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Evaluation of Benefits Associated with Chemotherapy Dose-Banding Practices

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OBJECTIVE

The objective of this study was to evaluate the benefit of applying a 10% rounding strategy with predetermined dose-bands to the current chemotherapy dosing policy at Parkview Health.

BACKGROUND

- Historically, chemotherapeutic agents have been dosed based on body weight or body surface area (BSA), while also accounting for patient specific factors such as age, renal and/or hepatic function, and individual tolerability.
- Dose-banding is a method of dosing which standardizes weight, BSA, and area under the curve dosing.
- Dose-banding within the accepted 10% range has shown non-inferiority for efficacy outcomes and is supported by the Hematology/Oncology Pharmacy Association and the American Society of Clinical Oncology.[1,2]
- Benefits of dose-banding:[3-5]
  - Reduces calculation and measuring errors, and overall improves safety of prescribing, preparation, and administration.
  - Allows for certain chemotherapy agents with extended stability, such as 5-fluorouracil, to be compounded in advance.
  - Reduces drug waste and serves as a cost saving measure.
- The current policy at Parkview Health supports the use of up to 10% rounding of prescribed doses for many monoclonal antibodies and up to 5% for all chemotherapeutic agents.
- The chemotherapeutic agents chosen for investigation have been previously studied for their dose-banding eligibility.

METHODS

- A retrospective chart review was conducted at Parkview Cancer Institute and Parkview Wabash Hospital outpatient infusion clinics from June 1st, 2019, to May 31st, 2021.
- Prespecified dose-banding tables were created.
- **Inclusion:** Any dose of fluorouracil (ambulatory pumps or syringe), gemcitabine, carboplatin, cisplatin, cyclophosphamide, etoposide, irinotecan, leucovorin, oxaliplatin, or paclitaxel administered
- **Exclusion:**
  - Doses given as part of a research protocol
  - Doses which did not have a patient height or weight recorded within three days prior to administration
- **Outcomes:**
  - **Primary outcome:** The percent of doses that fall within the 10% rounding parameter when using pre-specified dose bands
  - **Secondary outcomes:**
    - Quantity of unique doses administered versus quantity of unique doses using dose bands
    - Theoretical medication savings in milligrams and dollars
    - Predicted impact on workflow efficiency

RESULTS

Table 1. Baseline Characteristics

Baseline Characteristics	n = 20897
Age, mean age in years ± SD	61.87 ± 12.5
BSA, mean BSA in m^2 ± SD	1.96 ± 0.3
Male, n (%)	10581 (50.6)
Chemotherapeutic Agent Doses, n (%)	
cisplatin	1184 (5.7)
carboplatin	1594 (7.6)
cyclophosphamide	1387 (6.6)
etoposide	1503 (7.2)
fluorouracil	5152 (24.7)
gemcitabine	1488 (7.1)
irinotecan	1240 (6.4)
leucovorin	2056 (9.8)
oxaliplatin	2108 (9.8)
paclitaxel	3187 (15.3)

Figure 1. Percent of Doses within the 10% Rounding Parameter Overall

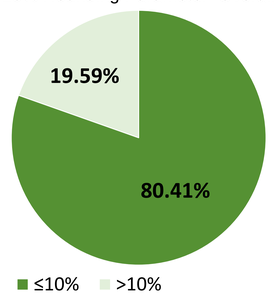


Figure 2. Percent of Doses within the 10% Rounding Parameter Per Agent

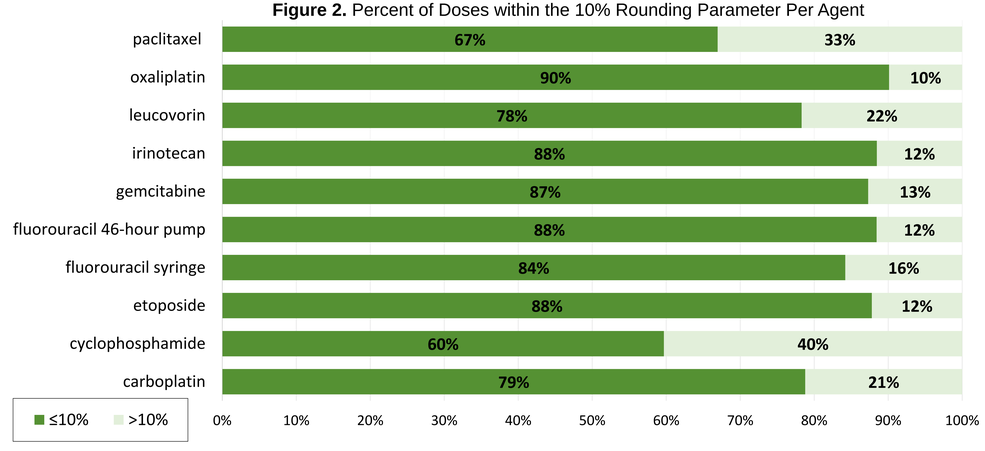


Table 2. Quantity of Unique Doses with Current Rounding Practice versus with Dose-bands

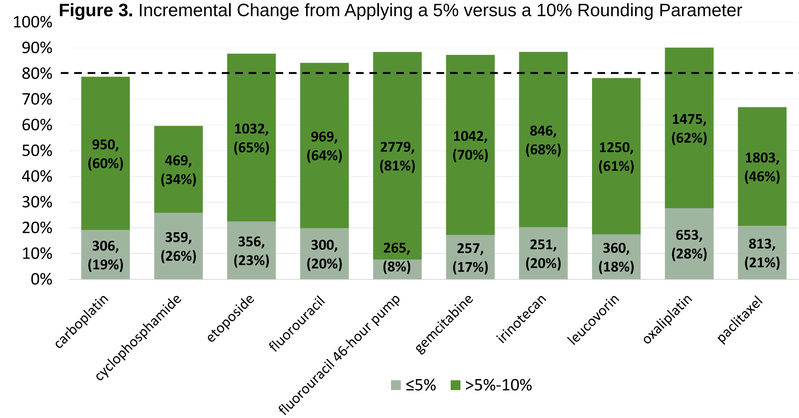
Drug	# of Unique Doses Pre	# of Unique Doses Post	% reduction
carboplatin	98	56	43%
cyclophosphamide	231	127	45%
etoposide	162	44	73%
fluorouracil	182	75	59%
fluorouracil 46-hour pump	358	138	61%
gemcitabine	202	70	65%
irinotecan	161	48	70%
leucovorin	233	119	49%
oxaliplatin	310	88	72%
paclitaxel	468	263	44%
Overall	**2405**	**1028**	**57%**

Table 3. Net Savings in Milligrams and Dollars Saved

Drug	Net Change (mg)	Dollar Amount
carboplatin	-6217	$ (1,865)
cyclophosphamide	2997	$ 2,622
etoposide	-3324	$ (497)
fluorouracil syringe	1374	$ 19
fluorouracil 46-hour pump	-76981	$ (1,062)
gemcitabine	-22208	$ (1,197)
irinotecan	-29	$ (10)
leucovorin	3867	$ 1,021
oxaliplatin	-802	$ (3,404)
paclitaxel	2072	$ 1,071
Total	**-99250**	**$ (3,302)**

RESULTS

Figure 3. Incremental Change from Applying a 5% versus a 10% Rounding Parameter



DISCUSSION & CONCLUSIONS

- While reduction of unique doses varied per agent overall, the dose bands would have reduced the number of unique doses from 2405 to 1028 – a 57% reduction.
- An overall cost reduction of $3,302 was shown with the application of dose-bands.
- The primary benefit gained is the ability to batch dose-banded doses in anticipation for scheduled patients.
  - Based on the percent of doses within 10%, paclitaxel, leucovorin, cyclophosphamide, and carboplatin would be excluded from initial application to practice.
  - When narrowing the window of use to average daily and average weekly administrations, fluorouracil syringes, fluorouracil 46-hour pumps, and oxaliplatin are the highest volume agents and would benefit most from implementing the 10% dose-banding strategy due to their long stabilities.
- Much like with the institution's practice of batching intravenous antibiotics, implementing a 10% dose-banding strategy would allow chemotherapeutic agents to be prepared in advance, increasing workflow efficiency and patient satisfaction by decreasing wait times. Once implemented, future analysis of this strategy could provide insight into its effects on chair time efficiency and workflow optimization.

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Disclosure
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