



# SPATIAL ANALYSIS IN CANCER SURVEILLANCE:

## ADDRESSING COLORECTAL CANCER DISPARITIES IN A SPATIAL CONTEXT

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### I OVERVIEW:

Colorectal cancer (CRC) is one of the most common invasive cancers in the US. Routine screening reduces mortality and some screening modalities have the potential to reduce incidence. Despite strong evidence that CRC screening saves lives, screening rates remain low, particularly among minorities.

A multi-disciplinary team addressing colorectal cancer disparities has been working to identify geographic areas in Florida with higher burdens of CRC diagnosed at a late stage. **Identifying the location of areas at high risk of late-stage at diagnosis defines the physical location for screening intervention programs, and the characterization of the demographics of the populations at informs what type of intervention is appropriate for each community.**

This study modeled the odds of a CRC case being diagnosed in an area at high risk of late-stage CRC based on county-level CRC screening data, census tract-level SES characteristics, and patient-level data.

### II METHODS:

CRC cases diagnosed 2006-2010 and geocoded to 2010 Census boundaries in Florida were analyzed using SaTScan to identify clusters of late-stage at diagnosis of CRC for Blacks, Cubans, Hispanic Whites, and non-Hispanics Whites in Florida. Numerous analysis were conducted with varying methods and parameters to determine the appropriate area for intervention (see Abstract#2452). Both Poisson, rate of late-stage clusters, and Bernoulli, ratio of late:early stage clusters, were conducted.

Once the high risk areas were selected, logistic and hierarchical regression was performed (and compared) to identify demographic risk factors (individual from registry data; area-based from census) associated with increased risk of a late stage CRC diagnosis. Hierarchical modeling accounts for the data's geographically nested structure. County-level screening rates were from the 2010 BRFSS. Census tract-level SES data were from the 2010 American Community Survey.

### III RESULTS:

There were no statistically significant clusters of late-stage at diagnosis of CRC for Cubans and only clusters detected using the Poisson method were significant for White Hispanics. Census tract poverty, a known risk factor for late-stage disease, was protective against Blacks being diagnosed in a late-stage cluster in all models and protective for non-Hispanic Whites in the Poisson Models and a risk in the Bernoulli Models. In general, increased segregation by ethnicity was protective for Hispanics and a risk for Blacks and non-Hispanic Whites. Increased segregation by race was a risk for living in a cluster of late-stage CRC diagnoses.

Table 1. Blacks: Predictors of Colorectal Cancer Late-Stage at Diagnosis, Florida, 2006-2010

Poisson Method		Univariate		Full Model				Final Model													
		Logistic (SPSS)		Logistic (SPSS)		Hierarchical (SAS)		Logistic (SPSS)		Hierarchical (SAS)											
		OR	p-value	OR	p-value	OR	p-value	OR	p-value	OR	p-value										
Case Level	age	1.00	0.72	0.99	1.01	0.25	0.99	1.02	1.01	0.72	0.98	1.03	not included	not included							
	female vs male	1.17	0.2	0.92	1.11	0.47	0.83	1.49	0.96	0.89	0.56	1.67	not included	not included							
	govt vs private insurance	0.75	0.034	0.58	0.78	0.15	0.56	1.09	0.82	0.70	0.43	1.56	not included	not included							
	no insurance/self-pay vs private insurance	1.01	0.976	0.62	1.38	0.28	0.77	2.45	1.24	0.47	0.41	3.72	not included	not included							
Tract Level	% non-white	1.02	<.01	1.02	1.02	not included	not included	not included	not included	not included	not included	not included	not included	not included							
	% hispanic	1.03	<.01	1.03	1.04	not included	not included	not included	not included	not included	not included	not included	not included	not included							
	% minority	1.08	<.01	1.07	1.09	1.06	<.01	1.05	1.08	1.06	<.01	1.01	1.09	1.06	<.01	1.04	1.07	1.05	<.01	1.03	1.08
	% foreign born	1.04	<.01	1.03	1.05	0.98	0.24	0.96	0.99	0.98	0.28	0.95	1.02	0.99	0.01	0.98	1.00	not included	not included	not included	
	% hs grad	0.97	<.01	0.96	0.98	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	
	% not hs grad	1.03	<.01	1.02	1.04	0.95	<.01	0.92	0.97	0.92	<.01	0.86	0.98	not included	not included	not included	not included	not included	not included	not included	
	% college	0.99	0.07	0.98	1.00	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	
	% linguistically isolated	1.04	<.01	1.04	1.05	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	
	% no English spoken	1.11	<.01	1.09	1.13	1.09	<.01	1.04	1.13	1.11	0.05	1.00	1.23	not included	not included	not included	not included	not included	not included	not included	
	% at 150 of poverty rate	1.01	0.16	1.0	1.01	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	
% below poverty	1.01	0.07	1.0	1.02	0.99	0.12	0.97	1.00	0.96	0.13	0.92	1.01	0.97	<.01	0.96	0.98	0.93	<.01	0.90	0.97	
County Level	% ever received sigmoidoscopy/colonoscopy	0.73	<.01	0.71	0.76	0.80	<.01	0.77	0.83	0.85	<.01	0.77	0.93	0.81	<.01	0.78	0.84	0.85	<.01	0.79	0.93
	% received fob last 2 years	0.70	<.01	0.67	0.75	0.80	<.01	0.71	0.90	0.79	0.05	0.63	1.00	0.78	<.01	0.69	0.88	0.78	0.03	0.62	0.98

Bernoulli Method		Univariate		Full Model				Final Model													
		Logistic (SPSS)		Logistic (SPSS)		Hierarchical (SAS)		Logistic (SPSS)		Hierarchical (SAS)											
		OR	p-value	OR	p-value	OR	p-value	OR	p-value	OR	p-value										
Case Level	age	0.99	<.01	0.98	1.00	1.00	0.92	0.99	1.01	1.00	0.72	0.98	1.03	not included	not included						
	female vs male	1.02	0.796	0.86	1.20	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included						
	govt vs private insurance	0.63	<.01	0.52	0.76	0.86	0.23	0.67	1.10	0.82	0.55	0.43	1.56	not included	not included						
	no insurance/self-pay vs private insurance	1.06	0.73	0.76	1.48	1.18	0.42	0.79	1.77	1.23	0.71	0.41	3.70	not included	not included						
Tract Level	% non-white	1.01	<.01	1.01	1.02	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included						
	% hispanic	1.03	<.01	1.03	1.04	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included						
	% minority	1.03	<.01	1.03	1.03	1.02	<.01	1.02	1.03	1.06	<.01	1.04	1.09	1.02	<.01	1.02	1.03	1.05	<.01	1.03	1.08
	% foreign born	1.07	<.01	1.07	1.08	1.06	<.01	1.05	1.07	0.98	0.28	0.95	1.02	1.06	<.01	1.05	1.07	not included	not included	not included	
	% hs grad	0.99	0.014	0.98	1.00	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	
	% not hs grad	1.01	0.014	1.00	1.02	1.04	<.01	1.02	1.05	0.92	0.01	0.86	0.98	1.03	<.01	1.01	1.05	not included	not included	not included	
	% college	1.00	0.286	1.00	1.01	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	
	% linguistically isolated	1.06	<.01	1.06	1.07	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	
	% no English spoken	1.10	<.01	1.08	1.12	0.88	<.01	0.85	0.91	1.11	0.05	1.00	1.23	0.88	<.01	0.85	0.91	not included	not included	not included	
	% at 150 of poverty rate	0.98	<.01	0.98	0.99	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	
% below poverty	0.97	<.01	0.96	0.98	0.94	<.01	0.93	0.96	0.96	0.13	0.92	1.01	0.94	<.01	0.93	0.96	0.93	<.01	0.90	0.97	
County Level	% ever received sigmoidoscopy/colonoscopy	0.84	<.01	0.82	0.85	0.92	<.01	0.90	0.94	0.85	<.01	0.77	0.93	0.92	<.01	0.90	0.94	0.79	<.01	0.79	0.93
	% received fob last 2 years	0.79	<.01	0.77	0.82	0.86	<.01	0.81	0.90	0.79	0.05	0.63	1.00	0.85	<.01	0.81	0.90	0.62	0.03	0.62	0.98

Table 2. White Hispanics: Predictors of Colorectal Cancer Late-Stage at Diagnosis, Florida, 2006-2010

Poisson Method		Univariate		Full Model				Final Model													
		Logistic (SPSS)		Logistic (SPSS)		Hierarchical (SAS)		Logistic (SPSS)		Hierarchical (SAS)											
		OR	p-value	OR	p-value	OR	p-value	OR	p-value	OR	p-value										
Case Level	age	1.02	<.01	1.02	1.03	1.01	<.01	1.01	1.02	1.01	0.03	1.00	1.02	not included	not included						
	female vs male	1.11	0.08	0.99	1.25	1.01	0.89	0.86	1.19	0.99	0.97	0.74	1.34	not included	not included						
	govt vs private insurance	1.05	0.457	0.92	1.21	0.82	0.06	0.67	1.01	0.87	0.47	0.59	1.28	not included	not included						
	no insurance/self-pay vs private insurance	0.81	0.144	0.61	1.08	1.07	0.73	0.73	1.58	1.11	0.78	0.55	2.23	not included	not included						
Tract Level	% non-white	0.98	<.01	0.98	0.98	1.00	0.31	1.00	1.00	1.01	0.24	1.00	1.02	not included	not included						
	% hispanic	1.04	<.01	1.04	1.05	0.97	<.01	0.96	0.98	0.96	<.01	0.95	0.98	0.97	<.01	0.96	0.98	0.96	<.01	0.94	0.97
	% minority	1.05	<.01	1.05	1.06	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	
	% foreign born	1.08	<.01	1.07	1.08	1.09	<.01	1.08	1.10	1.12	<.01	1.09	1.14	1.09	<.01	1.08	1.10	1.12	<.01	1.09	1.14
	% hs grad	0.92	<.01	0.91	0.92	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	
	% not hs grad	1.09	<.01	1.09	1.10	1.02	<.01	1.01	1.04	1.01	0.65	0.98	1.04	not included	not included	not included	not included	not included	not included	not included	
	% college	0.98	<.01	0.98	0.99	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	
	% linguistically isolated	1.11	<.01	1.11	1.12	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	
	% no English spoken	1.25	<.01	1.23	1.26	1.05	<.01	1.03	1.08	1.08	0.02	1.01	1.15	1.07	<.01	1.05	1.10	1.10	<.01	1.05	1.16
	% at 150 of poverty rate	1.05	<.01	1.04	1.05	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	not included	
% below poverty	1.06	<.01	1.05	1.06	1.00	0.60	0.98	1.01	1.01	0.76	0.98	1.04	1.01	0.02	1.00	1.02	not included	not included	not included		
County Level	% ever received sigmoidoscopy/colonoscopy	0.78	<.01	0.77	0.79	0.80	<.01	0.78	0.82	0.74	<.01	0.69	0.78	0.80	<.01	0.78	0.82	0.73	<.01	0.69	0.77
	% received fob last 2 years	0.78	<.01	0.76	0.80	1.34	<.01	1.28	1.39	1.36	<.01	1.26	1.47	1.30	<.01	1.30	1.40	1.35	<.01	1.25	1.46

Table 3. Non-Hispanic Whites: Predictors of Colorectal Cancer Late-Stage at Diagnosis, Florida, 2006-2010

Poisson Method		Univariate		Full Model				Final Model											
		Logistic (SPSS)		Logistic (SPSS)		Hierarchical (SAS)		Logistic (SPSS)		Hierarchical (SAS)									
		OR	p-value	OR	p-value	OR	p-value	OR	p-value	OR	p-value								
Case Level	age	1.00	0.05	0.99	1.00	1.01	<.01	1.01	1.02	1.01	0.30	0.99	1.02	1.02	<.01	1.01	1.02	not included	not included
	female vs male	1.08	0.09	0.99	1.17	1.10	0.10	0.98	1.23	1.04	0.79	0.79	1.36	1.04	<.01	0.53	0.72	not included	not included
	govt vs private insurance	0.58	<.01	0.53	0.64	0.64	<.01	0.55	0.75	0.78	0.17	0.55	1.11	0.62	<.01	0.53	0.72</		