

The work overload is related to an increased risk of error during chemotherapy preparation: a pilot simulation study

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Objectives

Chemotherapy preparation units have to manage an increase of activity with constant staff. Safety is therefore threatened.

The objective of the study was to measure the effect of a work overload

- on preparations accuracy
- on errors.

Conclusion

Operators increased their working speed

- without impacting mean doses accuracy
 - with a greater probability of making a mistake
 - with a large proportion of inaccurate preparations
- The inclusion of robust control methods in the process can be recommended.
- The results encourage to avoid work overload and to take actions to smooth the activity over the day.

Method

- **A simulation study** using tracers (lidocaine and phenylephrine) was conducted in an operational context.

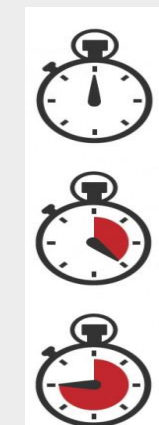
- **21 operators, 1007 preparations**

Study:

3 randomised blocks of 1, 2 or 3 series of 8 randomised preparations at different dosages and volumes, starting from 2 concentrations of stock solutions were compounded.

1x8 syringes=8:

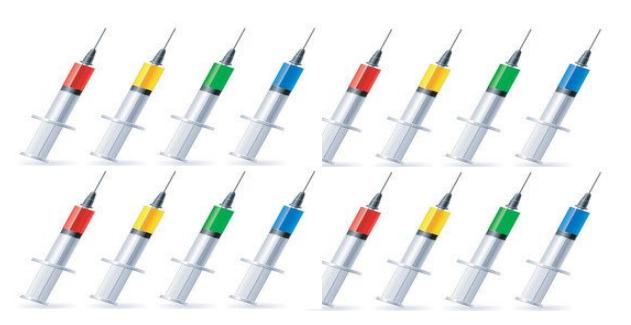
- 4 x phenylephrine
- 4 x lidocaïne



Fixed time of 1h

2x8 syringes=16:

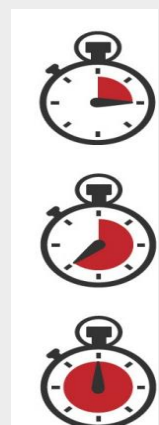
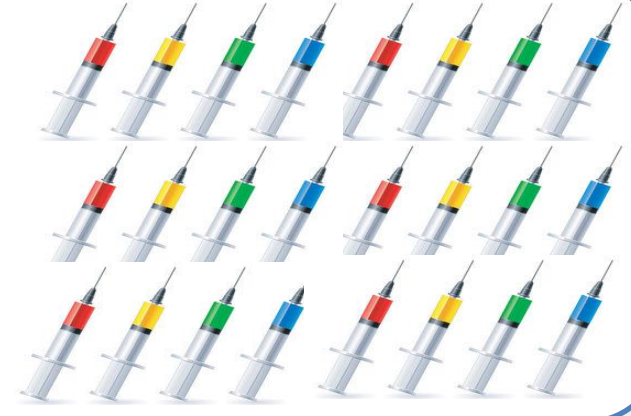
- 8 x phenylephrine
- 8 x lidocaïne



Fixed time of 1h

3x8 syringes=24:

- 12 x phenylephrine
- 12 x lidocaïne



Fixed time of 1h

Analysis

Qualitative criteria

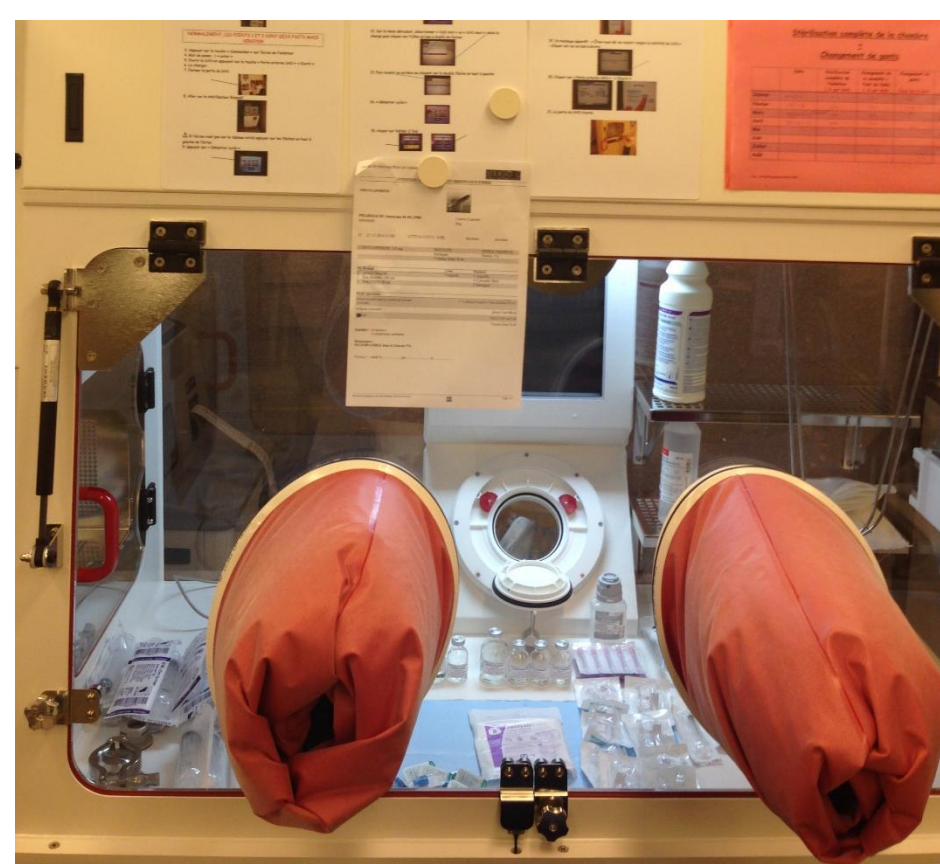
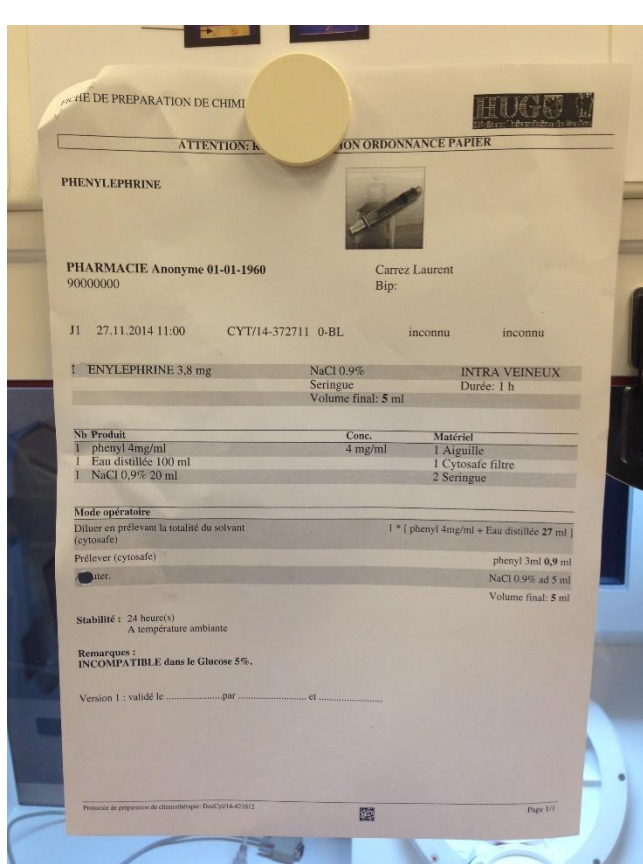
Visual observations

- wrong stock solution
- wrong diluent
- labelling error

Quantitative criteria

Validated CE methods

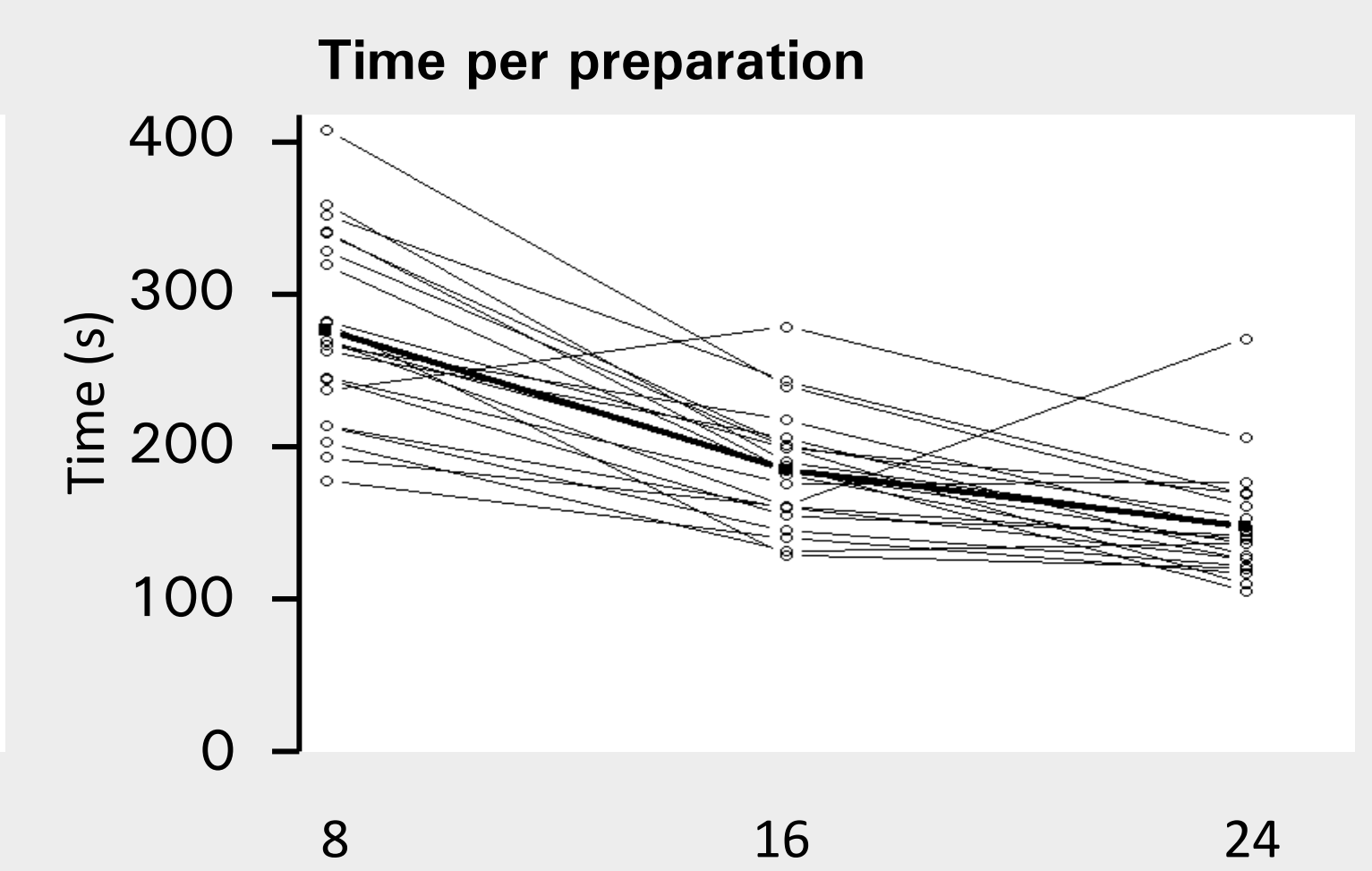
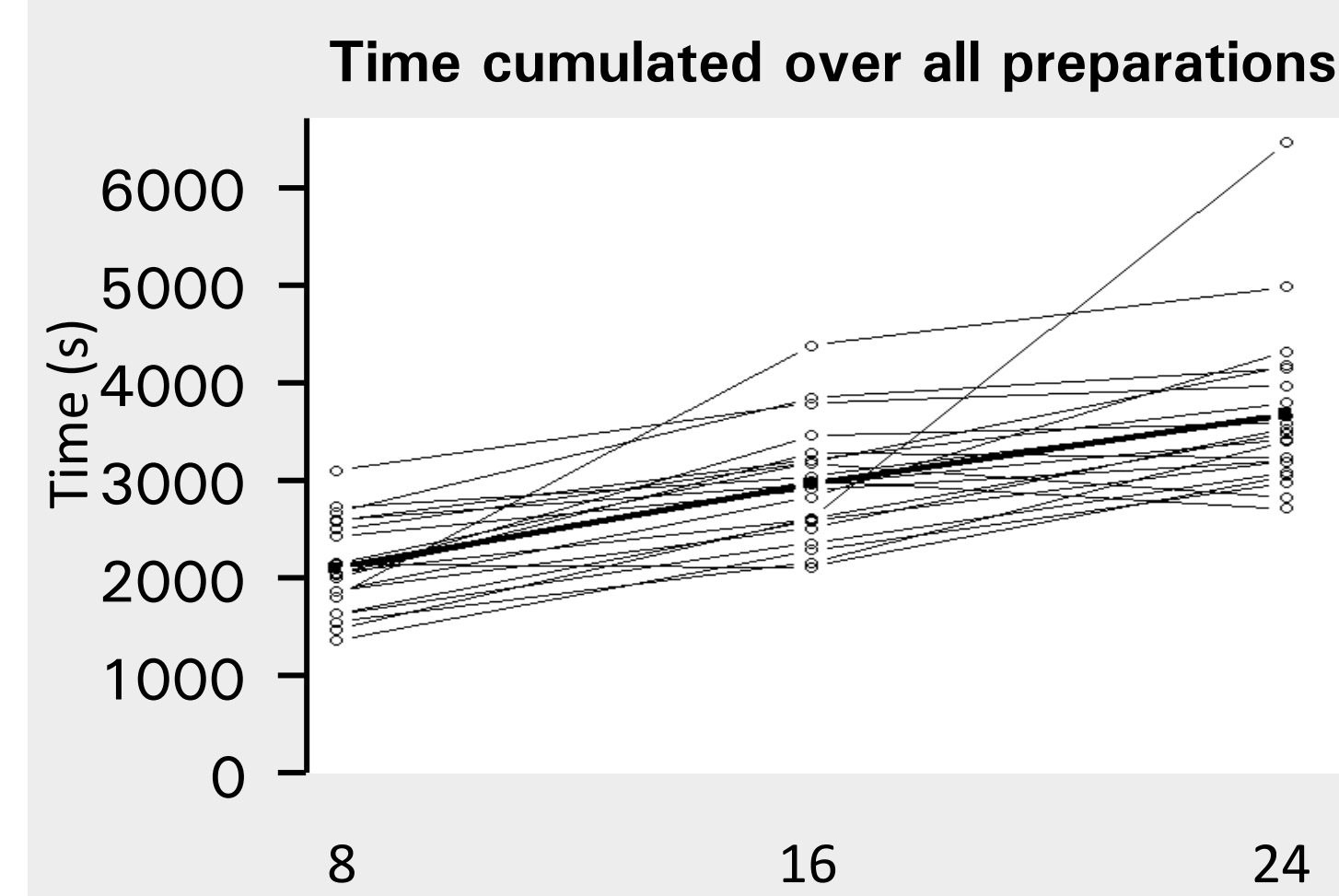
- accurate (<5% deviation)
- weakly accurate (5-10%)
- inaccurate (10-30%)
- error (>30%)



Results

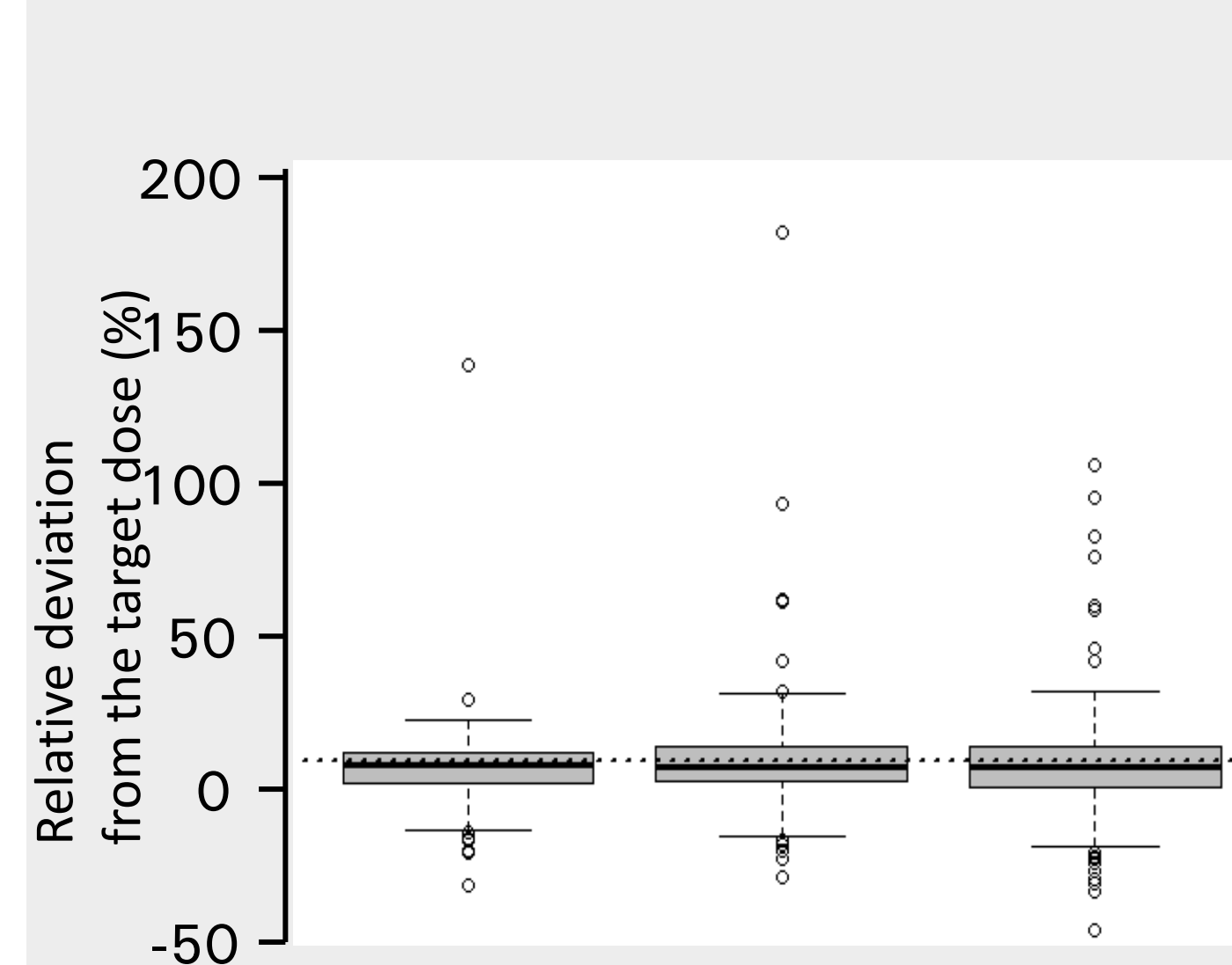
Preparation time:

A gradual reduction of the preparation time, inversely correlated with the workload, was observed. The average time for a preparation was 4min39s, 3min13s and 2min38s for sessions with 8, 16 and 24 syringes, respectively ($p < 0.001$).



Accuracy:

The mean accuracy of the syringes concentrations measured by quantitative analysis was not different between the three series ($p=0.23$, mixed-effect Cox model regression).

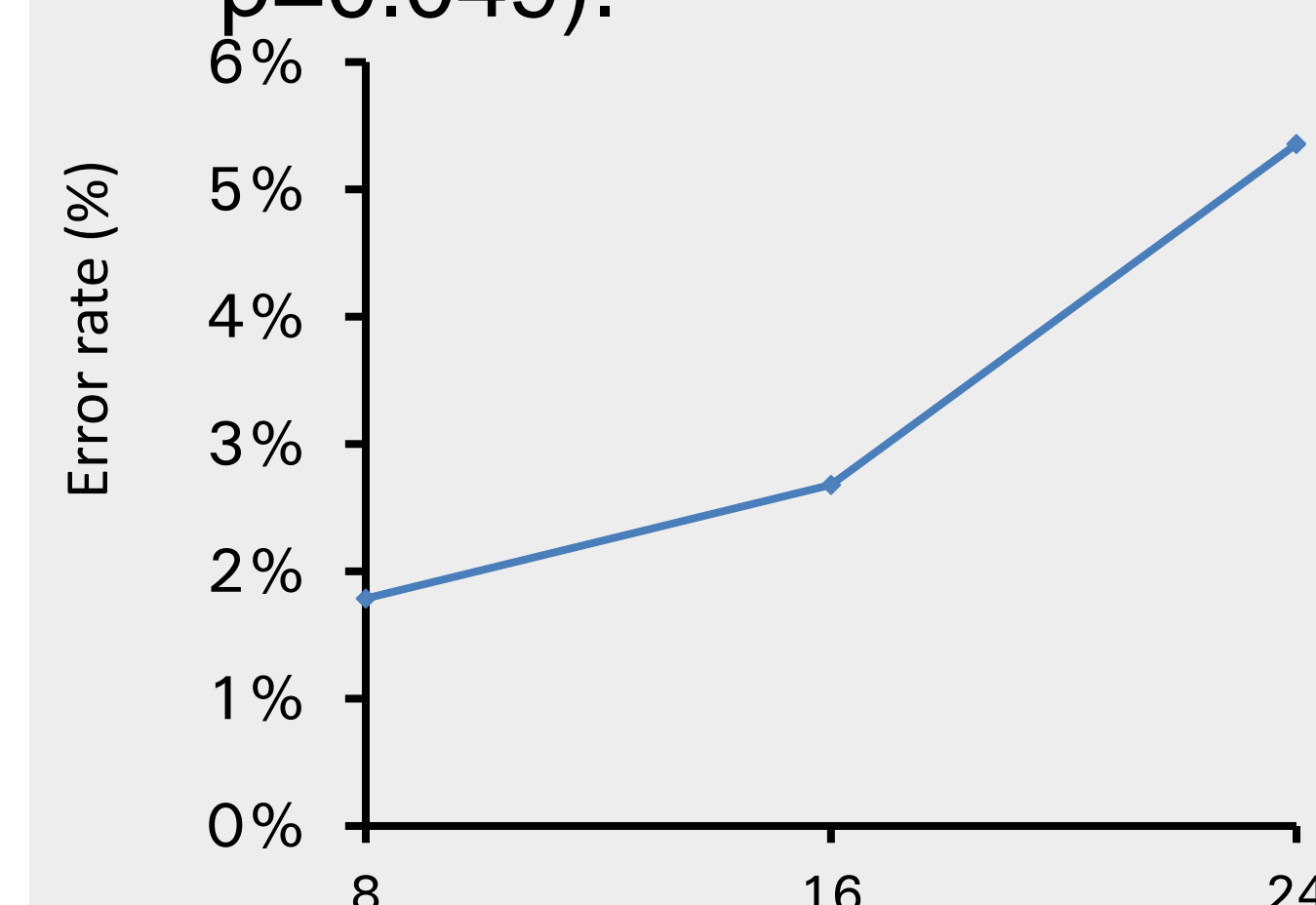


Distribution of preparations (%) based on deviation from the target dose

	$X \leq \pm 5\%$	$\pm 5 < X \leq \pm 10\%$	$\pm 10 < X \leq \pm 30\%$	$\pm 30 > X$
8	51%	25%	22%	2%
16	46%	23%	29%	2%
24	45%	26%	25%	4%
3 series	47%	25%	25%	3%

Error:

The error rate (qualitative and quantitative analysis) increased with the number of preparations made in 1 hour: 1.8%, 2.7% and 5.4% for 8, 16 and 24 syringes, respectively. The difference was statistically significant (mixed-effects logistic regression, $p=0.049$).



Number of errors per type and per block

Type of errors	Error of labelling	Error of diluant	Error of active ingredient	dose>30%
8	0	0	0	3
16	1	2	0	6
24	6	0	1	20