ACCURACY AND STERILITY PERFORMANCE OF A NEW PHARMACY ROBOT-CSTD COMBINATION

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Background and Importance:

- Oncology pharmacists must provide sterile and accurate preparations, while limiting exposure to hazardous drugs.
- Robotic compounding may provide a partial solution for short-staffed pharmacies.
- SmartCompounders empowered by Chemfort®:
  - new automation solution
  - works together with the Chemfort® closed system transfer device (CSTD) to maintain drug sterility and prevent hazardous drug release
  - streamlines CSTD implementation for administration according to USP <800>
- Accuracy and sterility must be verified when integrating the robot into production.
- Incidence of incorrect drug concentration with manual production can reach 88%,[i] while reported robot failure rates range from 0.9-18.7%.[ii]
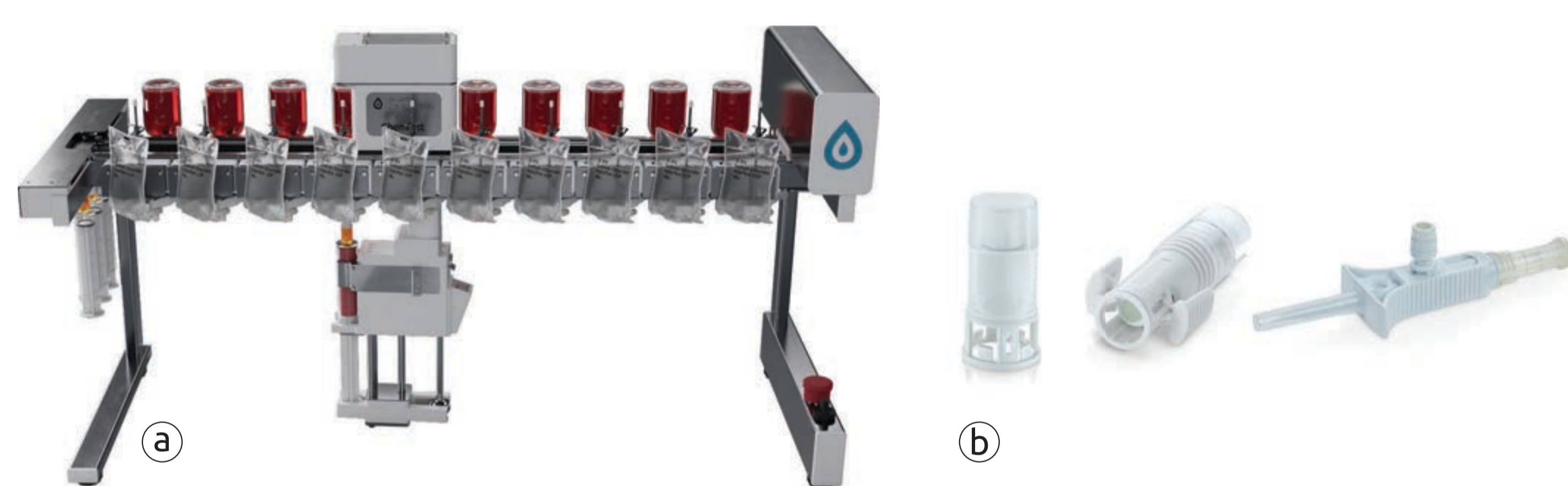
Figure 1. *SmartCompounders robot (a) in combination with Chemfort® CSTD (b), including (from left to right) Vial Adaptor, Syringe Adaptor, and Bag Adaptor SP*

Aims and Objectives:

The aim was to determine drug dilution accuracy and verify sterility using SmartCompounders empowered by Chemfort®.

Materials and Methods:

Tests were performed at Remedix Care, a preparation center with ISO/IEC 17025:2017 accreditation.

Dose accuracy:

- Determined deviation of actual vs. expected concentrations
- 522 preparations
- 6 drugs: carboplatin, cyclophosphamide, 5-fluorouracil, gemcitabine, oxaliplatin, and paclitaxel
- Injected volumes (expected) ranged from 7 to 85 ml.
- Accuracy self-checked gravimetrically

Drug	Carboplatin	Cyclophosphamide	5-Fluorouracil	Gemcitabine	Oxaliplatin	Paclitaxel
# of preps	130	6	93	57	17	219
Range of expected injection volumes (ml)	8-85	37-81	7-64	23-50	18-34	10-60

Table 1. *Number of preparations and range of expected injection volumes for each drug*

Media fill tests:

- 210 infusion bags
- 4 different days
- Typical manipulations performed using the robot with CSTD
- Incubated at 25-30 °C for 14 days
- Growth promotion tests (GPT) were performed with 10 microorganism species
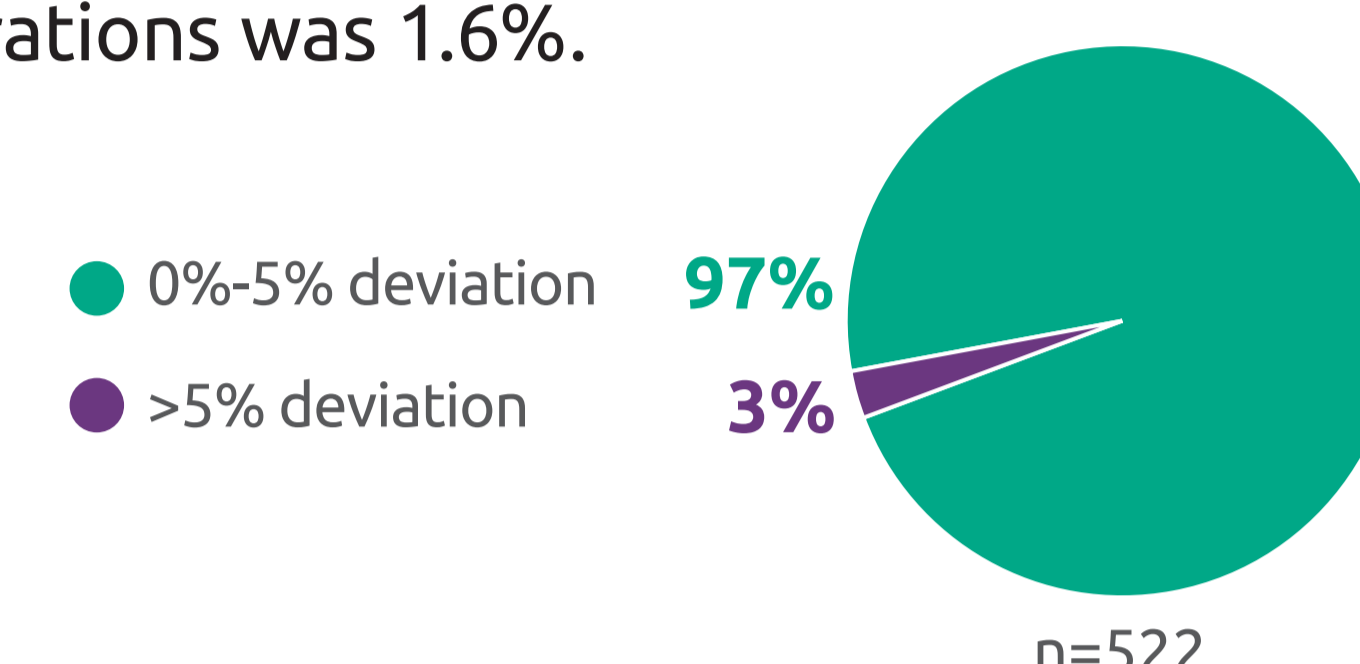
Results:

Dose accuracy:

Overall, 97% of preparations met the strict criterion of <5% deviation. Mean absolute deviation for all preparations was 1.6%.

Preparations Meeting Acceptance Criteria

Figure 2. *Pie chart showing percent of preparations meeting <5% deviation acceptance criteria and those that did not*

- 0%-5% deviation **97%**
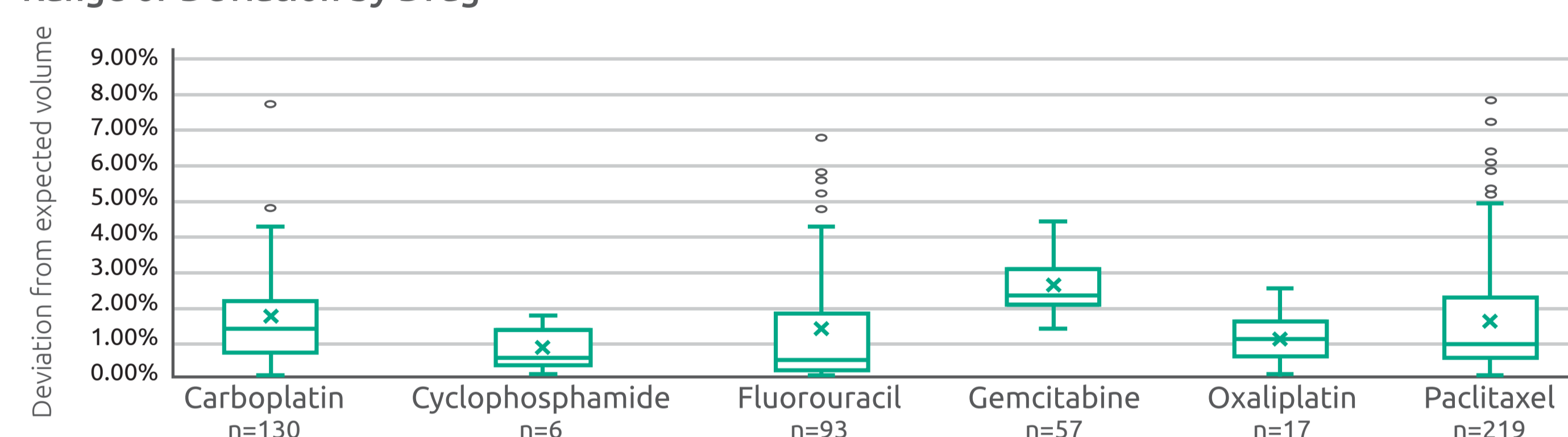- >5% deviation **3%**

n=522

Notably all preparations that exceeded the <5% deviation acceptance criterion demonstrated a negative deviation. These preparations could be corrected by adding drug volume, rather than being wasted.

Deviation per Volume
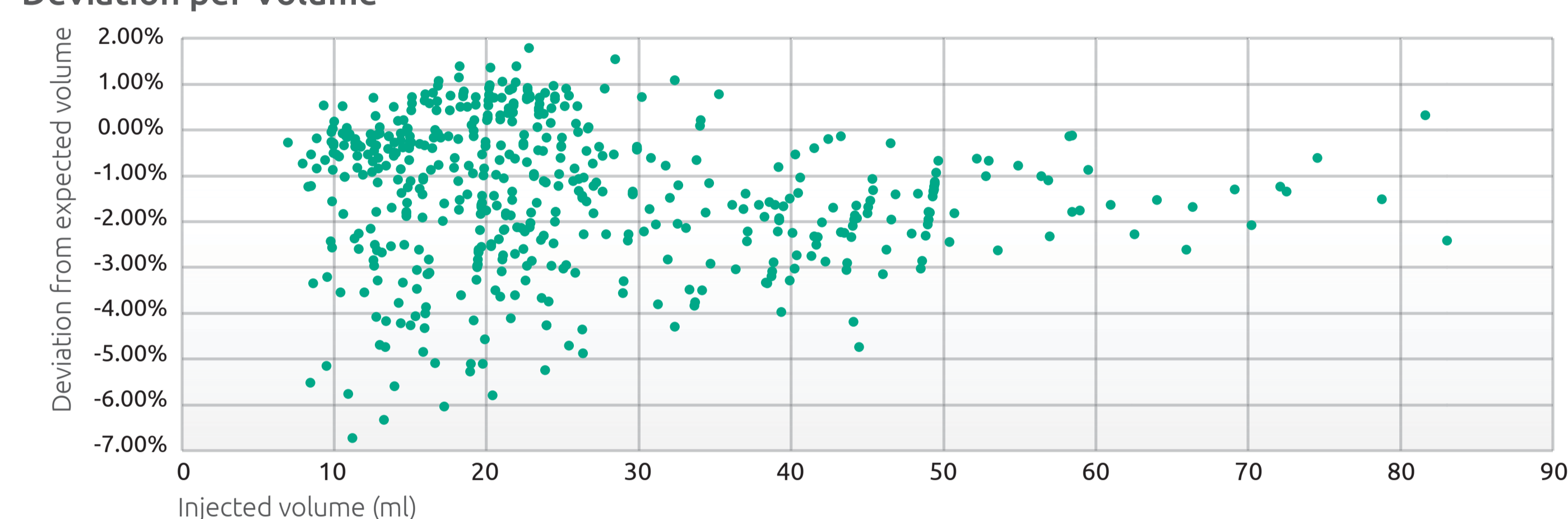
Figure 3. *Deviation from expected volume vs. actual injected volume*

Range of Deviation by Drug

Figure 4. *Box and whisker plot showing mean (X's), first (bottoms of rectangles), second (median; center line), third (tops of rectangles), and fourth (top T shape) quartiles of deviation data by drug.*

Media fill tests

None of the 210 infusion bags showed any growth in the media fill test, while all GPT controls exhibited growth.

Date of simulated prep	Day 1-Aug 2023	Day 2-Aug 2023	Day 3-Aug 2023	Day 4-April 2024
Number of bags	50	50	50	60
Result	No growth	No growth	No growth	No growth

Table 2. *Medial fill results from 4 different preparation days*

Conclusion and Relevance:

The SmartCompounders + Chemfort® combination system was found to maintain sterility in prepared infusion bags and to reliably produce doses of the correct concentration. Comparison to other studies is difficult, due to variation in drugs prepared, acceptance criteria, and variable inclusion of a CSTD. The new combination device represents a new paradigm for safe and accurate cytotoxic preparation.

References:

i Hedlund N, et al. *BMJ Open.* 2017; 7:e015912. doi:10.1136/bmjopen-2017-015912
ii Yang C, Ni X, Zhang L, Peng L. *Medicine.* 2023;102:19(e33476)