Using Data Science and Machine Learning to Improve Metastasis and Mortality Prognostics in Colorectal Cancer

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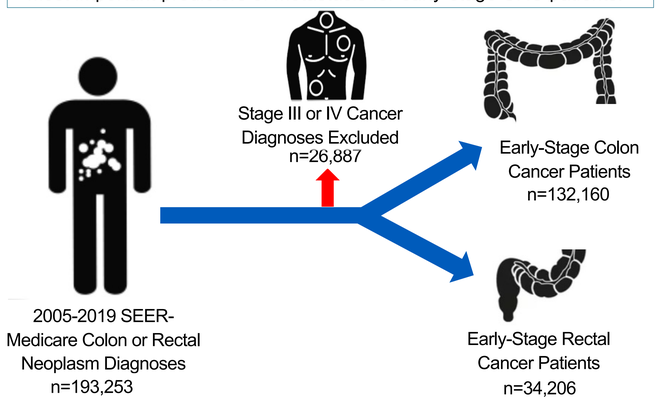
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INTRODUCTION

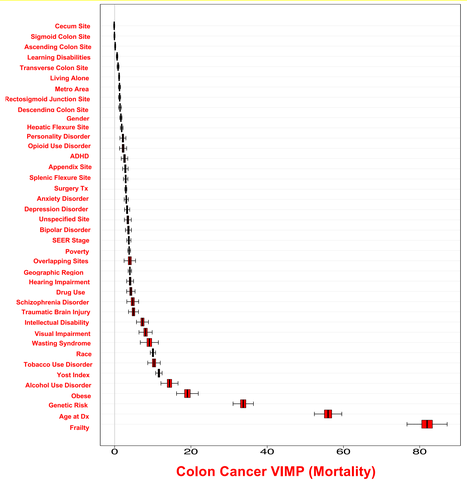
- Colorectal cancer (CRC) remains a leading cause of cancer mortality with a 5-year survival rate of 65.1% in the United States (US) and increasing incidence among younger populations.
- Current CRC diagnostic/therapeutic guidelines do not take factors like demographics, social determinants of health (SDOH), mental health, and frailty into account.
- **Aim: We examined the relative importance of various pathophysiological and SDOH predictors in mortality and metastasis risk for early-stage colon and rectal cancer patients.**

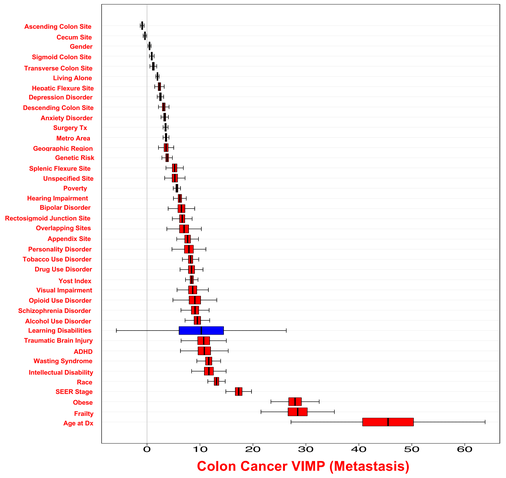
METHODS

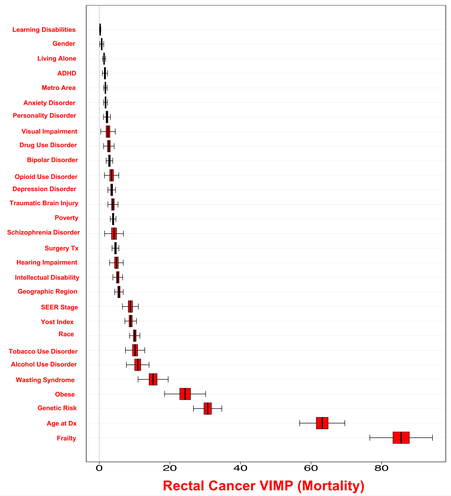
- Data: SEER-Medicare Linked Database
  SEER: Surveillance, Epidemiology, and End Results
- Study sample: Stage 0, I, and II colon or rectal cancer patients diagnosed 2005–2017, identified using ICD 9 & ICD 10 codes.
- Outcomes: Local or distant lymph node or organ metastasis ≥90 days and mortality (≤2 years) following CRC diagnosis.
- Variables: age at diagnosis, race, obesity, gender, residence, Yost index, access to an NCI-designated cancer center and colorectal surgeon, medical and psychiatric comorbidities, and frailty status.
- Statistics: Random forest survival models were used to examine the most important predictors of metastasis for early-stage CRC patients.

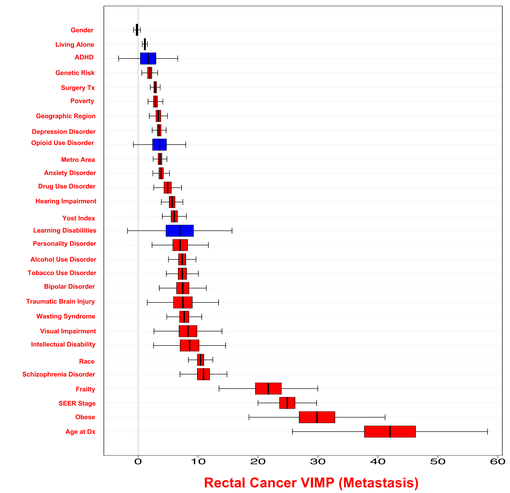


RESULTS









KEY FINDINGS AND CONCLUSIONS

- Genetic risk, age at dx, and frailty were the top three predictors for rectal and colon cancer mortality
- Obesity, frailty, and age at dx were the top three predictors for colon cancer metastasis
- SEER stage, obesity, and age at dx were the top three predictors for rectal cancer metastasis
- Some social factors and characteristics such as living alone, drug use, psychiatric diagnoses were more important in predicting colorectal cancer metastasis and mortality when compared to the site of the primary tumor, whether surgery was used for treatment, and genetic risk

RESULTS

The VIMP metric quantifies the change in prediction error, comparing the variable's observed value and the value when the variable undergoes a random permutation. A positive VIMP should be interpreted as a variable that improves the predictive accuracy of the outcome being studied. Contrastingly, a negative or zero VIMP has either a negligible or detrimental influence on predictive performance.

- Colon Cancer VIMP Mortality: All variables except for cecum site and sigmoid colon site had a positive VIMP.
- Colon Cancer VIMP Metastasis: All variables except for ascending colon site and cecum site had a positive VIMP.
- Rectal Cancer VIMP Mortality: Every clinical and non-clinical variable included in the analysis had a positive VIMP.
- Rectal Cancer VIMP Metastasis: All variables except for sex had a positive VIMP

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