Reducing Cancer Disparities Based on Race and Ethnicity

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Rocky Mountain Oncology Society
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Objectives

- What is currently known about adult and pediatric disparities
- Progression of work on establishing existence of disparities, investigating causes, and piloting interventions
- Current work on interventions and what we can learn
- Future directions

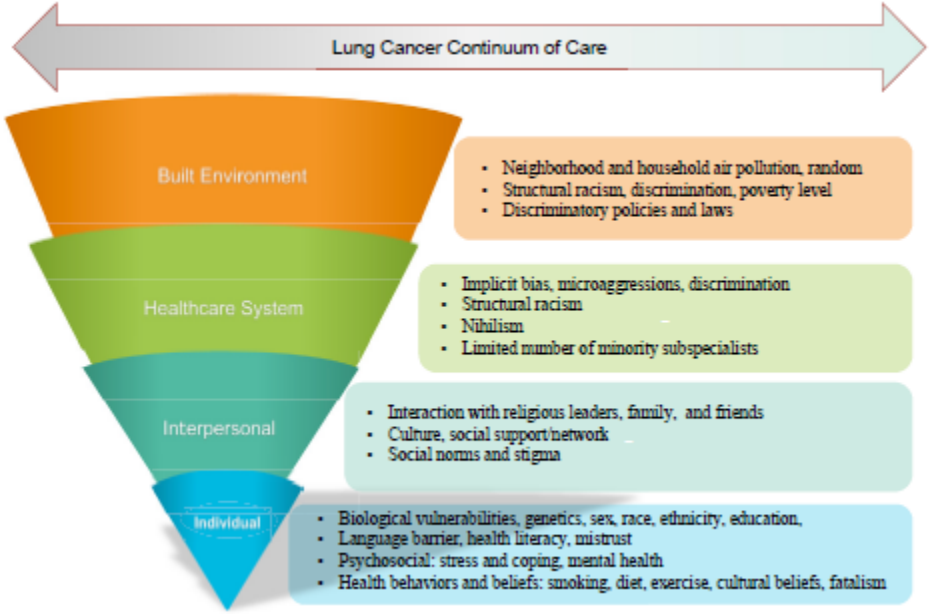
Introduction to Cancer Disparities

- Differences in morbidity and mortality based on demographic and socioeconomic factors
- Multifactorial causes
  - Healthcare system, insurance
  - Socioeconomic status
  - Differences in environmental exposures, infections
- Racial/ethnic vs. socioeconomic factors

Beltrami … Green, *Cancer Epi* 2022

Lung Cancer

- Minority racial, ethnic, and rural populations bear the majority of lung cancer mortality burden
  - Less referral to smoking cessation programs
  - Higher exposure to air pollution



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Rivera *et al., Clin Chest Med* 2023

Breast Cancer

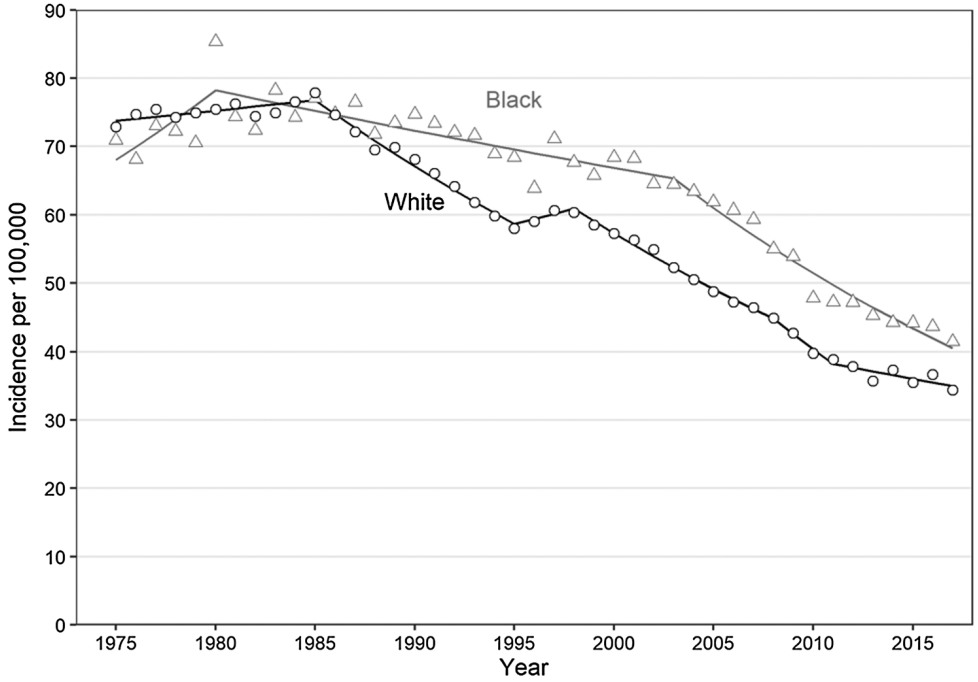
- Multiple risk factors lead to disparities in breast cancer
  - BRCA1 rates are higher among Hispanic compared to non-Hispanic women
  - Differences in rates of physical activity and obesity by race and ethnicity (important both in incidence and mortality after diagnosis)
  - Tumor biology and treatment response/complications
  - History of medical abuse and experimentation leading to mistrust and treatment differences

	White	Black
Incidence rates	127.7	125.1
Death rates	20.6	29.2

Yedjou *et al., Adv Exp Med Biol* 2019

Colon Cancer

- Disparities in colon cancer incidence emerged when screening became widely available, suggesting a cause.
- Mortality is highest among Black patients compared to other races



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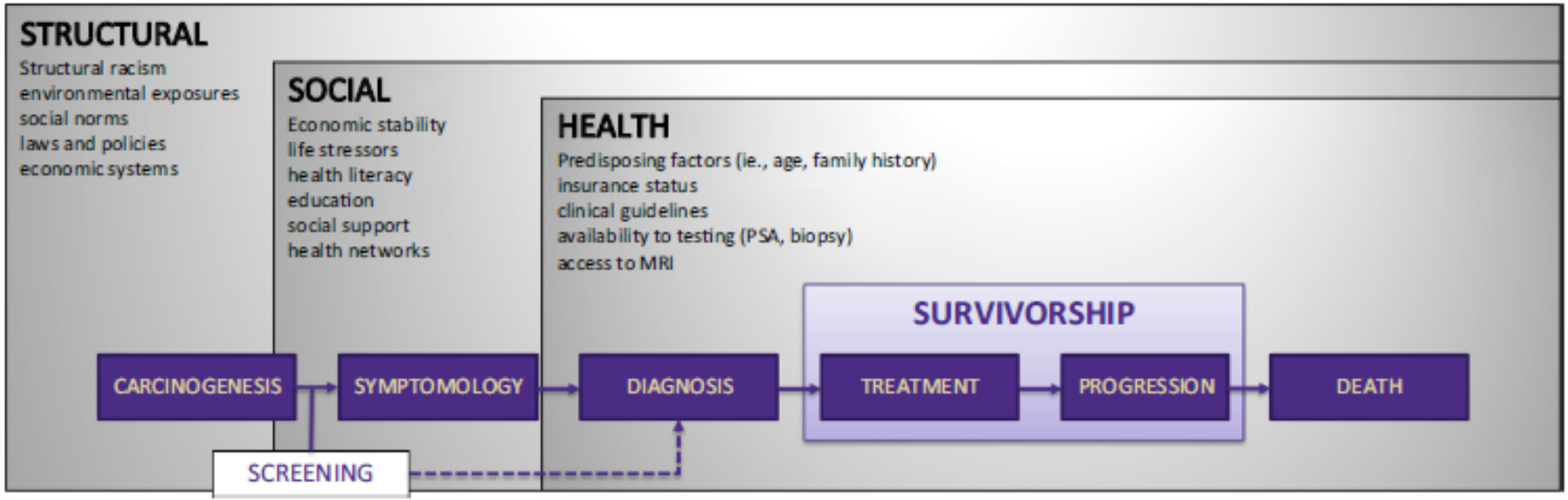
Rutter *et al., Cancer Epidemiol Biomarkers Prev* 2021

Prostate Cancer

- Few Black men involved in screening/PSA studies
- Increased incidence of aggressive/metastatic disease; largest disparities



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Nyame *et al., Eur Urol* 2022

Childhood Cancer Disparities

Cancer Type	Ethnic/Racial Disparities	SES Disparities
Hematologic Malignancies		
ALL	Black, Hispanic, & Native American have worse OS compared to White children [8–11]. Asian American children can either have worse [8] or similar [9] OS compared to White children.	Lower SES is associated with poorer recurrence-free and OS [5,7,29–30].
AML	Black children have worse OS compared to White children [10,12]. Hispanic children have no difference in OS compared to white children [12].	Lower SES is associated with poorer recurrence-free and OS [5,7,29–31].
Hodgkin Lymphoma	OS differences have been mixed between non-White and White children; some studies found no difference [10], while others found a difference [13,14]. Poorer OS in Black adolescents has been noted [10].	No or private insurance associated with poorer OS for AYAs [30].
Non-Hodgkin Lymphoma	No difference in OS found [13].	Not studied in reviewed references
Central Nervous System Tumors		
General CNS	Non-White children have worse OS compared to White children [15–18].	Lower SES is associated with worse OS [17].
Astrocytoma	Hispanic, Black, and Asian American children have worse OS compared to White children [19].	Not studied in reviewed references
High-Grade Glioma	Non-White children have worse OS compared to White children [18].	For AYAs, insurance status is a predictor of OS [30].
Medulloblastoma	No difference in OS found [18]	Lower SES is associated with worse OS [32].
Solid Tumors		
Soft Tissue Sarcoma	Hispanic and Black children have worse OS compared to White children [20].	Not studied in reviewed references
Melanoma	Hispanic children have worse OS compared to white children [25]	Not studied in reviewed references
Chest Wall Sarcoma	Black children have worse OS compared to White children [21].	AYAs with lower SES have worse OS [21].
Ewing Sarcoma	Hispanic, Black, and Asian American children have a higher likelihood of death compared to White children [22]. Black children have worse OS compared to White children [22].	AYAs with lower SES have worse OS [13,36].
Retinoblastoma	Hispanic children have worse OS [23,24] compared to non-Hispanics. Black children have lower OS compared to White children [24].	Lower SES is associated with more invasive disease [23,24].
Liver Cancer/ Hepatoblastoma	Black children have worse OS compared to White children [26].	Lower SES is associated with worse OS [23,30]. AYAs with lower SES have worse OS [35].
Rectal Cancer	Black and Hispanic AYAs had delays in care compared to white AYAs [27].	Lower SES is associated with lack of treatment and significant delays in treatment [27].
Testicular Cancer	Hispanic, Black, and Asian American AYAs have worse OS compared to White AYAs [28].	Lower SES is associated with worse OS [28].
Well-differentiated thyroid cancer	Not studied in reviewed references	Lower SES is associated with advanced stage of disease at diagnosis [33].
Rhabdomyosarcoma	Not studied in reviewed references	AYAs with lower SES have worse OS [13,37].
Osteosarcoma	Not studied in reviewed references	AYAs with lower SES have worse OS [38].
Fibrosarcoma	Not studied in reviewed references	AYA insurance status is a predictor of OS [30].
Peripheral Nerve Tumors	Not studied in reviewed references	AYA insurance status is a predictor of OS [30].
Malignant Germ Cell Tumors	Not studied in reviewed references	AYA insurance status is a predictor of OS [30].

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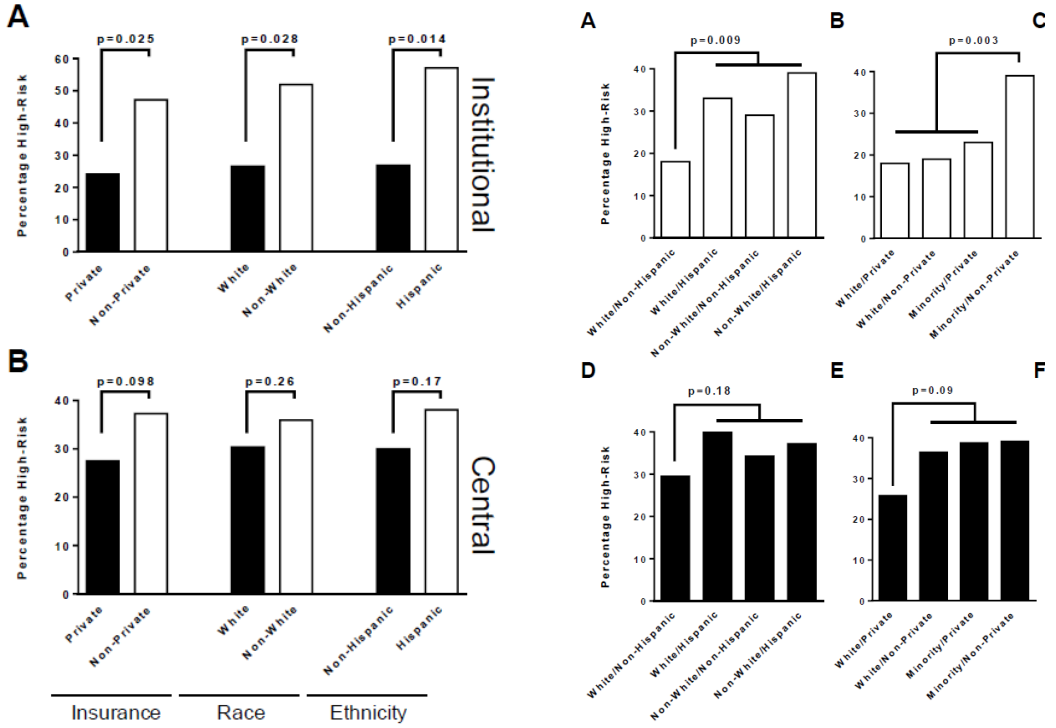
Beltrami … Green, *Cancer Epi* 2022

Access to Care in Retinoblastoma

Black, Hispanic, and patients with non-private insurance showed more extensive disease at diagnosis than their counterparts.



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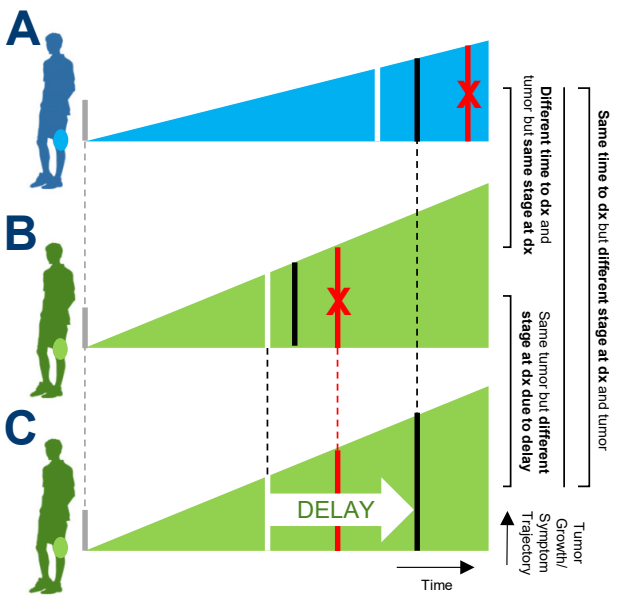
Green *et al., Ophthalmology* 2016

Disparities in Bone Tumors

- SEER study 2004-2015
- Osteosarcoma:
  - Hispanic and those living in areas of high language isolation more likely to have metastatic disease
  - Public insurance patients have increased odds of death
- Ewing sarcoma: Non-white adolescents and adolescents in high areas of poverty with metastatic disease have higher odds of death
- Time (biology) vs. delay (socioeconomic)?



Symptom onset / Diagnosis and start of treatment / First care seeking / Metastatic breakout (X if avoided)			DELAY
Rate of Tumor Size Increase	Low	Standard	Standard
Time from Care Seeking to Dx	Standard	Standard	**Delayed**
Time from Sx Onset to Dx	Long	Standard	Long
Metastases at Dx?	No	No	**Yes**

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Goulding … Green *JPHO* 2022

Early Death in Childhood Cancer

	Model											
	Hematologic Malignancies*				CNS Tumors†				Solid Tumors‡			
	Crude	Adjusted			Crude	Adjusted			Crude	Adjusted		
Variable	OR	OR	95% CI	*P*	OR	OR	95% CI	*P*	OR	OR	95% CI	*P*
Age, years												
< 1	**4.36**	**4.32**	**2.76 to 6.78**	**< .001**	**19.30**	**18.55**	**9.97 to 34.53**	**< .001**	**7.98**	**5.34**	**2.41 to 11.83**	**< .001**
1-4	0.75	0.76	0.51 to 1.15	.194	**2.91**	**2.84**	**1.52 to 5.31**	**< .001**	1.84	1.29	0.55 to 3.04	.557
5-9	0.78	0.79	0.50 to 1.22	.285	1.75	1.73	0.88 to 3.38	.110	1.27	0.70	0.21 to 2.34	.561
10-14	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
15-19	**1.69**	**1.76**	**1.24 to 2.51**	**.002**	**2.05**	**2.10**	**1.04 to 4.24**	**.039**	1.70	1.69	0.77 to 3.72	.192
Race												
White	Ref	Ref	Ref	Ref					Ref	Ref	Ref	
Black	**1.33**	**1.68**	**1.13 to 2.49**	**.010**					1.72	**1.88**	**1.03 to 3.44**	**.041**
Other	1.15	1.44	0.94 to 2.19	.091					1.35	1.15	0.55 to 2.38	.716
Ethnicity												
Non-Hispanic	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref				
Hispanic	**1.57**	**1.48**	**1.10 to 1.99**	**.009**	**2.04**	**1.66**	**1.16 to 2.37**	**.005**				
Income												
Advantaged	Ref	Ref	Ref	Ref								
Disadvantaged	**1.41**	**1.51**	**1.07 to 2.14**	**.019**								

Black race, Hispanic ethnicity, and low family income are all risk factors for death within one month of childhood cancer

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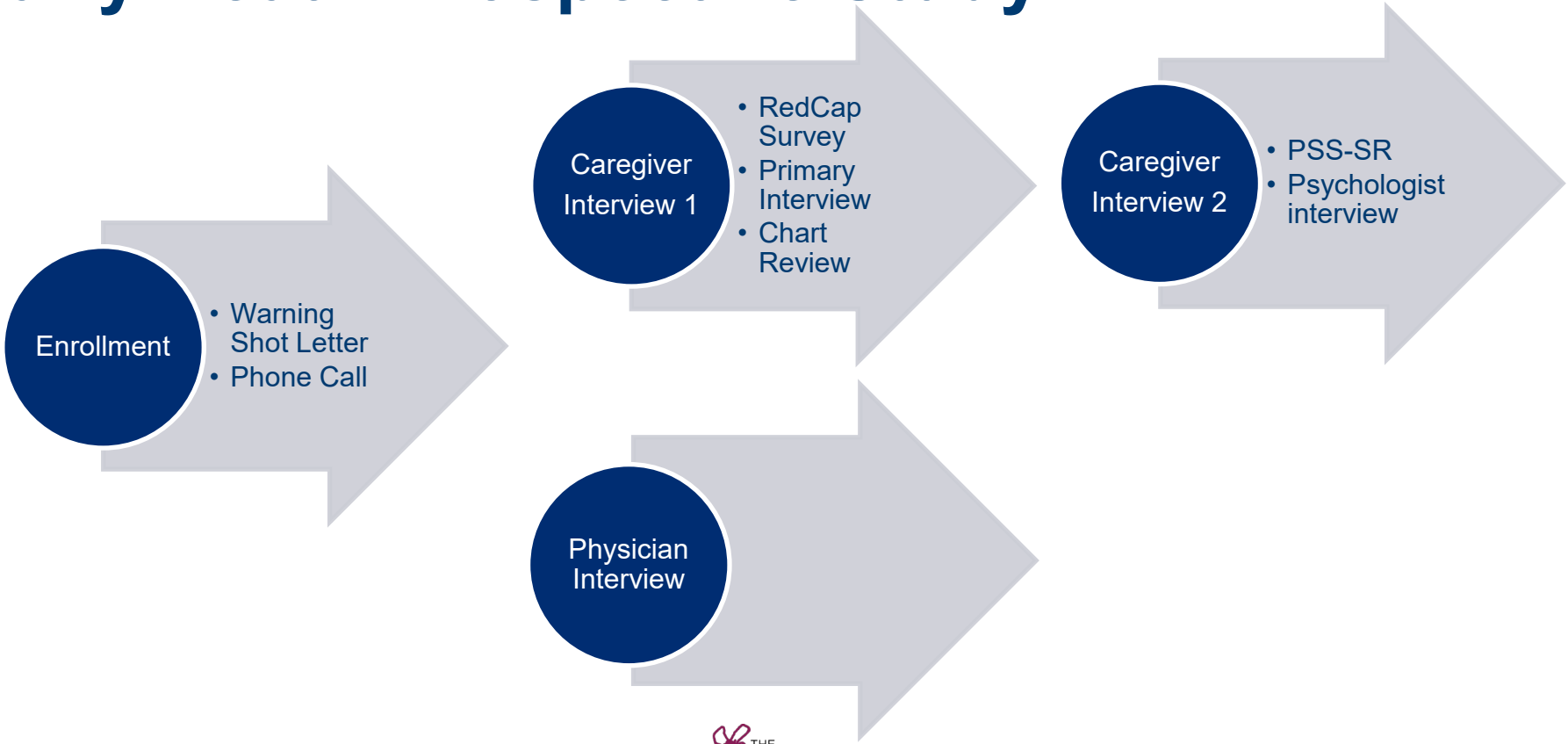
Green … Rodriguez Galindo, *JCO* 2017

Early Death: Diagnostic Timing

Variable	Case		Control		T-test [2]
	N	Mean	N	Mean	*P*
Overall	39	29.41	35	9.77	0.074
Type of Malignancy					
Brain/CNS	21	37.10	12	14.42	0.250
Hematologic	13	21.31	11	9.00	0.191
Solid	5	18.20	12	5.83	0.458
Type of Insurance					
Private (only)	13	45.15	16	9.06	0.256
Public (any)/Uninsured	13	22.62	12	6.42	0.075

Early Death Prospective Study



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Lind … Green COMIRB protocol

Pediatric CNS Tumor Disparities

- SEER 18 registries since 2000
- 2000 census-based SES analysis except for insurance (2007-)
- Correlate characteristics with metastatic disease at diagnosis and overall survival

	Multivariable analysis								
	Controlled for: Demographic and Tumor Characteristics (N = 1787)			Controlled for: Demographic, Tumor, and Treatment Characteristics (N = 1769)			Controlled for: Demographic, Tumor, Treatment, and SES Characteristics (N = 1769)		
Variable	HR	HR 95% CI	p-value	HR	HR 95% CI	p-value	HR	HR 95% CI	p-value
Year of Diagnosis	0.99	(0.97, 1.01)	0.2321	0.99	(0.97, 1.00)	0.1021	0.99	(0.97, 1.00)	0.1409
Female (ref) Male	1.15	(1.00, 1.33)	0.0529	1.13	(0.98, 1.31)	0.0936	1.14	(0.99, 1.32)	0.0696
White (ref) Black Other	1.39 1.09	(1.14, 1.70) (0.83, 1.43)	**0.0014** 0.5329	1.36 1.09	(1.11, 1.67) (0.83, 1.43)	**0.0035** 0.5243	1.29 1.06	(1.04, 1.59) (0.80, 1.40)	**0.0206** 0.6765
Non-Hispanic (ref) Hispanic	1.36	(1.16, 1.60)	**0.0002**	1.33	(1.13, 1.57)	**0.0006**	1.29	(1.08, 1.53)	**0.0051**

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Fineberg, Zahedi … Green *Sci Rep* 2020

Extent of Disease at Diagnosis

Variable	Total N	Percent Reg/Dist	Controlled for: Demographic and Tumor Characteristics			Controlled for: Demographic, Tumor, and SES Characteristics		
			OR	OR 95% CI	p-value	OR	OR 95% CI	p-value
Year of Diagnosis (continuous)			0.97	(0.95, 0.99)	**0.0145**	0.97	(0.95, 0.99)	**0.0148**
Female (ref) Male	808 988	27.35% 24.09%	0.84	(0.67, 1.04)	0.1129	0.84	(0.67, 1.04)	0.1116
White (ref) Black Other	1409 231 147	26.12% 23.38% 23.81%	 0.89 0.94	 (0.63, 1.25) (0.62, 1.42)	 0.5097 0.7645	 0.93 0.91	 (0.65, 1.31) (0.59, 1.38)	 0.6653 0.6520
Non-Hispanic (ref) Hispanic	1294 502	23.88% 29.88%	1.32	(1.03, 1.68)	**0.0272**	1.25	(0.96, 1.63)	0.0905

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Fineberg, Zahedi … Green *Sci Rep* 2020

Stratified Survival Analysis

Localized Disease at Diagnosis									
	Controlled for: Demographic and Tumor Characteristics (N = 1330)			Controlled for: Demographic, Tumor, and Treatment Characteristics (N = 1315)			Controlled for: Demographic, Tumor, Treatment, and SES Characteristics (N = 1315)		
Variable	HR	HR 95% CI	p-value	HR	HR 95% CI	p-value	HR	HR 95% CI	p-value
Year of Diagnosis	1.00	(0.98, 1.02)	0.7188	0.99	(0.97, 1.01)	0.3675	0.99	(0.97, 1.01)	0.3839
Male vs. Female (ref)	1.12	(0.94, 1.33)	0.2133	1.09	(0.92, 1.30)	0.3305	1.09	(0.91, 1.29)	0.3554
Black vs. White Race (ref)	1.35	(1.07, 1.72)	**0.0131**	1.26	(0.99, 1.61)	0.0616	1.24	(0.96, 1.59)	0.0954
Other vs. White Race (ref)	1.14	(0.82, 1.57)	0.4421	1.16	(0.84, 1.61)	0.3745	1.11	(0.80, 1.55)	0.5292
Hispanic vs. Non-Hispanic Ethnicity (ref)	1.36	(1.12, 1.66)	**0.0023**	1.32	(1.08, 1.62)	**0.0064**	1.27	(1.02, 1.57)	**0.0304**

Regional/Distant Disease at Diagnosis									
	Controlled for: Demographic and Tumor Characteristics (N = 457)			Controlled for: Demographic, Tumor, and Treatment Characteristics (N = 454)			Controlled for: Demographic, Tumor, Treatment, and SES Characteristics (N = 454)		
Variable	HR	HR 95% CI	p-value	HR	HR 95% CI	p-value	HR	HR 95% CI	p-value
Year of Diagnosis	0.97	(0.94, 1.00)	**0.0346**	0.97	(0.94, 1.00)	**0.0285**	0.96	(0.93, 1.00)	**0.0265**
Male vs. Female (ref)	1.24	(0.96, 1.62)	0.0996	1.24	(0.95, 1.61)	0.1120	1.30	(1.00, 1.70)	**0.0495**
Black vs. White Race (ref)	1.53	(1.04, 2.25)	**0.0323**	1.63	(1.10, 2.41)	**0.0144**	1.41	(0.93, 2.14)	0.1026
Other vs. White Race (ref)	1.04	(0.64, 1.70)	0.8701	1.00	(0.60, 1.65)	0.9970	1.00	(0.60, 1.68)	0.9852
Hispanic vs. Non-Hispanic Ethnicity (ref)	1.35	(1.02, 1.80)	**0.0351**	1.36	(1.02, 1.81)	**0.0335**	1.38	(1.01, 1.88)	**0.0462**

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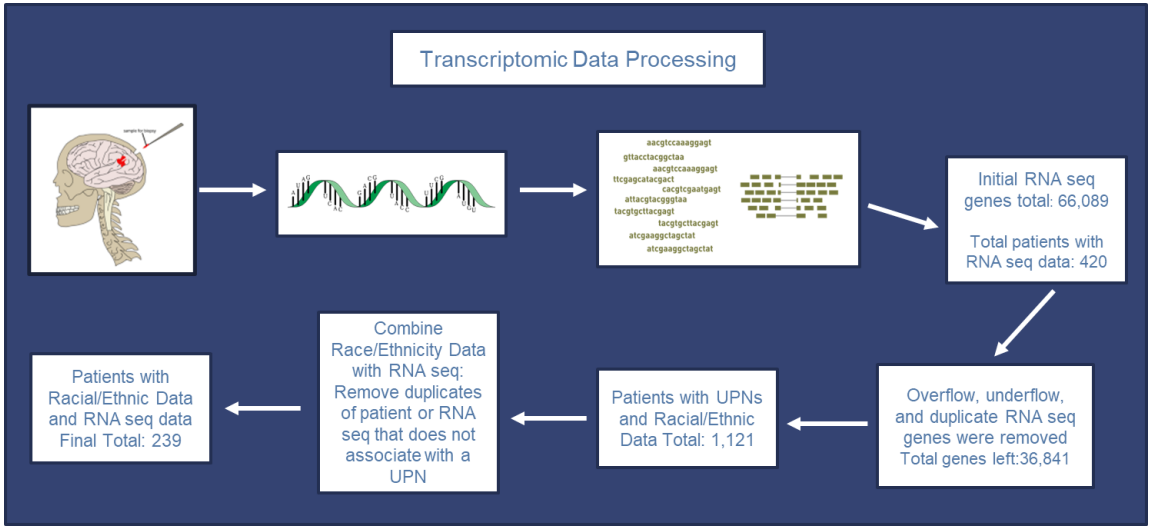
Fineberg, Zahedi … Green *Sci Rep* 2020

CNS Tumor Disparities at CHCO Patient-Level

- Much more detail, ability to assess social determinants, treatment, diagnostic timing
- Black and other non-White race patients less likely to receive cytotoxic chemo and be enrolled on a clinical trial
- Patients with social concerns more likely to receive radiation, targeted chemotherapy, and any form of chemotherapy
- Black patients and those with social concerns with low-grade tumors experienced slower diagnosis
- Asian/PI patients and children living in rural areas had worse overall survival

Hilliard … Green, ASPHO 2022

Tumor Expression Based on Demographics



- Preliminary results indicate differences in immune pathway expression but not tumor expression based on race/ethnicity
- Further analysis ongoing

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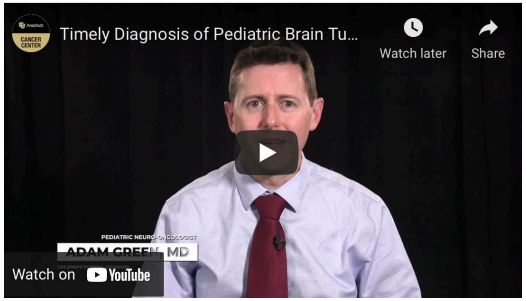
Aryanna Ryan, DU Master's Capstone 2022

Interventions: Family Interviews

- Goal: Understand family/patient considerations in treatment discussions
- Qualitative interviews of families and/or patients at new diagnosis and recurrence
- Follow-up interviews several months later
- Interviews and analysis ongoing

Interventions: HeadSmart

- Created talk on timely diagnosis of pediatric brain tumors based on HeadSmart program
- Disseminated via live talk or recording to primary providers to disadvantaged pediatric populations across the state
- Pre-post analysis of knowledge



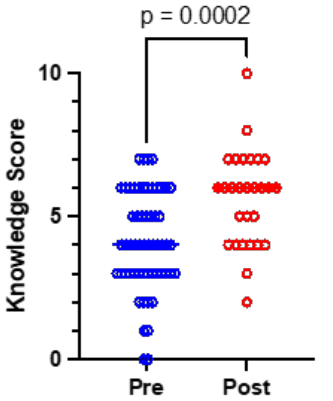


Figure 1. Unpaired knowledge scores for providers taking the pre- and post-assessment

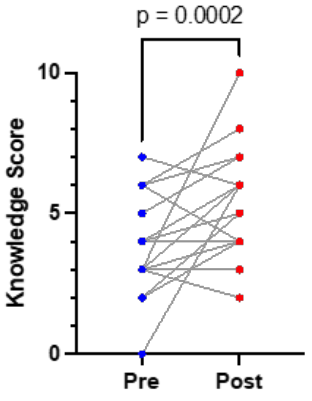


Figure 2. Paired knowledge scores for providers taking both the pre- and post-assessment

Pacheco … Green, ISPNO 2022

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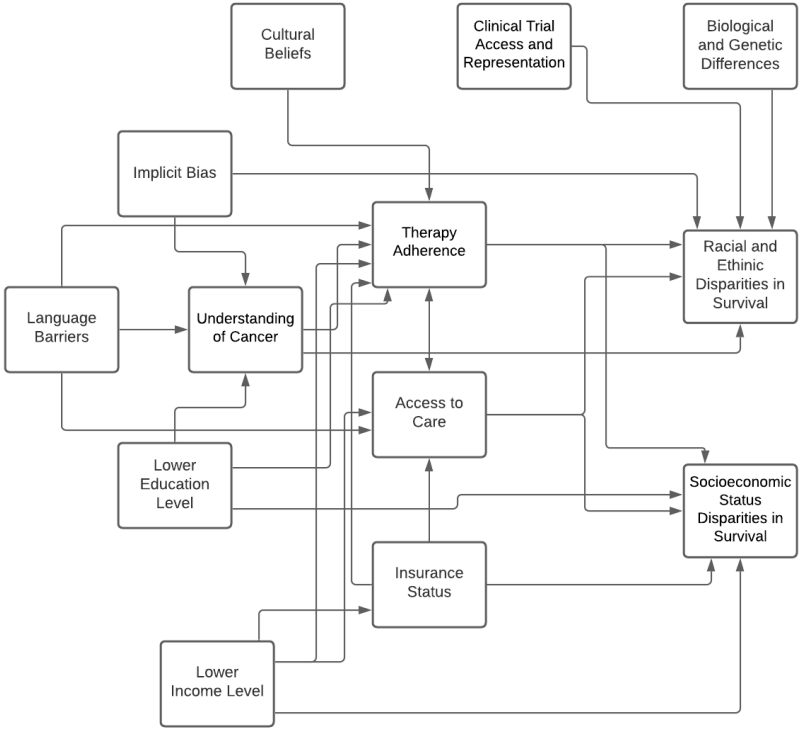
Summary: Childhood Cancer Disparity Causes

Identifying risk groups

Determining causes

Designing interventions



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Beltrami … Green, *Cancer Epi* 2022

Other Ongoing Work and Next Steps

- COG Registries: Using CCRN and PEC data to study disparities in extent of disease at diagnosis in Hodgkin, STS, GCT, and retinoblastoma
- Pediatric cancer understanding in healthy teens
- Develop early death project toward early interventions
- HeadSmart-like national project
- Epidemiology/lab synergy:
  - Understanding models
  - Biological risk factor differences by race/ethnicity

Interventions in Adult Cancer

- Engaging patient navigators as liaisons between patients and healthcare systems to address social determinants of health, improve screening
- Community partnerships: knowledge dissemination, trust building
- Diversification of healthcare workforce and representation in leadership/decision making
- Use of technology like text messaging, telehealth, and mobile screening
- Representation in biological models and genetic databases

Adult/Peds Differences and Commonalities

- Differences:
  - Cancer types and incidence
  - Screening and lifestyle factors less relevant in pediatrics
- Commonalities
  - Presence across cancers
  - Multifactorial causes
  - Many interventions

CBPR Principles	Implementing CBPR Principles in This Proposal
Community identifies a health concern	Communities across the country consistently identify the urgent need to enhance cancer screening interventions among high-risk individuals experiencing greater burden.
Community shares leadership to guide decision-making	The community participates in all phases of research or implementation of programs and outreach.
Community is engaged in intervention design	Communities provide feedback on all aspects of the intervention ensuring the cultural and linguistic congruency needed to impact the disparities in the lung cancer continuum.
Community guides researchers to effective recruitment strategies	The community guides the proposed referral methods, including collaborating with local community-based organizations and community health centers to reach the communities in greatest need of access to lung cancer care.
Community collaborates in interpreting findings	Continuously sharing the results with the community. The presence of the community voice will expand the understanding of the progress and help troubleshoot barriers or limitations over time.
Community collaborates in disseminating of the intervention	The community partners in defining and implementing dissemination activities in both academic, health care, and community settings.

Abbreviation: CBPR, community-based participatory research.

Rivera *et al., Clin Chest Med* 2023

Summary

- We have found racial, ethnic, and socioeconomic disparities almost everywhere we've looked in cancer.
- The causes differ across types but are multifactorial and involve pre-diagnostic, post-diagnostic, and biological factors
- Interventions are still developing and so far inadequate; need system-wide progress and community-based changes tailored to specific groups and problems

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Alex's Lemonade Stand
FOUNDATION FOR CHILDHOOD CANCER

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- The causes differ across types but are multifactorial and involve pre-diagnostic, post-diagnostic, and biological factors
- Interventions are still developing and so far inadequate; need system-wide progress and community-based changes tailored to specific groups and problems