# Patient Demographics and Socioeconomic Factors in Selection for Minimally Invasive Pancreatectomy

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## INTRODUCTION

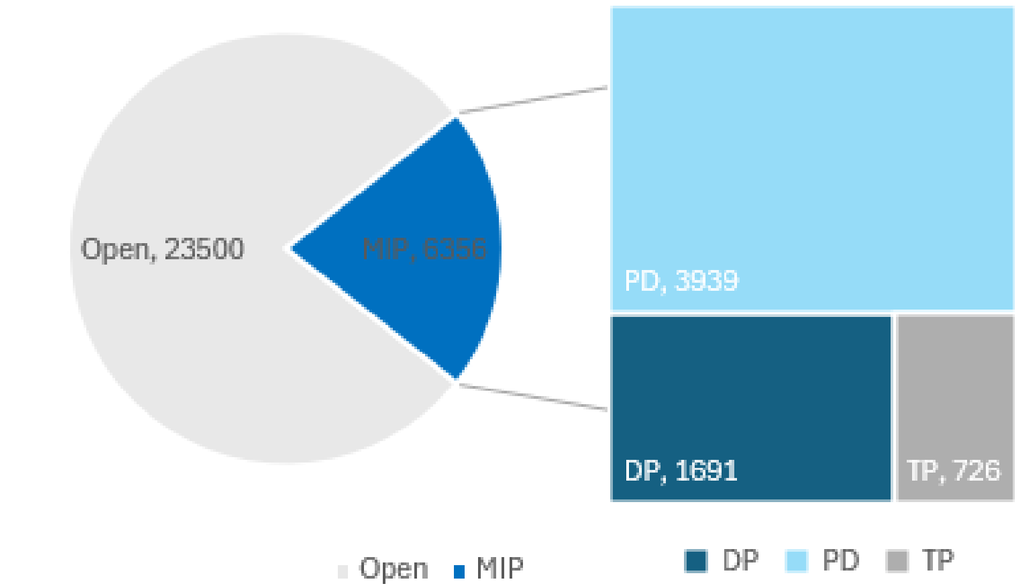
Minimally invasive pancreatectomy (MIP) is being increasingly utilized in the United States, but questions remain about uniform patient access to this approach. This study aimed to evaluate the demographics and socioeconomic status of patients undergoing MIP versus open pancreatectomy (OP) for cancer.

## METHODS

The National Cancer Database (NCDB) was utilized to analyze all patients who underwent pancreatectomy between 2013 and 2024. Univariate and multivariate analyses via multivariable Cox proportional hazards model were performed comparing MIP vs OP for all pancreatic resections as well as for distal pancreatectomy (DP), pancreaticoduodenectomy (PD), and total pancreatectomy (TP). In total 29,856 patients were included in the analysis.

## PROCEDURES PERFORMED

**FIGURE 1 – Pancreas Procedures**




Pancreas procedures performed defined by operation type.. 21% of patients underwent MIP, of which PD was the most commonly performed procedure.

## SOCIOECONOMIC FACTORS

**FIGURE 2 – Race, Ethnicity, and Education**

| | Open (N=23500) | MIS (N=6356) | |
|---|---|---|---|
| **Race** | | | 0.3428[2] |
| White | 19740 (84.0%) | 5281 (83.1%) | |
| Black | 2490 (10.6%) | 727 (11.4%) | |
| Asian | 731 (3.1%) | 194 (3.1%) | |
| Other | 352 (1.5%) | 97 (1.5%) | |
| Unknown | 187 (0.8%) | 57 (0.9%) | |
| **Ethnicity** | | | 0.4976[2] |
| Non Spanish His | 21711 (92.4%) | 5898 (92.8%) | |
| Spanish Hispanic | 1439 (6.1%) | 364 (5.7%) | |
| Unknown | 350 (1.5%) | 94 (1.5%) | |
| **Education (% No HSD)** | | | 0.0946[2] |
| Missing | 3353 | 918 | |
| 15.3%+ | 3966 (19.7%) | 1006 (18.5%) | |
| 9.1-15.2% | 5558 (27.6%) | 1474 (27.1%) | |
| 5.0-9.0% | 5961 (29.6%) | 1635 (30.1%) | |
| <5.0% | 4662 (23.1%) | 1323 (24.3%) | |

On univariate and multivariate analysis, there were no differences in patient race, ethnicity, or education levels for MIS vs OP. Education levels are reported by percentage of population without a high school diploma.

**FIGURE 3 – Proximity to Care**

| | Open (N=23500) | MIS (N=6356) | |
|---|---|---|---|
| **Miles between patient's residence and the reporting hospital** | | | 0.0001[2] |
| Missing | 3160 | 874 | |
| <=50 | 14979 (73.6%) | 4184 (76.3%) | |
| >50 | 5361 (26.4%) | 1298 (23.7%) | |
| **Living areas of PD Patients Urban/Rural** | Open (N=17687) | MIS (N=3939) | 0.0014[2] |
| Missing | 935 | 203 | |
| Metro | 14193 (84.7%) | 3240 (86.7%) | |
| Urban | 2271 (13.6%) | 455 (12.2%) | |
| Rural | 288 (1.7%) | 41 (1.1%) | |

On univariate analysis, MIP patients lived closer to their reporting hospital compared to OP. On multivariate analysis, minimally invasive PD patients were also more likely to live in more populated area compared to open PD.

**FIGURE 4 - Income**

| | Open (N=23500) | MIS (N=6356) | |
|---|---|---|---|
| **All Income** | | | <0.0001[2] |
| Missing | 3415 | 928 | |
| <46277 | 3149 (15.7%) | 768 (14.1%) | |
| 46277 - 57856 | 4289 (21.4%) | 1048 (19.3%) | |
| 57857 - 74062 | 4866 (24.2%) | 1360 (25.1%) | |
| 74063+ | 7781 (38.7%) | 2252 (41.5%) | |
| **DP Income** | Open (N=3095) | MIS (N=1691) | 0.0280[2] |
| Missing | 457 | 291 | |
| <46277 | 423 (16.0%) | 195 (13.9%) | |
| 46277 - 57856 | 512 (19.4%) | 258 (18.4%) | |
| 57857 - 74062 | 678 (25.7%) | 337 (24.1%) | |
| 74063+ | 1025 (38.9%) | 610 (43.6%) | |
| **TP Income** | | | 0.0065[2] |
| Missing | 395 | 96 | |
| <46277 | 377 (16.2%) | 72 (11.4%) | |
| 46277 - 57856 | 520 (22.4%) | 129 (20.5%) | |
| 57857 - 74062 | 572 (24.6%) | 165 (26.2%) | |
| 74063+ | 854 (36.8%) | 264 (41.9%) | |

On univariate analysis, MIP patients were more likely to be in a higher income group compared to OP. On multivariate analysis, minimally invasive DP and TP patients were more likely to be in a higher income group compared to OP.

## CLINICAL FACTORS

**FIGURE 5 – Staging**

| | Open (N=23500) | MIS (N=6356) | |
|---|---|---|---|
| **Clinical T Category** | | | <0.0001[2] |
| cT1 | 3861 (16.4%) | 1154 (18.2%) | |
| cT2 | 11042 (47.0%) | 3162 (49.7%) | |
| cT3 | 7045 (30.0%) | 1701 (26.8%) | |
| cT4 | 1552 (6.6%) | 339 (5.3%) | |
| **Clinical N Category** | | | <0.0001[2] |
| Missing | 66 | 16 | |
| cN0 | 18348 (78.3%) | 5154 (81.3%) | |
| cN1 | 4907 (20.9%) | 1118 (17.6%) | |
| cN2 | 179 (0.8%) | 68 (1.1%) | |
| **Clinical Stage Group** | | | <0.0001[2] |
| 1 | 12689 (54.0%) | 3760 (59.2%) | |
| 2 | 9097 (38.7%) | 2192 (34.5%) | |
| 3 | 1714 (7.3%) | 404 (6.4%) | |

MIP patients were more likely to have lower T, N, and clinical stage compared to OP. On multivariate analysis MIP patients were specifically more likely to have cT3 or cT4 tumors or cN2 disease compared to OP.

## CONCLUSIONS

- MIP remains a limited approach to pancreas resection for cancer in the United States, but rates are increasing.
- MIP is being offered to patients despite race, ethnicity, and education level.
- MIP is mostly limited to smaller tumors, higher income status, and patients treated outside of community cancer programs.
- Further efforts should be focused on ensuring equal access to MIP and access to highly skilled MIS pancreas surgeons.