Differential covariate and stage relationships in GI cancers

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INTRODUCTION

GI cancers constitute a diverse group of malignancies affecting the digestive system, including the following seen in Table 1.

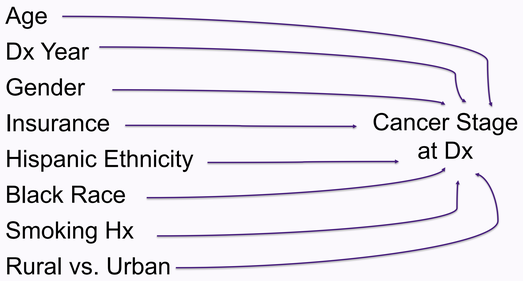
Table 1. GI cancer site information: sample sizes, average stage, % diagnosed at stage 3-4, and average age.

GI Cancer Site	N	Avg Stage	% 3-4 Stage	Avg Age at Dx
Esophagus	1186	2.85	66.0	66.11
Stomach	1307	2.86	63.0	66.11
Liver	2022	2.41	45.8	63.48
Pancreas	3992	3.22	72.4	68.33
Colon	2401	2.48	51.2	66.60
Rectum	1906	2.32	46.2	62.04

The sample population had the following demographics:

- 32.83% black
- 41.12% female
- 28.01% private insurance
- 41.22% high poverty
- 23.80% Rural
- 2.17% Hispanic
- Years 2000 to 2020

Do these relationships differ among each GI cancer site?



METHODS

This retrospective analysis uses data from the Louisiana Tumor Registry (LTR), a SEER-based statewide population-based registry. Data from 2000-2020 was included. Patients with a diagnosis of GI cancer were included in the initial review (n=88,401).

METHODS (cont.)

Exclusion criteria included:

- Unknown clinical stage or secondary cancer
- Unknown race or census tract poverty
- Unlisted insurance status or urban/rural residence status
- Uninsured patients & unlisted smoking history

After exclusion criteria was met, 14,568 patients were included in the study.

A multivariable linear regression model was fit using all covariates and dummy variables for each GI cancer site relative to a baseline group of stomach cancer. Interactions between each covariate and cancer site were tested one-by-one by fitting a linear regression model with all site interactions in addition to the model described above and tests of interaction were performed using the model deviances.

MULTIVARIABLE LINEAR REGRESSION MODEL

Variable	Coef (CI)	P-value	P-Interact
Age	-0.01 (-0.01, 0)	<.001	0.003
Dx Year	-0.02 (-0.02, -0.02)	<.001	<.001
Male vs Female Gender	0.1 (0.05, 0.15)	<.001	0.323
Private Insurance vs Public	-0.05 (-0.1, 0)	0.068	0.364
High Poverty vs Other	-0.01 (-0.06, 0.04)	0.73	0.419
Hispanic Ethnicity	-0.1 (-0.25, 0.05)	0.186	0.774
Black Race vs Other	0.12 (0.07, 0.17)	<.001	0.311
Smoking History	0.14 (0.09, 0.19)	<.001	0.049
Rural Address vs Urban	0.04 (-0.01, 0.09)	0.105	0.821

Figure 1. Full multivariable linear regression model without site-covariate interactions. Odds ratios, p-values testing effects and average treatment effect. The tumor site effects are not shown; P-Interact tests whether each effect differs by cancer site.

Interactions between GI site and Age, Dx Year, & Smoking.

- As diagnosis year increased, average stage decreased by about 0.2 per decade.
- As age increased, average cancer stage decreased by about 0.1 per decade (p<.001).
- Males present at .1 higher stage than females
- Black patients present at .12 higher stage Smokers present at .14 higher stage than non-smokers

RESULTS

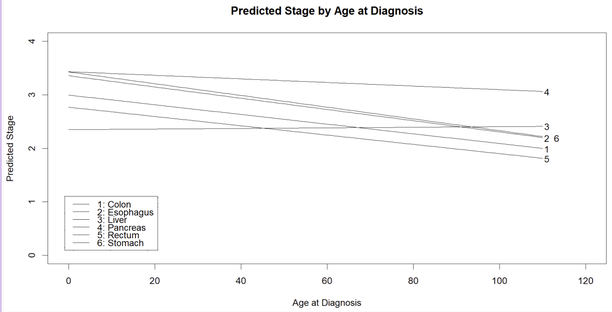


Figure 2. Age difference by cancer site. Variations in age at diagnosis with predicted stage for various GI cancer sites.

- Liver cancer had significantly more positive associations than all other cancer sites except pancreatic cancer
- Pancreatic cancers had a more positive slope than all other cancer types with no association seen overall
- For all other cancer sites, age-stage relationships are negative (increased age associated with decreased stage)

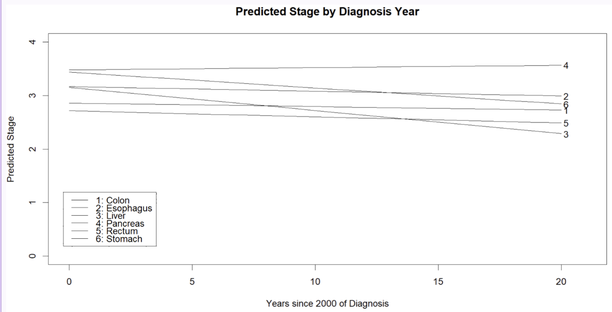


Figure 3. Years since 2000 of diagnosis and predicted cancer stage. Comparisons of lapse in time since 2000 for diagnosis of various GI cancers and how it relates to clinical stage for each cancer site.

- Liver cancer had a significantly more negative slope than all cancers except stomach cancer.
- Stomach cancers also had a more negative slope relative to rectal cancer (and liver/stomach)
- The effect on stomach cancer did not differ when compared to esophageal cancer

RESULTS (cont.)

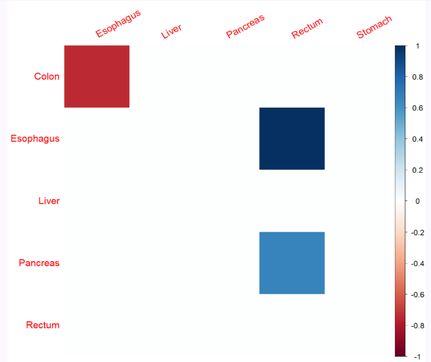


Figure 4. Heatmap of comparative differences of smoking on stage at diagnosis. Above figure compares how smoking affects stage at diagnosis for the various GI cancer sites.

Estimated adjusted differences in smoking vs nonsmoking stages were:

- .188 for colon
- .014 for esophageal
- .148 for liver
- .077 for pancreatic
- .259 for rectal
- .152 for stomach

- Effect of smoking in esophageal cancer was significantly lower (less positive) than colon cancer and rectal cancer.
- Pancreatic cancer's smoking effect on stage was significantly smaller than rectal cancer.

CONCLUSIONS

Using data from the LTR, we found:

- Age is associated with advanced stage diagnosis of rectal, stomach, and esophageal cancer
- Improved screening has allowed for earlier stage diagnosis of stomach and liver cancer while pancreatic cancer has had limited improvements in screening procedures
- Smoking plays a more critical risk factor for diagnosis of advanced stage colorectal cancer when compared with pancreatic and esophageal cancer

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