Explore Cohort Definitions

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Intro

Defining general surgery surgeons is difficult because we don't have complete data for fellowship training records. As June 2021, we have ABS and fellowship council data that contain fellowship training information.

Below we are going to explore 3 different ways to define general surgery surgeons, and their pros and cons for using each definition.

Cohort definition

1. Exclude fellowship-trained surgeons using ABS and fellowship council data

Pros:

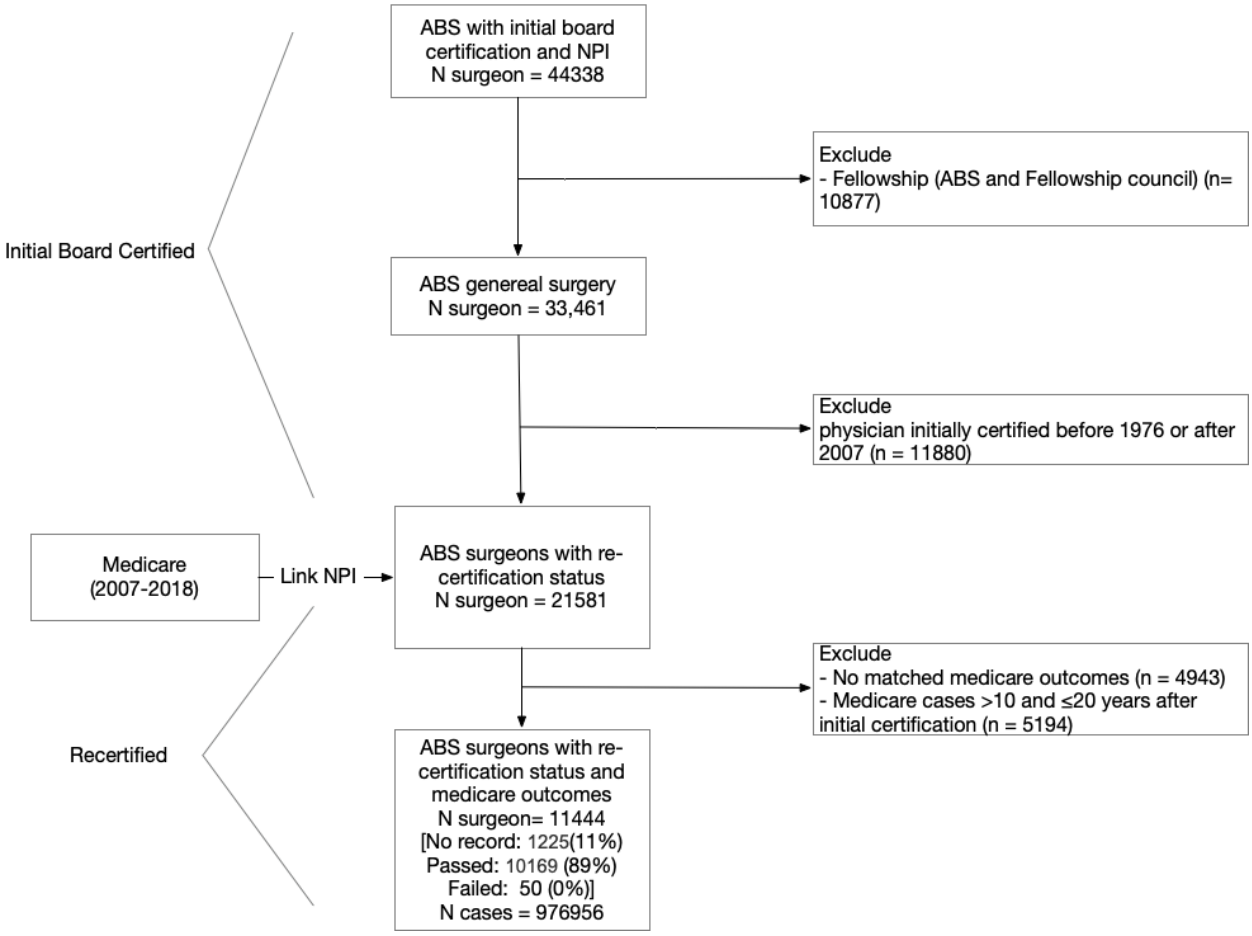
1. ABS and fellowship council data have reliable fellowship training data.
2. Most ABS and fellowship council surgeons records have matched NPIs.

Cons:

1. Can't exclude fellowship trained surgeons who were not in ABS or fellowship council data. ABS and fellowship council only have a subset of fellowship training programs. ABS fellowship includes Vascular, Pediatric, Oncology and Critical Care. fellowship council includes Adv GI, Bariatric, Colorectal, Flexible Endoscopy, HPB and Thoracic.

2. ABS and fellowship council data don't have complete NPI. 56% of ABS surgeons have NPI; 80% of fellowship council data have matched NPI.

Cohort definition diagram



dataset at */Volumes/George_Surgeon_Projects/MOC_vs_Outcome/data/abs_medicare_10_20yr.rdata*

2. Exclude fellowship-trained surgeons using ABS, fellowship council and medicare specialty code

The same as option 1 but added medicare specialty as an additional data source. medicare specialty code was from Carrier file. Only surgeons who have only filed as general surgery specialty in carrier file are considers general surgery surgeons.

Pros

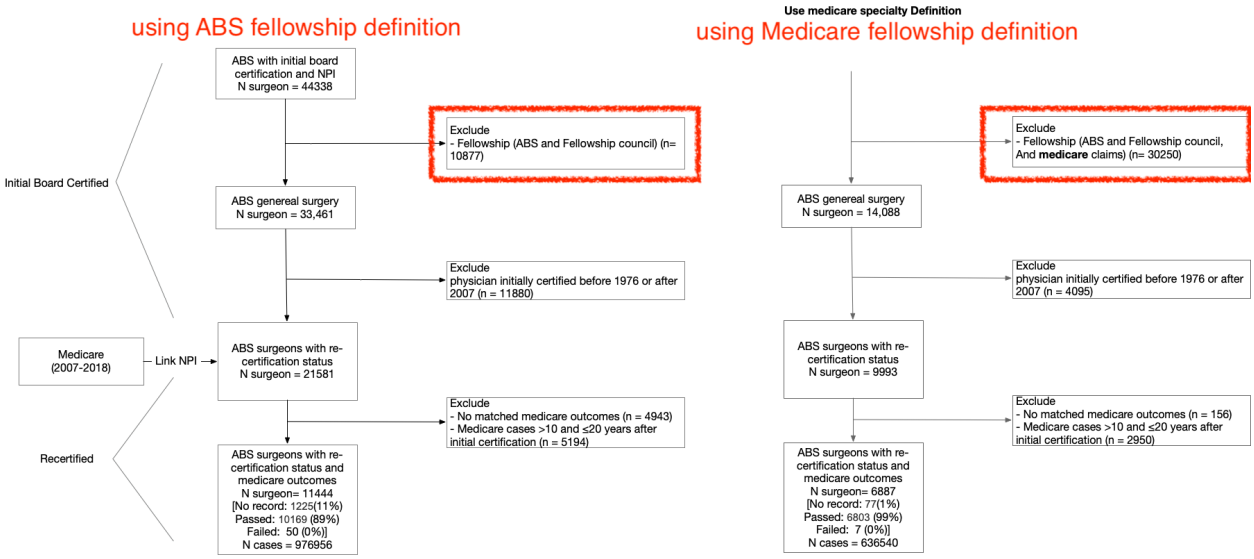
1. Using medicare specialty code excluded most of the specialty trained surgeons.

Cons

1. Medicare specialty code excluded a lot general surgery surgeons.
2. Among the excluded surgeons(based on medicare specialty code only group), 34% of the surgeons were identified as general surgery surgeons based on NPPES dataset. (*34% was based on script "code/data_prep/QA/qa_surgeon_medicare_splty.R"*)
3. I also manually checked 10 surgeons for their specialty info on their personal websites among the exclude surgeons cohort. 6 out of 10 were general surgery surgeons.

Cohort definition diagram

The two diagrams below compare the differences between adding medicare specialty code filter vs. not.



dataset at */Volumes/George_Surgeon_Projects/MOC_vs_Outcome/data/abs_medicare_10_20yr_medicare_splty.rdata*

3. Exclude non-GS surgeons by practice patterns, i.e. surgeons who don't perform cases like general surgery surgeons using number of types of procedures as threshold.

N types of procedures is defined using median number of types of procedures performed in ABS medicare data cohort. N = 21.

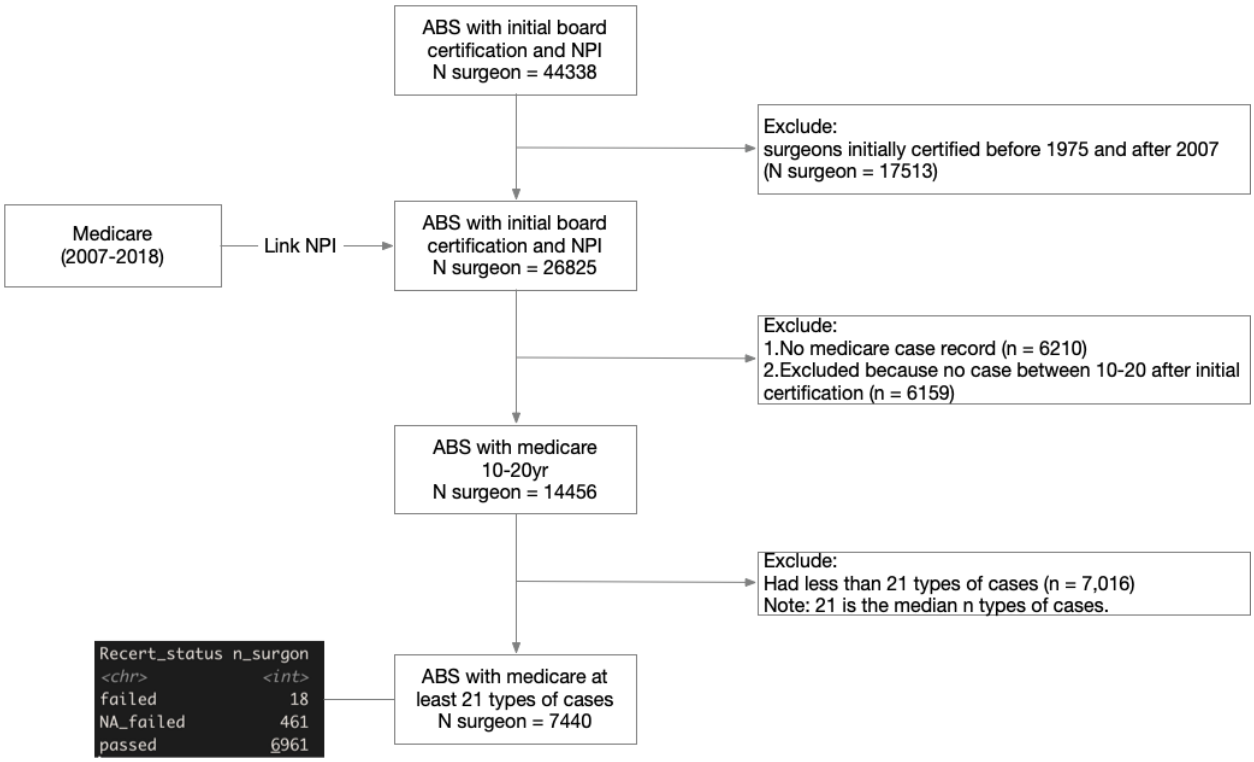
Pros:

1. Don't need to rely on our incomplete fellowship training data.

Cons:

1. Hard to define how many types of procedures a surgeon should perform to be defined as a general surgery surgeon.

Cohort definition diagram



dataset at */Volumes/George_Surgeon_Projects/MOC_vs_Outcome/data/abs_medicare_10_20yr_21_types_procs.rdata*

4. Exclude non-GS surgeons by ABS, fellowship council and practice patterns.

This combines the option1 and 3 by excluding recorded fellowship trained surgeons first, and then excluded surgeons by having performed minimal 5 types of procedures. 5 was defined by the median number of procedures performed by the non re-certified surgeon groups.

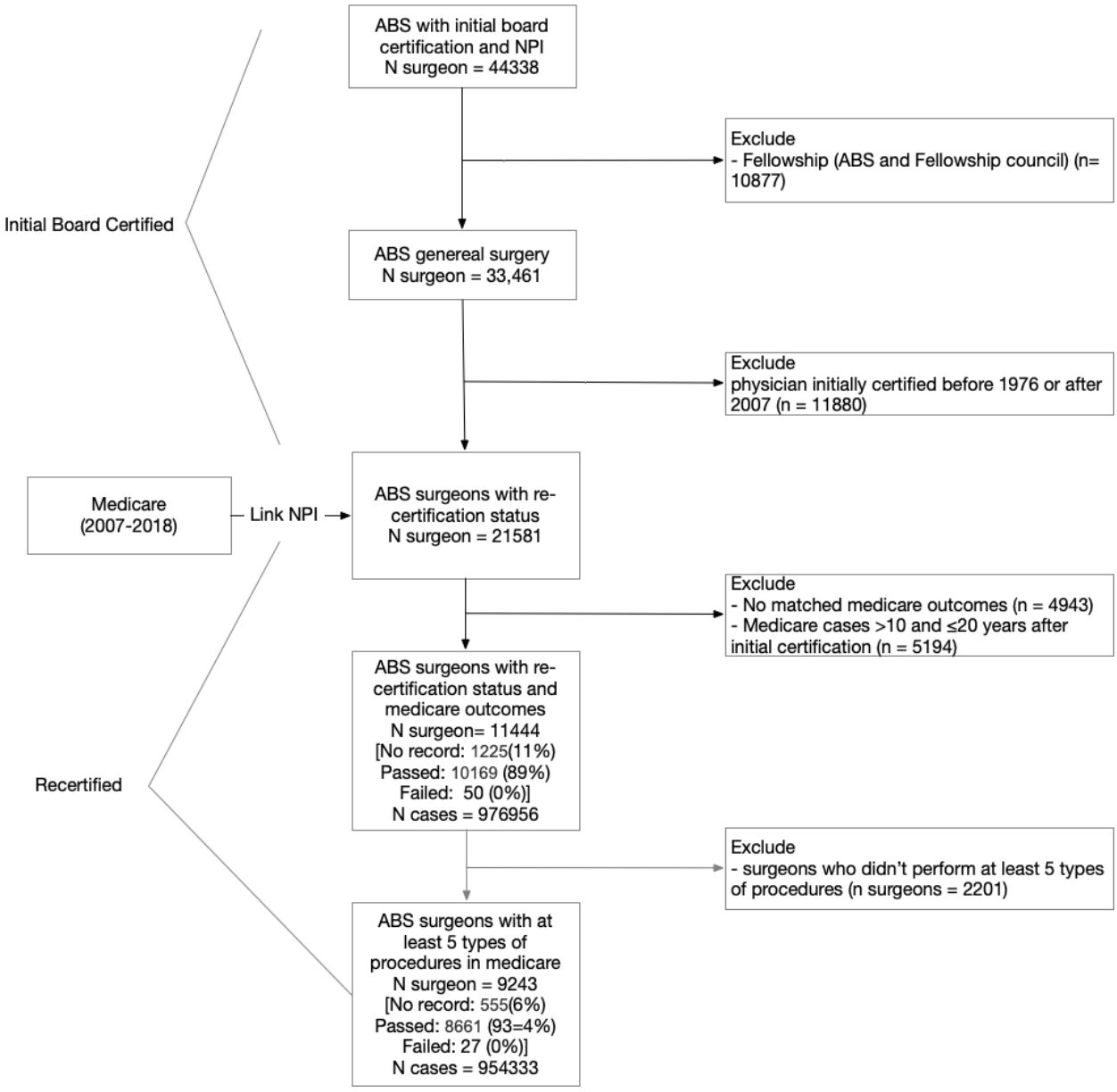
Pros

1. using our existing fellowship training information from ABS and fellowship council
2. Fellowship trained surgeons usually perform fewer general surgery procedure types. By using a minimal number of types procedures can help exclude non-gs surgeons.
3. If we want to manually check surgeon specialties, using practice patterns help reduce number of surgeons in our cohort, comparing with only using ABS and fellowship council data.

Con

1. Still not a perfect solution to eliminate fellowship trained surgeons.
2. Number of types of procedures used to define general surgery surgeons can be argued.

Cohort definition diagram



dataset at */Volumes/George_Surgeon_Projects/MOC_vs_Outcome/data/abs_fc_medicare_10_20yr_5_type.rdata*

Table1 and model results

1. ABS and fellowship council

table1

case level

Characteristic	Failed, N = 52,170	Passed, N = 847,207	p-value
flg_male	27,334 (52%)	359,049 (42%)	<0.001
age_at_admit	74 (70, 80)	75 (70, 82)	<0.001
AHRQ_score	9 (2, 17)	9 (1, 19)	0.2
race_white	45,980 (88%)	739,283 (87%)	<0.001
ses			<0.001
high_ses	21,684 (42%)	384,934 (45%)	
low_ses	30,486 (58%)	462,273 (55%)	
emergent_admit	16,371 (31%)	406,781 (48%)	<0.001
had_assist_surg	1,113 (2.1%)	7,727 (0.9%)	<0.001

[1] n (%); Median (IQR)

[2] Pearson's Chi-squared test; Wilcoxon rank sum test

Surgeon level

re_cert_bin	n_surgeon	yearly_case_mean	yearly_case_median
Failed	1,240	12.16170	7
Passed	10,014	18.40421	13

Model results

Regression table

```
death_30d ~ 1 + re_cert_bin + flg_male + age_at_admit + AHRQ_score +
    race_white + ses + emergent_admit + year + surgeon_yearly_load +
    had_assist_surg + (1 | procedure)
```

term	estimate	OR	p_value
(Intercept)	-7.117	0.001	0.000
re_cert_binPassed	0.012	1.012	0.546
flg_male	0.132	1.141	0.000
age_at_admit	0.044	1.045	0.000
AHRQ_score	0.054	1.055	0.000
race_white	0.067	1.069	0.000
seslow_ses	0.181	1.198	0.000
emergent_admit	0.865	2.375	0.000
year	-0.038	0.963	0.000
surgeon_yearly_load	-0.001	0.999	0.000
had_assist_surg	0.089	1.093	0.035

2. ABS, fellowship council and medicare

table1 case level

Characteristic	Failed, N = 3,989	Passed, N = 588,578	p-value
flg_male	1,738 (44%)	243,391 (41%)	0.005
age_at_admit	76 (71, 82)	76 (70, 82)	0.14
AHRQ_score	9 (2, 19)	9 (0, 18)	<0.001
race_white	3,449 (86%)	515,040 (88%)	0.047
ses			<0.001
high_ses	996 (25%)	261,022 (44%)	
low_ses	2,993 (75%)	327,556 (56%)	
emergent_admit	2,557 (64%)	313,495 (53%)	<0.001
had_assist_surg	35 (0.9%)	3,177 (0.5%)	0.004

[1] n (%); Median (IQR)

[2] Pearson's Chi-squared test; Wilcoxon rank sum test

Surgeon level

re_cert_bin	n_surgeon	yearly_case_mean	yearly_case_median
Failed	78	14.13937	11
Passed	6,714	18.16144	14

Model results *Regression table*

```
death_30d ~ 1 + re_cert_bin + flg_male + age_at_admit + AHRQ_score +
    race_white + ses + emergent_admit + year + surgeon_yearly_load +
    had_assist_surg + (1 | procedure)
```

term	estimate	OR	p_value
(Intercept)	-6.700	0.001	0.000
re_cert_binPassed	-0.248	0.780	0.000
flg_male	0.134	1.143	0.000
age_at_admit	0.043	1.044	0.000
AHRQ_score	0.053	1.054	0.000
race_white	0.059	1.061	0.000
seslow_ses	0.183	1.201	0.000
emergent_admit	0.825	2.282	0.000
year	-0.036	0.965	0.000
surgeon_yearly_load	0.000	1.000	0.918
had_assist_surg	0.248	1.281	0.000

3. Practice patterns to define general surgery surgeons

table1 case level

Characteristic	Failed, N = 76,155	Passed, N = 954,274	p-value
flg_male	41,237 (54%)	425,548 (45%)	<0.001
age_at_admit	75 (70, 81)	76 (70, 82)	<0.001
AHRQ_score	8 (2, 17)	9 (2, 19)	0.028
race_white	62,142 (82%)	825,322 (86%)	<0.001
ses			<0.001
high_ses	32,348 (42%)	427,104 (45%)	
low_ses	43,807 (58%)	527,170 (55%)	
emergent_admit	35,766 (47%)	479,498 (50%)	<0.001
had_assist_surg	795 (1.0%)	8,009 (0.8%)	<0.001

[1] n (%); Median (IQR)

[2] Pearson's Chi-squared test; Wilcoxon rank sum test

Surgeon level

re_cert_bin	n_surgeon	yearly_case_mean	yearly_case_median
Failed	476	27.81932	24
Passed	6,943	23.64701	19

Model results *Regression table*

```
death_30d ~ 1 + re_cert_bin + flg_male + age_at_admit + AHRQ_score +
    race_white + ses + emergent_admit + year + surgeon_yearly_load +
    had_assist_surg + (1 | procedure)
```

```
# A tibble: 11 x 4
   term                estimate    OR p_value
   <chr>                  <dbl> <dbl>   <dbl>
 1 (Intercept)           -6.86  0.001   0
 2 re_cert_binPassed      0     1       0.974
 3 flg_male               0.116 1.12    0
 4 age_at_admit           0.041 1.04    0
 5 AHRQ_score             0.054 1.06    0
 6 race_white             0.074 1.08    0
 7 seslow_ses             0.171 1.19    0
 8 emergent_admit         0.836 2.31    0
 9 year                  -0.038 0.963   0
10 surgeon_yearly_load   -0.001 0.999   0
11 had_assist_surg        0.179 1.20    0
```