

Using Medical Dosing Across PEDSnet to Respond to Chemotherapy Sterile Injectable Drug Shortages



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• The research reported here was conducted using PEDSnet (pedsnet.org) and includes data from the following PEDSnet institutions: Children’s Hospital of Philadelphia, Children’s Hospital Colorado, Nationwide Children’s Hospital, Nemours Children’s Health System, St. Louis Children’s Hospital, Seattle Children’s Hospital

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Highlights

- **Chemotherapy drug shortages could be alleviated by the establishment of a national drug reserve.**
- **PEDSnet data standardized to the OMOP CDM can be used as an effective tool to evaluate and understand the usage of these drugs for planning reserves.**
- **Specific Data Quality Analysis (DQA) of chemotherapy medications representing broad treatment plans may reveal site-wide discordance and agreement compared to other children’s hospital health systems in the network**

Background

Within the past decade, a number of critical drug shortages have occurred in the United States. In pediatric oncology, this problem was brought to the forefront in October 2019 when Pfizer Pharmaceuticals, the only remaining supplier of vincristine experienced delays in manufacturing this critical chemotherapy agent. In order to inform planning for drug reserves, we aim to estimate the annual use of of commonly used pediatric parenteral chemotherapeutics through evaluation of medication administration data.

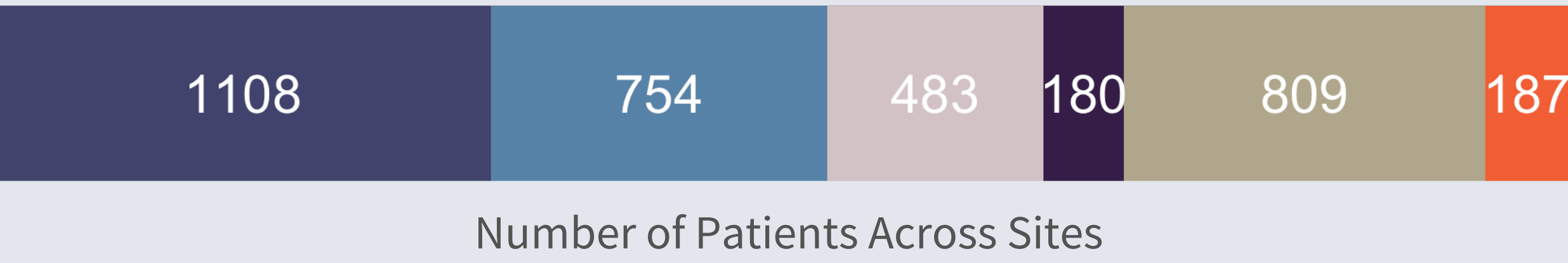
The goal of this pilot project is to assess the effectiveness of a pediatric clinical data network as a representative sample for estimating chemotherapy usage, and to take preliminary steps in capturing medical dosing data for common chemotherapy sterile injectables across the network.

Methods

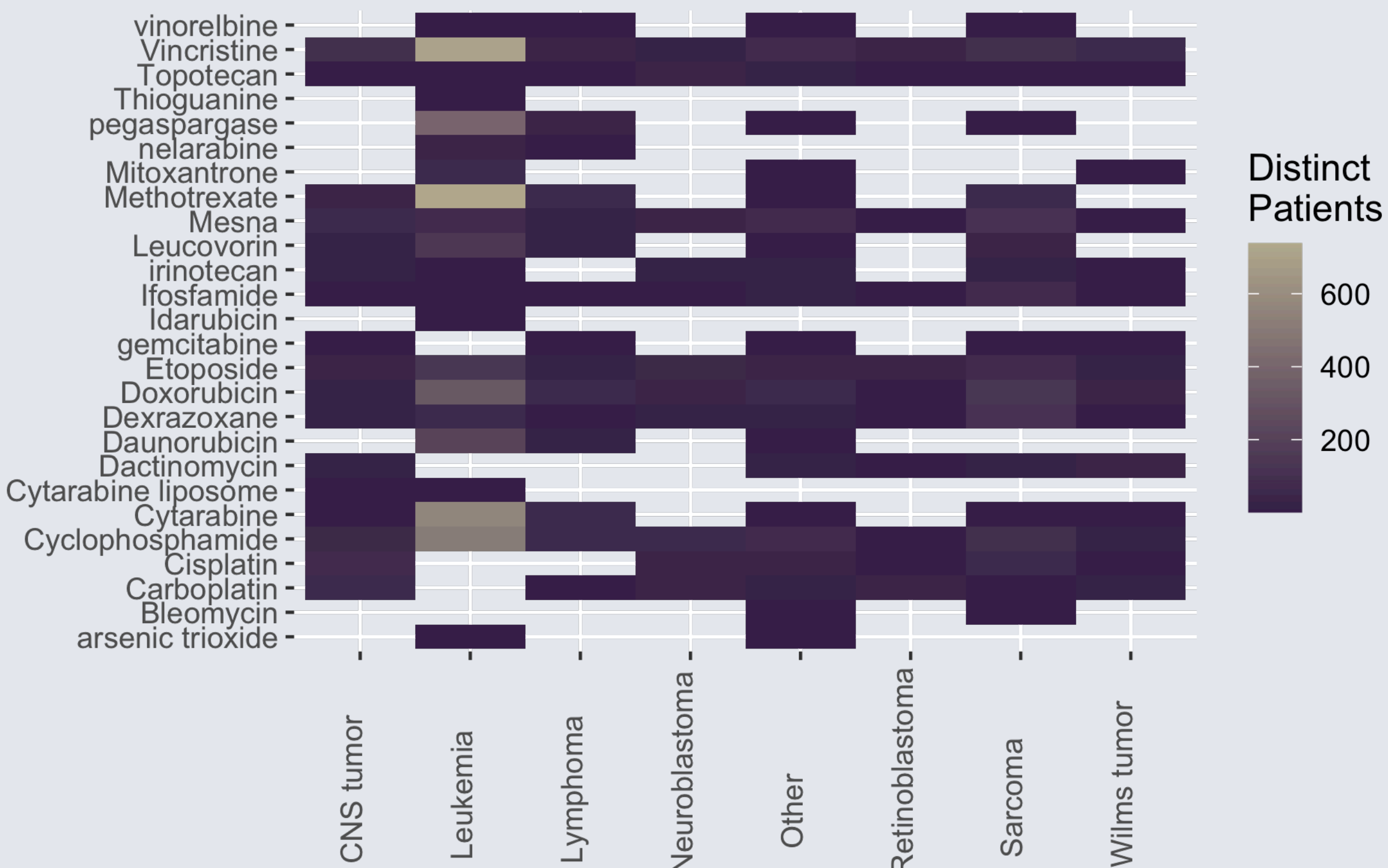
- **PEDSnet:** Clinical Data Research Network (CDRN) of over 6 million children in the United States from seven children’s hospital health systems (those included in this study are anonymized)
- **Target Analysis:** Drug exposure data from 6 PEDSnet institutions for 25 common parenteral chemotherapy medications between January 1, 2017 and December 1, 2018
- **Preparing for Analysis:** Intermediate mappings between ancestor ingredients and descendant drug formulations through concept_ancestor, filtering drug exposures by interdose intervals, and converting all drug exposures to milligrams/m² using the Mosteller method for body surface area (BSA) computation
- **Quality Analysis of Network Data:** (1) Mean drug exposure per patient; (2) Total drug exposure count/total person count; (3) Specific checks for vincristine, daunorubicin, doxorubicin, and ifosfamide as agents representing a broad range of treatment plans, (3a) Median dose basis compared to expected dose basis based on expected treatment protocols, (3b) Total number of drug exposures per person

Results

The pilot spanned a cohort of 3521 patients. Of these patients 98% had height and weight records at site A, 88% at site B, 99% at site C, 95% at site D, 88% at site E, and 85% at site F necessary for mg/m² conversions.



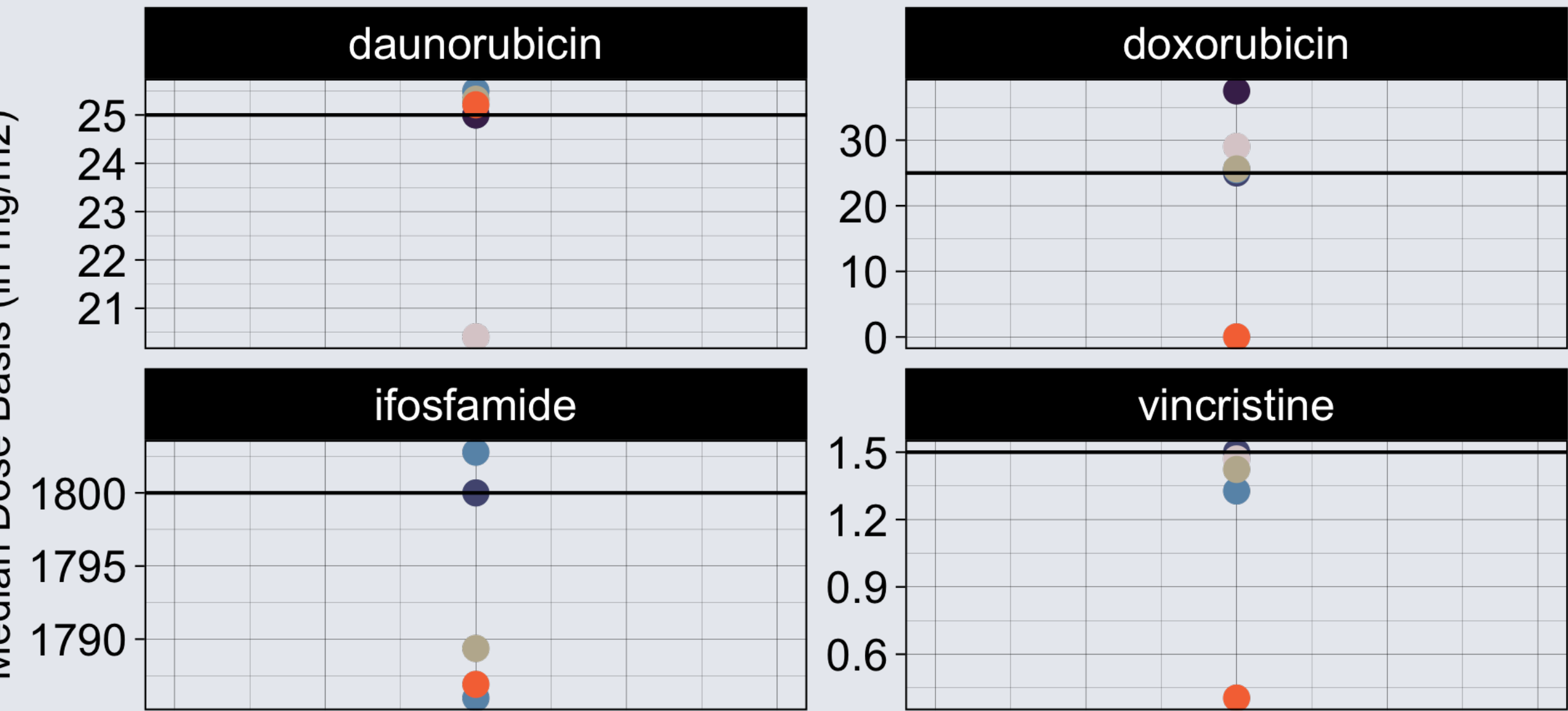
Across all sites, leukemia and sarcoma were the most treated conditions, and methotrexate and vincristine were the most used chemotherapeutics.



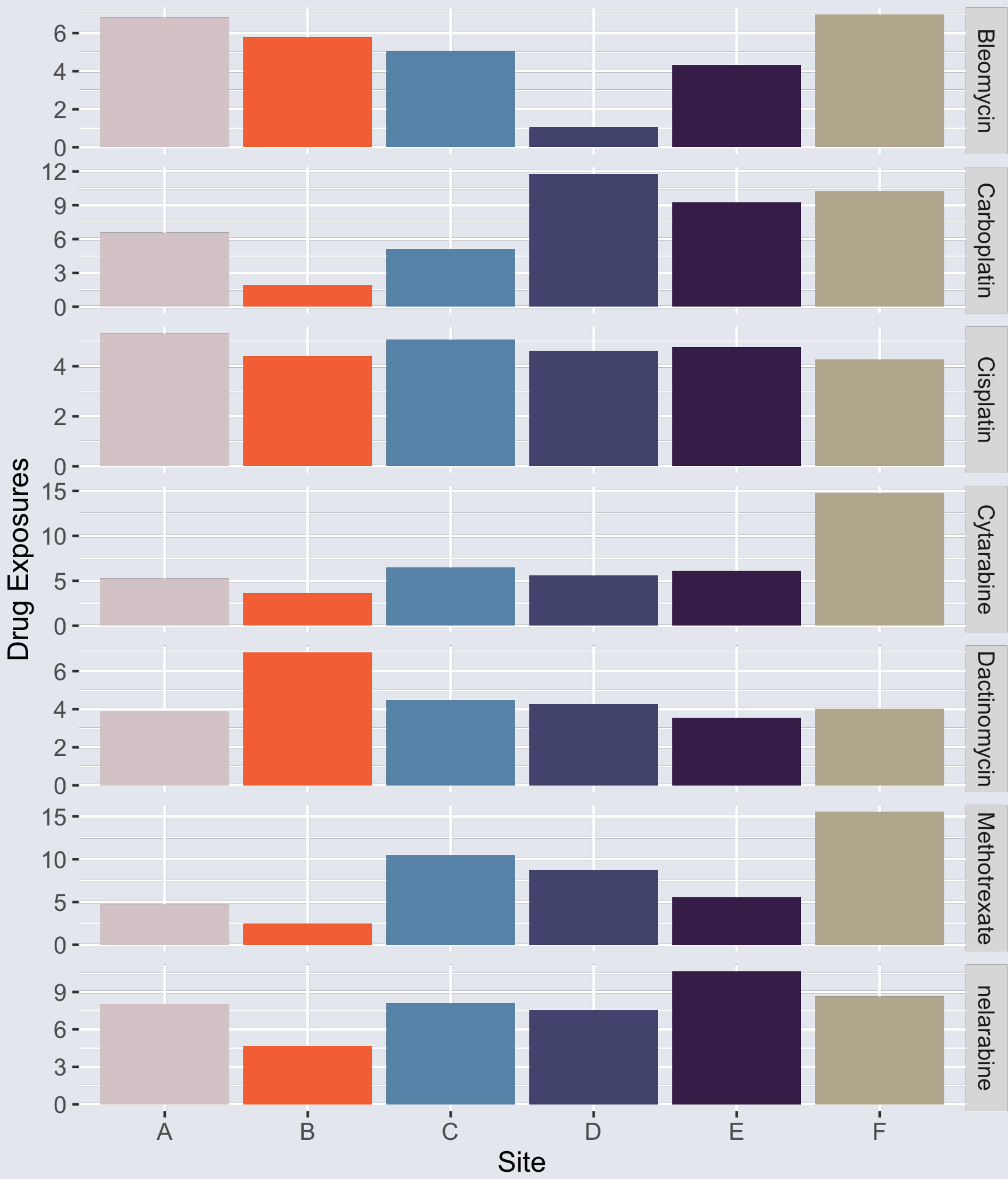
Eleven drugs were present in all 6 sites , nine drugs were present in all 5, three drugs were present in 4, one drug was present in all 3 sites, and one drug was present in 1 site.

Arsenic Trioxide (4/6 sites)	Bleomycin	Carboplatin	Cisplatin
Cyclophosphamide (5/6)	Cytarabine	Dactinomycin	Daunorubicin
	Cytarabine Liposomal (2/6)		Daunorubicin Liposomal (2/6)
Dexrazoxane (5/6)	Doxorubicin	Etoposide (5/6)	Gemcitabine (4/6)
	Doxorubicin Liposomal (1/6)		
Ifosfamide (5/6)	Irinotecan (5/6)	Leucovorin	Mesna (5/6)
Methotrexate	Mitoxantrone (4/6)	Nelarabine	Pegaspargase
Thioguanine (1/6)	Topotecan (5/6)	Vincristine (5/6)	Vinorelbine (5/6)
			Idarubicin (3/6)

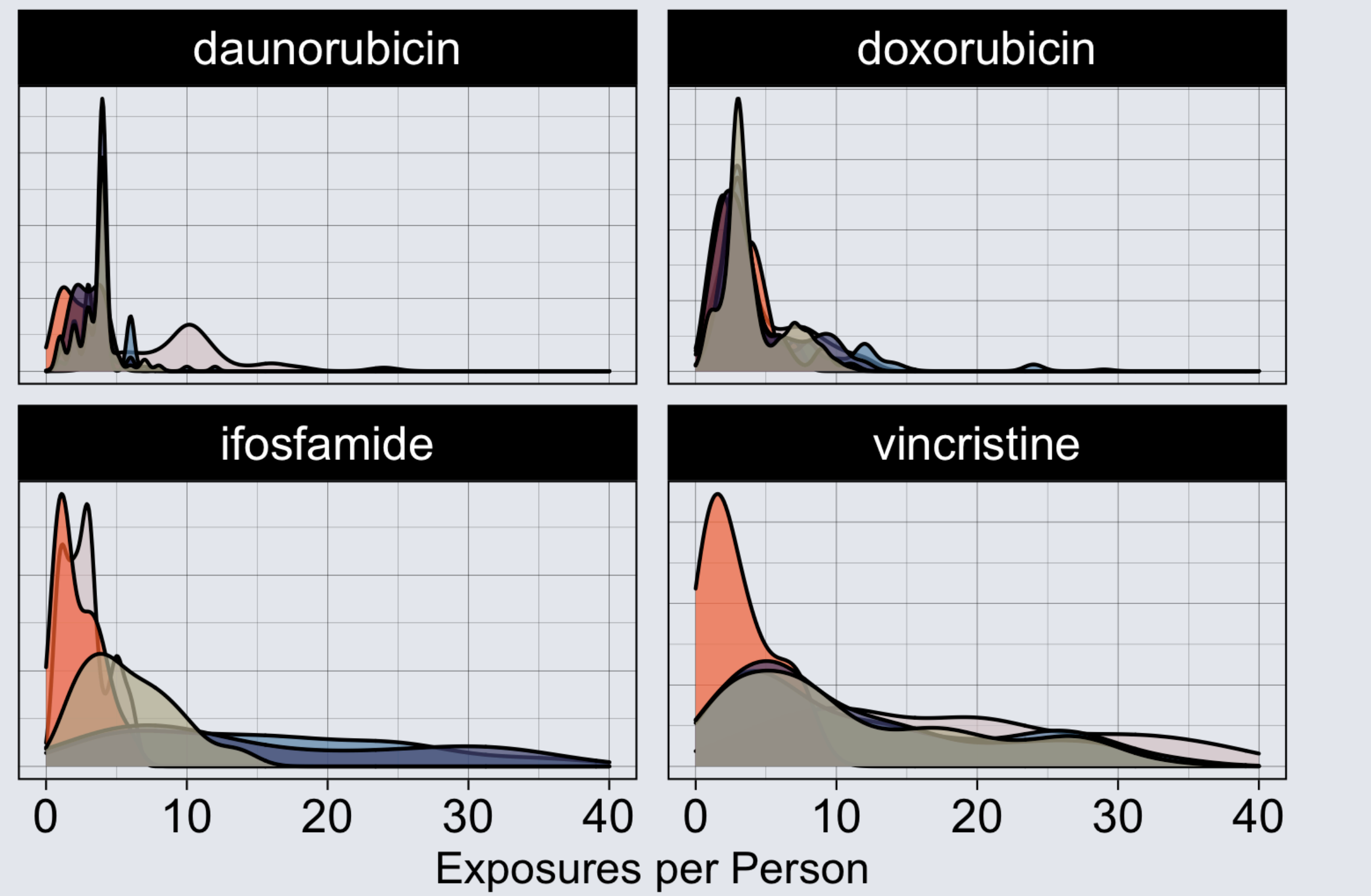
Comparing median dose basis by site against the expected dose basis



Distribution of total drug exposures for all patients that have been exposed to a specific medication



Total number of drug exposures per person



Conclusion + Discussion

- There is still work that needs to be done to use PEDSnet as a tool to reliably estimate the use of chemotherapeutics
- Many of these remaining underlying issues are not clear without going back to the institutions for further investigation (e.g. high number of drug exposures in Site A and F, missing effective drug doses in Site A, B; missing drug exposures for Vincristine in Site E)
- Despite these issues, data standardized to a common data model can be a useful tool for informing the establishment of a national drug reserve (e.g. comparison with pharmacy purchasing data for each site)