A Data Driven, Precision Public Health Approach to Uncovering and Addressing Disparities in Early Age at Onset Hematologic Malignancies

Tesla D. DuBois, MS; Tammarah Sklarz, MD; Shannon M. Lynch, PhD, MPH

Temple University

FOX CHASE CANCER CENTER
TEMPLE HEALTH

Background

Hematologic malignancies (HMs) are the third most prevalent group of cancers diagnosed at an early age (under the age of 50) after breast and gastrointestional cancers. HMs are generally considered sporadic cancers, driven by genetic errors. However, our prior work found patterns of geospatial variation in early age at onset hematologic malignancies (EOHM), thus suggesting environment, or where a person lives, may contribute to these geographic disparities and EOHM development. More specifically, the burden of EOHM was found to be in Northeastern States and Florida, where a higher percentage of race/ethnic minorities live.

HMs are heterogenous with a number of subtypes contributing to the burden of EOHM (Figure 1). Further evaluation into the role of race/ethnic, geographic, and sex-specific disparities for HMs and associated subtypes are needed, as this is an understudied area.

Goal:

This study leverages publicly available cancer surveillance data to identify race/ethnic, sex, and geographic disparities in the blood cancers overall and the 6 most prevalent EOHMs (Figure 1b). Utilizing a novel Precision Public Health approach, we aim to go beyond identifying disparities to pinpoint where public health resources and future research studies should be conducted to address EOHMs.

Methods

Step 1. Incidence rates (IRs) per 100,000 using the 2000 US standard population were calculated. Incidence Rate Ratios (IRR) and their confidence intervals (CI) were calculated for gender and race/ethnic subpopulations and States. An IRR of more than 1 indicates the race/ethnic group or State has a higher rate compared to the population overall.

Step 2. Within each race/ethnic subpopulation, IRRs were calculated for each State using the same subpopulation throughout the whole U.S as the reference to identify States doing worse than the US overall for the racial/ethnic subpopulations and EOHC.

Step 3. IRRs were calculated by state for each of the six EOHC subtypes, using the national rate for that subtype as the reference.

Results of a Precision Public Health "Narrow Down" Approach

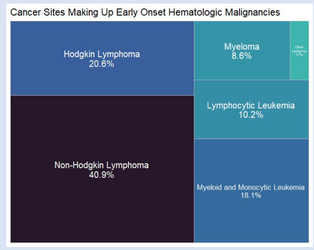
Step 1. Identify Subpopulations and States with Disproportionate EOHMS rates

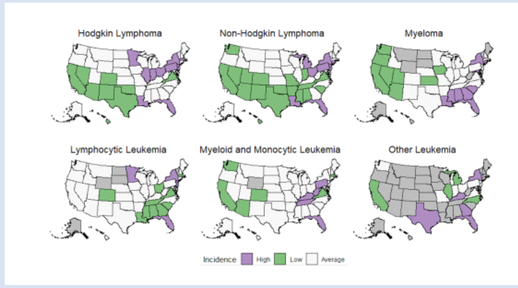
Table 1: U.S. Cancer Incidence Onset (2016 - 2020) by Sex, Race, & Region

	All Onset			Late Age				Early Age			
Population	Count	Advanced	Rate	Count	Advanced	Rate	IRR	Count	Advanced	Rate	IRR
Overall	791,674	72.8%	57.2	689,251	73.8%	121.5	Ref	102,423	65.7%	16.5	Ref
Male	448,208	73.8%	70.9	390,968	74.7%	153.7	1.265	57,240	67.3%	18.4	1.115
Female	343,466	71.5%	46.1	298,283	72.7%	95.9	0.789	45,183	63.5%	14.6	0.884
White	578,503	72.5%	58.9	519,884	73.3%	125.5	1.032	58,619	64.5%	16.7	1.012
Black	81,908	78.7%	56.5	66,023	81.0%	115.1	0.947	15,885	69.2%	19.3	1.169
American Indian / Alaskan Native	4,125	73.9%	45.6	3,366	74.5%	93.7	0.771	759	71.4%	15.2	0.921
Asian / Pacific Islander	24,995	69.3%	34.4	19,759	70.9%	70.8	0.582	5,236	63.5%	11.4	0.690
Hispanic	74,278	70.9%	49.4	56,031	71.8%	104.2	0.857	18,247	68.0%	14.8	0.896

- *Count = the count of cases within the given population*
- *Advanced = the percentage of cases within the population that were "Distant" stage.*
- *Rate = the age-adjusted rate for the given population*
- *IRR = Incidence Rate Ratio of given population compared to overall incidence rate for early age at onset*

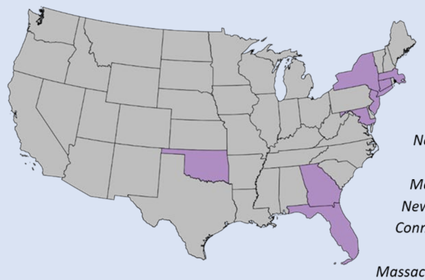
Figure 1.





Step 1 Summary: Non-Hispanic Black males have a highest burden of (EOHM) compared to other populations; females are disproportionately impacted by early onset compared to late onset. Slight geographic variation exists in EOHC subtypes, with Northeast Eastern, MidWest, and Florida commonly identified as having a higher than expected incidence of EOHM.

Step 2. States with High EOHMs Rates AND Race/Ethnic Disparities



'ncidence Rate Ratios (IRR) Comparing State to Nation within Race/Ethnic Group

	NHB	NHAIAN	NHAPI	Hispanic
Florida	1.1727			1.3325
New York	1.1355		1.1648	1.3166
Maryland			1.2642	
New Jersey			1.206	1.2807
Connecticut				1.2525
Massachusetts				1.1392

Summary:

States identified to have significant disparities in incidence of EOHM in the racial subpopulations who are most burdened with early onset disease.

Step 3. EOHM Subtypes for States with High Rates AND Race/Sex Disparities

Summary:

Florida had high IRR across all subtypes and New York had the high IRR across five out of six subtypes. Namely, rates of Hodgkin Lymphoma and Non-Hodgkin Lymphoma increased between 2015-2019 for NHB and Hispanic race/ethnic groups in New York, and rates of Myeloid and Monocytic Leukemia increased in Florida for the Hispanic population.

	Hodgkin Lymphoma	*Lymphocytic Leukemia*	*Myeloid and Monocytic Leukemia*	*Myeloma*	*Non-Hodgkin Lymphoma*	*Other Leukemia*
New York	**1.2105#+**	1.2349		1.2429	**1.264#+**	1.3092
Florida	1.185	1.231	**1.2741+**	1.2404	1.3076	1.7083
New Jersey	1.3006	1.2199			1.1936	
				1.4773		1.3493
Connecticut				1.2302	1.1303	
Maryland				1.2579		

 # Denotes rates increased between 2015-2019 among NHB population
+ Denotes rates increased between 2015-2019 among Hispanic population

Conclusion:

Our novel approach offers replicable methods for identifying and prioritizing areas for resource allocation and intervention. Our results suggest research efforts to decrease the burden of EOHMs should focus on New York (non-Hodgkins and Hodgkins) and Florida (Myeloid and Monocytic Leukemia).