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# Factors Influencing Resection in Locoregional Pancreatic Cancer Patients

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## Background

- Pancreatic cancer has surpassed breast cancer as the **3rd leading cause of U.S. cancer deaths**, with 41,780 deaths in 2016[1]
- Projected to be **2nd leading cause of cancer death by 2030**[2]
- Mean direct medical costs of **$65,700 per patient** (2000-2007)[3]
- **Five-year survival rate is 7.7%[1],** due to often advanced stage at diagnosis, lack of effective treatment options

- **Five-year survival rate for pancreatic cancer patients undergoing resection, the only potentially curative treatment, is 18-24%**[4]
- Pancreatic cancer resection is underused in eligible patients[5-7]
- ***Factors associated with underuse of pancreatic cancer resection are poorly understood***

## Objective

Identify factors associated with resection in a national sample of locoregional pancreatic cancer patients

## Methods

### Data Source

Surveillance, Epidemiology and End Results (SEER) dataset[8]

- National Cancer Institute cancer statistics program
- Cancer demographics, incidence, treatment and survival data
- Combines data from 20 regional and state registries; covers 30% of U.S. population
- 8,689,771 total cancer cases from 1973-2014

### Study Population

**Inclusion criteria**

- 2004-2012 SEER patients, age 15-89, with primary diagnosis of locoregional (Stage I or II) pancreatic cancer in the pancreas head, body, or tail
- Staging based on American Joint Committee on Cancer (AJCC6)[9] criteria instituted in 2004

**Exclusion criteria:**

- Pancreatic cancer diagnosis via death certificate or autopsy
- Incomplete survival data
- Incomplete surgical data

### Statistical Analyses

- Primary outcome: receipt of pancreatic cancer resection
- Descriptive statistics to characterize sample
- Chi-square tests to identify associations between demographic variables and pancreatic cancer resection
- Multivariate logistic regression to build final model of associations between covariates and pancreatic cancer resection
- Model fit assessed using Hosmer-Lemeshow test
- All analyses performed using Statistical Analysis System (SAS) Studio software[10]

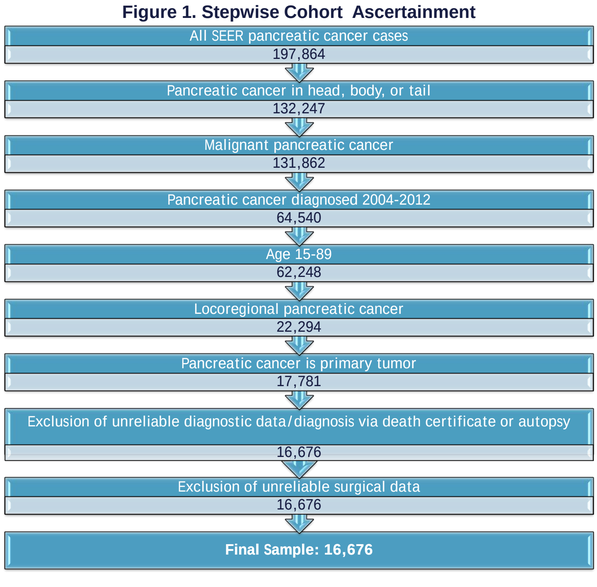
## Results

**Final sample:** 16,676 locoregional pancreatic cancer patients (Figure 1, Table 1), of whom **8152 (48.9%)** did not receive surgery (Figure 2)

**Variables associated with not receiving surgery** (controlling for registry, stage, and tumor location)(Table 2):

1. **Age:** 65-74 **30%** less likely; 75 or older **72%** less likely to undergo resection
2. **Sex:** Men **9%** less likely to undergo resection
3. **Race/ethnicity**: Non-Hispanic black individuals **31%** less likely, Hispanic **20%** less likely, other non-white race/ethnicity **14%** less likely to undergo resection
4. **Marital status:** Unmarried individuals **29%** less likely to undergo resection

**Figure 1. Stepwise Cohort Ascertainment**




## Results(contd.)

**Table 1.Demographics of final sample**

| Characteristic | Resection N(%) | No resection N(%) | p-value |
|---|---|---|---|
| **Total (N=16,676)** | 8524(51.1) | 8152(48.9) | |
| **Age Category** | | | <.001 |
| <65 | 4088(48.0) | 2325(28.5) | |
| 65-74 | 2647(31.1) | 2120(26.0) | |
| ≥75 | 1780(21.0) | 3707(45.5) | |
| **Sex** | | | <.001 |
| Male | 4290(52.7) | 3857(47.3) | |
| Female | 4234(49.6) | 4295(50.4) | |
| **Race/Ethnicity** | | | <.001 |
| White/Non Hispanic | 6187(52.2) | 5665(47.8) | |
| Non-Hispanic Black | 879(45.9) | 1034(54.1) | |
| Hispanic | 804(48.9) | 840(51.1) | |
| Other Race/Ethnicity | 654(51.6) | 613(48.4) | |
| **Marital Status** | | | <.001 |
| Married | 5328(56.2) | 44159(43.8) | |
| Not married | 3196(44.5) | 3993(55.5) | |
| **Registry** | | | <.001 |
| **Diagnosis Year** | | | .313 |
| 2004-2006 | 2390(49.9) | 2398(50.1) | |
| 2007-2009 | 2934(52.1) | 2699(47.9) | |
| 2010-2012 | 3200(51.2) | 3055(48.8) | |
| **AJCC Stage** | | | <.001 |
| Stage I | 1537(39.7) | 2332(60.3) | |
| Stage II | 6987(54.6) | 5820(45.4) | |
| **Tumor Location** | | | <.001 |
| Head | 6930(49.8) | 6994(50.2) | |
| Body | 555(41.0) | 799(59.0) | |
| Tail | 1039(74.3) | 359(25.7) | |

**Figure 2. Reason Given for No Surgery (N=8152)**

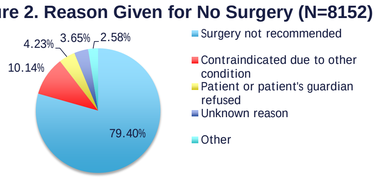



**Table 2. Odds of Undergoing Resection**

| Variable | Univariate Analysis Odds Ratio (CI) | Multivariate Analysis* Odds Ratio (CI) |
|---|---|---|
| **Age Category** | | |
| >65 | Reference | Reference |
| 65-74 | .71[.66-.77] | .70[.65-.76] |
| ≥ 75 | .28[.26-.30] | .28[.25-.30] |
| **Sex** | | |
| Female | Reference | Reference |
| Male | .89[.83-.94] | .91[.85-.98] |
| **Race/Ethnicity** | | |
| White/Non-Hispanic | Reference | Reference |
| Non-Hispanic Black | .78[.71-.86] | .69[.62-.77] |
| Hispanic | .88[.79-.97] | .80[.71-.89] |
| Other race/ethnicity | .98[.87-1.10] | .86[.75-.98] |
| **Marital Status** | | |
| Married | Reference | Reference |
| Not married | .63[.59-.67] | .71[.66-.76] |

* Controlling for registry, stage, and tumor location

## Discussion

- Nearly half of patients with locoregional pancreatic cancer do not receive surgery; the reason why is often unclear
- Factors associated with lower resection rates are non-white race/ethnicity, older age, male sex and being unmarried
- Understanding and addressing these disparities could increase pancreatic cancer resection rates and improve survival

**Limitations**

- Observational data limits ability to make causal inferences
- Some variables associated with resection (comorbidities, insurance, socioeconomic status) [4] are not available in SEER
- No details on resection decision-making process

**Recommendations for Future Research**

- Perform sensitivity analysis and instrumental variable analysis
- Explore SEER-Medicare linked data
- Analyze regional care patterns and the impact of high-volume pancreatic surgery hospitals on resection rates
- Conduct interviews with physicians, patients and their caregivers on resection decision-making process

## Acknowledgements

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