Qual Assur* **10**, 140–143 (2005).

Blind PT

‘Blind’ PT is probably more suitable for periodically assessing the ‘current state of analysis’

Participants initially are not aware they are taking part in PT

- They may be informed once the process is complete

As a result participants are unable to collude with other participants or the PT provider

Processes used to analyse the samples will be those used for customer samples

Blind PT faces a number of logistical and operational challenges

- Not practicable for routine PT

Conclusions

Collusion and Falsification	• Collusion and/or falsification undermine many of the benefits of PT participation
Prevalence of collusion	• Collusion does not appear prevalent, but awareness is high • Both participants and PT providers have a responsibility to prevent collusion
Detection of collusion	• Detection of collusion can be difficult in large datasets or where methods which have poor precision are used
Prevention of collusion	• Methods exist for collusion prevention by educating participants and by requiring additional data/evidence • Scheme designs using multiple samples, make collusion very, very hard and can provide a potential means of detecting it

Acknowledgements

Thank you to all those people who gave me information about the processes used to detect, prevent and handle collusion with their PT schemes

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Any questions?