Do screenings help to prevent mortality in Colorectal Cancer?

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Topic Importance

- Colorectal cancer affects men and women of all racial and ethnic groups and is most often found in people who are 50 years old or older.

- Not counting some kinds of skin cancer, colorectal cancer is the third most common cancer in men and women & the third leading cause of cancer-related deaths in the United States.

- Screening can find precancerous polyps or abnormal growths in the colon or rectum—that can be removed before they turn into cancer. Screening also helps find colorectal cancer at an early stage, when treatment is most effective

- From 2012 through 2016, colon cancer incidence has increased every year by 2% in people younger than 50 and 1% in people 50 to 64.
- Colorectal Cancer Statistics | How Common Is Colorectal Cancer?

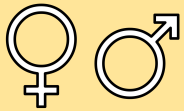
Data Source

- Data Provided by: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Division of Population Health
  - 3 main types of information
    - **Screenings**: BRFSS, Age Adjusted Prevalence, % have had Fecal occult blood test, sigmoidoscopy, or colonoscopy among adults aged 50-75 years
    - **Mortality:** Death Certificates, Average Annual Age Adjusted Rate per 100,000 Cancer of the colon and rectum (colorectal), mortality
    - **Incidence**: Statewide Central Cancer Registries, Average Annual Age Adjusted Rate per 100,000 Cancer of the colon and rectum (colorectal), incidence
  - Demographics
    - Gender and Race

Quotes

- “Screening lowers colorectal cancer (CRC) incidence and mortality” (Centers for Disease Control and Prevention,2011)
- “The recommendation that all men and women aged 50 years or older undergo screening for colorectal cancer is supported by a large body of direct and indirect evidence. At present, the available evidence does not currently support choosing one test over another.” (Walsh & Terdiman, 2003)
- “Colorectal cancer (CRC) screening among average-risk patients is underused in the US. Clinician recommendation is strongly associated with screening completion.” (Zhu et al., 2022)

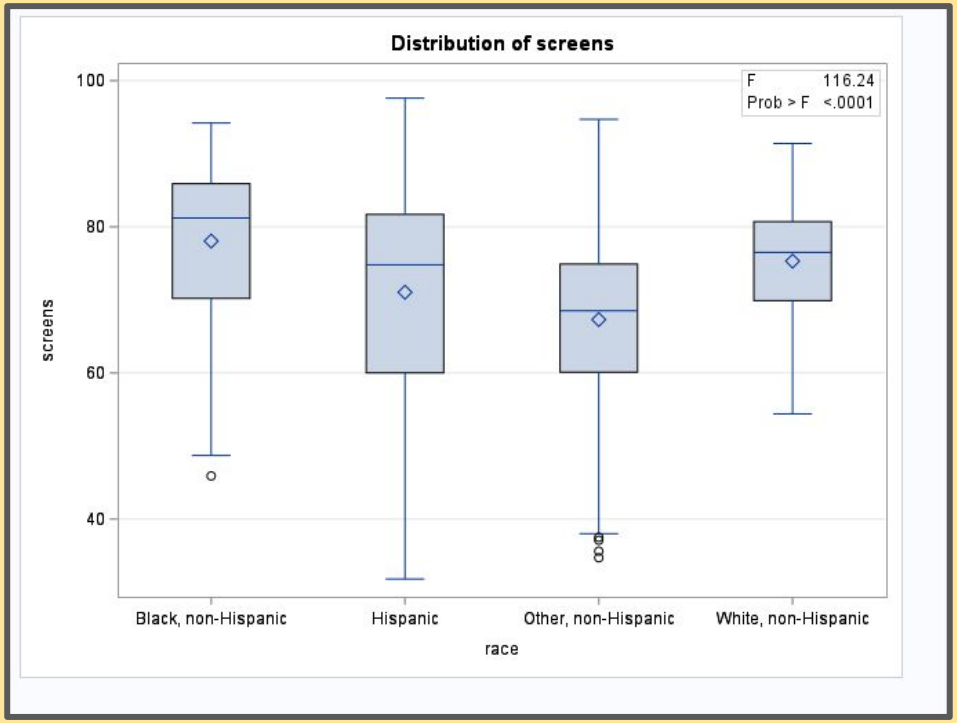
Demographics



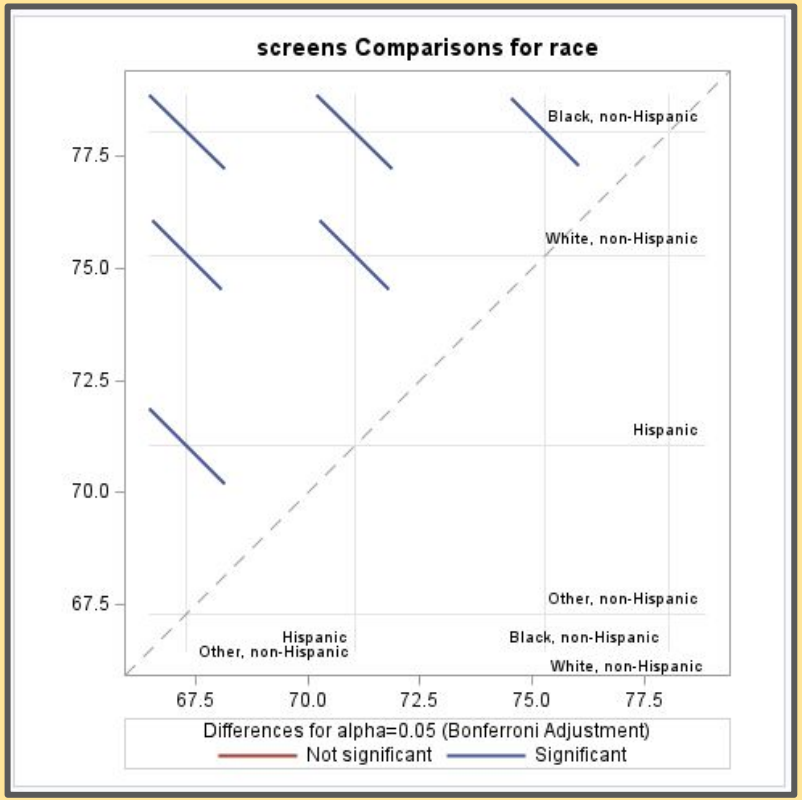
Demographics		Screening			Mortality			Incidence		
		Mean	Std. Dev	P-Value	Mean	Std. Dev	P-Value	Mean	Std. Dev	P-Value
Gender	Femlae	64	5.9	0.0143	11.7	1.4	<.0001	33.9	3.4	<.001
	Male	61.3	5.7		16.5	2.1		43.7	5.2	
Race	Asian or Pacific Islander			<.0001	8.8	2.1	<.0001	27.9	5.6	<.0001
	Black, Non-Hispanic	64.1	6.5		18.3	2.9		41.2	7.9	
	American Indian or Alaskan Native				14.6	7.8		36.2	19.8	
	White, Non-Hispanic	64.6	4.8		13.5	1.8		37.4	25.2	
	Hispanic	51.4	9.6		9.3	2.5		31.2	6.1	
	Multiracial, Non-Hispanic	59.2	9.1							
	Other, Non-Hispanic	55.1	7.1							

Graphs

Demonstrates statistically significant data not impacted by a type I error



Compare median, minimum, and maximum screening rates in each race category



One Sample T-tests: Do these metrics differ from the national average in 2018?

	Screening	Mortality	Incidence
National Average Comparison of 2018 from CDC	68.8%	37	13
Overall for all states	<.0001	0.0009	0.0011

(U.S. Cancer Statistics Working Groups. U.S Cancer Statistics Data Visualization Tool based on 2020 submission data,2018)

(Centers for Disease Control and Prevention, 2021)

Do screenings prevent mortality?

The GLM Procedure

Dependent Variable: overall_mortality DataValue

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	32.2702114	32.2702114	15.52	0.0003
Error	50	103.9690194	2.0793804		
Corrected Total	51	136.2392308			

R-Square	Coeff Var	Root MSE	overall_mortality Mean
0.236864	10.37701	1.442006	13.89615

Source	DF	Type I SS	Mean Square	F Value	Pr > F
overall_screening	1	32.27021136	32.27021136	15.52	0.0003

Source	DF	Type III SS	Mean Square	F Value	Pr > F
overall_screening	1	32.27021136	32.27021136	15.52	0.0003

Parameter	Estimate	Standard Error	t Value	Pr > |t|
Intercept	24.79365476	2.77347831	8.94	<.0001
overall_screening	-0.17209367	0.04368486	-3.94	0.0003

One way ANOVA

- Compare association between overall mortality and overall screening

The small p value of 0.0003 confirms that screenings are significant in preventing colon cancer mortality

Do screenings prevent mortality when controlling for Incidence?

The GLM Procedure

Dependent Variable: overall_mortality DataValue

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	100.0327580	50.0163790	74.76	<.0001
Error	48	32.1123400	0.6690071		
Corrected Total	50	132.1450980			

R-Square	Coeff Var	Root MSE	overall_mortality Mean
0.756992	5.902696	0.817929	13.85686

Source	DF	Type I SS	Mean Square	F Value	Pr > F
overall_screening	1	28.85205073	28.85205073	43.13	<.0001
overall_incidence	1	71.18070729	71.18070729	106.40	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
overall_screening	1	3.70028475	3.70028475	5.53	0.0228
overall_incidence	1	71.18070729	71.18070729	106.40	<.0001

Parameter	Estimate	Standard Error	t Value	Pr > |t|
Intercept	6.039562788	2.40505789	2.51	0.0155
overall_screening	-0.064084129	0.02724886	-2.35	0.0228
overall_incidence	0.309419328	0.02999726	10.31	<.0001

The small p value of <.0001 confirms that screenings and incidence are a good predictor of mortality. Incidence is a strong predictor with a small p-value of <.0001. When accounting for incidence screening is less significant but still statistically significant as a predictor of mortality with a p-value of .0228.

Do screenings prevent mortality when controlling for Gender?

The GLM Procedure

Dependent Variable: mortality_rate DataValue

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	659.8223699	329.9111850	129.45	<.0001
Error	101	257.4110916	2.5486247		
Corrected Total	103	917.2334615			

R-Square	Coeff Var	Root MSE	mortality_rate Mean
0.719361	11.30532	1.596441	14.12115

Source	DF	Type I SS	Mean Square	F Value	Pr > F
screens	1	227.9075983	227.9075983	89.42	<.0001
Gender	1	431.9147716	431.9147716	169.47	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
screens	1	65.5727545	65.5727545	25.73	<.0001
Gender	1	431.9147716	431.9147716	169.47	<.0001

Parameter	Estimate		Standard Error	t Value	Pr > |t|
Intercept	26.87191359	B	2.05448472	13.08	<.0001
screens	-0.16769057		0.03305977	-5.07	<.0001
Gender fema	-4.27640758	B	0.32849821	-13.02	<.0001
Gender male	0.00000000	B	.	.	.

The small p value of <0.0001 confirms that screenings and gender are statistically significant in preventing colon cancer mortality.

Conclusion

- Screening does have an impact on colon cancer mortality
  - The low R-square value of .236864 however, draws us to conclude that screening can not predict colon cancer mortality independently
- Incidence also has an impact on colon cancer mortality
  - The high R-square of 0.756992 demonstrates a strong positive correlation
- While controlling for incidence, the significance of screening goes down but it is still statistically significant and displays a correlation
- Gender and screening also proved to be statistically significant with a small p value and a large r-square value of .719361 demonstrating a strong relationship

References

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