

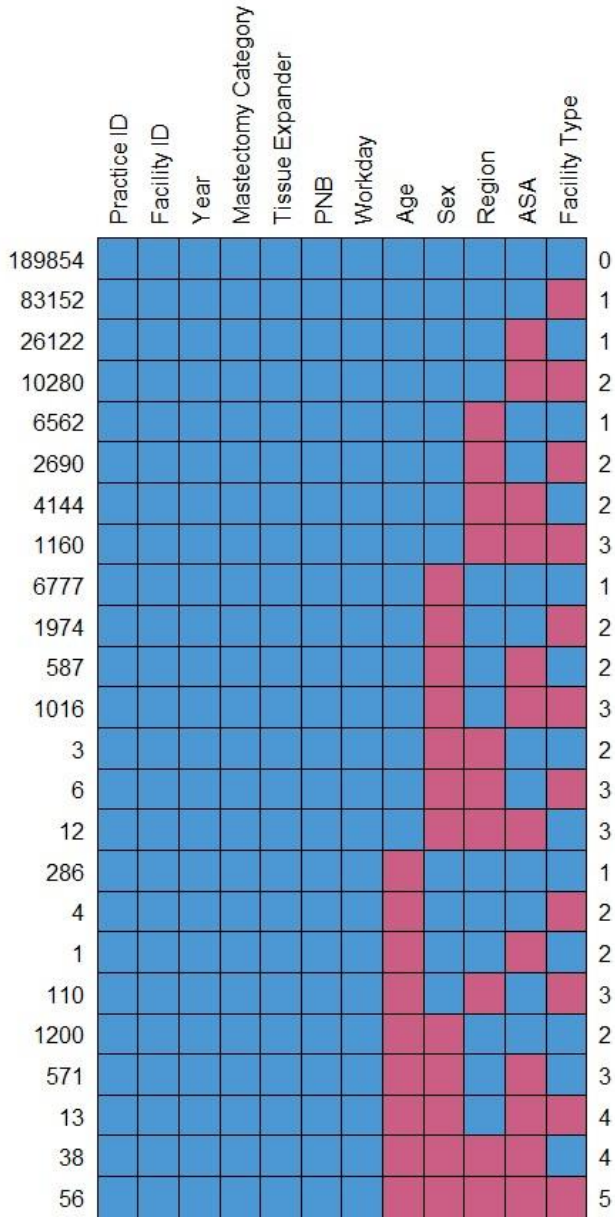
Supplemental Digital Content: Missingness Analysis

Analysis of the 336,618 cases that met our study criteria using Little's Missing Completely at Random (MCAR) test showed that the data was not MCAR. There were 282,258 observations with complete data for PNB status, year, American Society of Anesthesiologists Physical Status (ASA PS), sex, and age. These observations also had complete data for workday and tissue expander use. 83,152 cases were only missing facility type. There were 189,854 observations that were also complete for facility region and facility type (Figure 1).

There were several notable findings in our missingness analysis. Missingness appeared similar across procedure type (lumpectomy versus mastectomy). In the group that did not receive PNB, there were more cases missing sex and location information. At 30%, facility type had the most missing data when analyzing missingness by PNB use, and ASA PS was also missing 13% overall. In analyzing missingness of other variables, cases with missing sex appeared to have a higher proportion of ASA PS 2 and a lower proportion of ASA PS 1. Also, those missing sex had a higher proportion of other facility type and a lower proportion of medium community hospital or university hospital type. These cases also had a higher proportion from the Midwest. Missing age appeared to follow the same pattern as missing sex, as these cases were more likely to be ASA PS 2 and come from other facility type (Table 1). Details of missingness analyses can be found in Table 2 through Table 7.

Of the 474 unique practice identifiers in the all case dataset, the largest contributor to the full data set contributed 3.5% of cases, and the top 10 practices contributed 20% of all cases. After removal of cases with missing data 282 practices remained. The top contributor became the second highest contributor, and the largest practice comprised 2.1% of cases. The top 10 practices in the complete case set contributed 14% of all cases.

Figure 1. Missingness pattern within all cases.



Little's missing completely at random (MCAR) test showed that the data was not MCAR. There were 189,854 cases with complete data. Left axis indicates number of cases that matched missingness pattern. Right axis shows number of missing factors in missingness pattern. Top axis shows factors. Blue indicates not missing. Red indicates missing. PNB = peripheral nerve block; ASA = American Society of Anesthesiologists Physical Status.

Table 1. Missingness by procedure type (lumpectomy versus mastectomy) among all cases.

Missing factor¹	Overall, N = 336,618	Lumpectomy, N = 289,666	Mastectomy, N = 46,952
Age	2,279 (0.7%)	1,994 (0.7%)	285 (0.6%)
Sex	12,253 (3.6%)	10,695 (3.7%)	1,558 (3.3%)
ASA PS	44,000 (13%)	37,496 (13%)	6,504 (14%)
Location	14,781 (4.4%)	12,279 (4.2%)	2,502 (5.3%)
Facility type	100,461 (30%)	86,875 (30%)	13,586 (29%)
¹ Statistics presented: n (%)			

Missingness appears similar across procedure type. ASA PS = American Society of Anesthesiologists Physical Status.

Table 2. Missingness by peripheral nerve block use among all cases.

Missing factor¹	Overall, N = 336,618	Has PNB, N = 2,465	No PNB, N = 334,153
Age	2,279 (0.7%)	8 (0.3%)	2,271 (0.7%)
Sex	12,253 (3.6%)	8 (0.3%)	12,245 (3.7%)
ASA PS	44,000 (13%)	356 (14%)	43,644 (13%)
Location	14,781 (4.4%)	42 (1.7%)	14,739 (4.4%)
Facility type	100,461 (30%)	933 (38%)	99,528 (30%)
¹ Statistics presented: n (%)			

There appears to be a slight imbalance for missing sex and location. Facility type has the most missingness at 30%. ASA PS is 13% missing overall. PNB = peripheral nerve block; ASA PS = American Society of Anesthesiologists Physical Status.

Table 3. Missingness by age among all cases.

Missing factor ¹	Not Missing, N = 334,339	Missing, N = 2,279
Use of Peripheral Nerve Block	2,457 (0.7%)	8 (0.4%)
Surgical Procedure		
Lumpectomy	287,672 (86%)	1,994 (87%)
Mastectomy	46,667 (14%)	285 (13%)
Age	57 (46, 68)	–
Unknown	0	2,279
ASA PS		
1	67,827 (23%)	84 (5.2%)
2	139,514 (48%)	1,188 (74%)
3	79,014 (27%)	315 (20%)
4	4,586 (1.6%)	13 (0.8%)
5	72 (<0.1%)	0 (0%)
6	5 (<0.1%)	0 (0%)
Unknown	43,321	679
Male (vs Female)	8,329 (2.6%)	11 (2.7%)
Unknown	10,375	1,878
Facility Type		
University Hospital	26,420 (11%)	108 (5.2%)
Large Community Hospital (over 500 beds)	42,309 (18%)	622 (30%)
Medium Community Hospital (100-500 beds)	96,382 (41%)	221 (11%)
Small Community Hospital (less than 100 beds)	15,398 (6.6%)	9 (0.4%)
Specialty Hospital	6,205 (2.7%)	1 (<0.1%)
Other	47,347 (20%)	1,135 (54%)
Unknown	100,278	183
Facility Region		
Region 1 Northeast	62,777 (20%)	111 (5.3%)
Region 2 Midwest	71,998 (23%)	1,309 (63%)
Region 3 South	125,903 (39%)	12 (0.6%)
Region 4 West	59,084 (18%)	643 (31%)
Unknown	14,577	204
Workday (vs weekend/holiday)		
Weekend/Holiday	10,155 (3.0%)	49 (2.2%)
Workday	324,184 (97%)	2,230 (98%)
Has Tissue Expander	798 (0.2%)	8 (0.4%)
Year of procedure		
2010	21,822 (6.5%)	240 (11%)
2011	26,677 (8.0%)	639 (28%)
2012	33,185 (9.9%)	432 (19%)
2013	36,014 (11%)	362 (16%)
2014	44,205 (13%)	263 (12%)
2015	50,736 (15%)	225 (9.9%)
2016	52,421 (16%)	8 (0.4%)
2017	28,330 (8.5%)	110 (4.8%)
2018	40,949 (12%)	0 (0%)

¹ Statistics presented: n (%); median (IQR)

Cases missing age appear to be more likely to come from “Other” facility type.

ASA PS = American Society of Anesthesiologists Physical Status.

Table 4. Missingness by sex among all cases.

Missing factor ¹	Not Missing, N = 324,365	Missing, N = 12,253
Use of Peripheral Nerve Block	2,457 (0.8%)	8 (<0.1%)
Surgical Procedure		
Lumpectomy	278,971 (86%)	10,695 (87%)
Mastectomy	45,394 (14%)	1,558 (13%)
Age	57 (46, 68)	56 (46, 67)
Unknown	401	1,878
ASA PS		
1	67,030 (24%)	881 (8.8%)
2	134,399 (48%)	6,303 (63%)
3	76,649 (27%)	2,680 (27%)
4	4,503 (1.6%)	96 (1.0%)
5	72 (<0.1%)	0 (0%)
6	5 (<0.1%)	0 (0%)
Unknown	41,707	2,293
Male (vs Female)	8,340 (2.6%)	–
Unknown	0	12,253
Facility Type		
University Hospital	26,184 (12%)	344 (3.7%)
Large Community Hospital (over 500 beds)	40,922 (18%)	2,009 (22%)
Medium Community Hospital (100-500 beds)	95,031 (42%)	1,572 (17%)
Small Community Hospital (less than 100 beds)	15,001 (6.6%)	406 (4.4%)
Specialty Hospital	6,061 (2.7%)	145 (1.6%)
Other	43,770 (19%)	4,712 (51%)
Unknown	97,396	3,065
Facility Region		
Region 1 Northeast	61,107 (20%)	1,781 (15%)
Region 2 Midwest	67,233 (22%)	6,074 (50%)
Region 3 South	122,706 (40%)	3,209 (26%)
Region 4 West	58,653 (19%)	1,074 (8.8%)
Unknown	14,666	115
Workday (vs weekend/holiday)		
Weekend/Holiday	9,939 (3.1%)	265 (2.2%)
Workday	314,426 (97%)	11,988 (98%)
Has Tissue Expander	719 (0.2%)	87 (0.7%)
Year of procedure		
2010	21,340 (6.6%)	722 (5.9%)
2011	25,985 (8.0%)	1,331 (11%)
2012	32,450 (10%)	1,167 (9.5%)
2013	35,063 (11%)	1,313 (11%)
2014	42,508 (13%)	1,960 (16%)
2015	48,383 (15%)	2,578 (21%)
2016	52,147 (16%)	282 (2.3%)
2017	26,561 (8.2%)	1,879 (15%)
2018	39,928 (12%)	1,021 (8.3%)

¹ Statistics presented: n (%); median (IQR)

Cases missing sex appear to have slightly higher proportion of ASA PS 2 and slightly lower proportion of ASA PS 1. Cases missing sex also have a higher proportion of cases from “Other” facility type and slightly lower proportion of cases from “Medium Community Hospital” or “University Hospital”. ASA PS = American Society of Anesthesiologists Physical Status.

Table 5. Missingness by ASA PS among all cases.

Missing factor ¹	Not Missing, N = 292,618	Missing, N = 44,000
Use of Peripheral Nerve Block	2,109 (0.7%)	356 (0.8%)
Surgical Procedure		
Lumpectomy	252,170 (86%)	37,496 (85%)
Mastectomy	40,448 (14%)	6,504 (15%)
Age	57 (46, 68)	58 (46, 69)
Unknown	1,600	679
ASA PS		
1	67,911 (23%)	–
2	140,702 (48%)	–
3	79,329 (27%)	–
4	4,599 (1.6%)	–
5	72 (<0.1%)	–
6	5 (<0.1%)	–
Unknown	0	44,000
Male (vs Female)	7,191 (2.5%)	1,149 (2.8%)
Unknown	9,960	2,293
Facility Type		
University Hospital	23,304 (11%)	3,224 (10%)
Large Community Hospital (over 500 beds)	37,562 (18%)	5,369 (17%)
Medium Community Hospital (100-500 beds)	83,128 (41%)	13,475 (43%)
Small Community Hospital (less than 100 beds)	14,023 (6.9%)	1,384 (4.4%)
Specialty Hospital	6,204 (3.0%)	2 (<0.1%)
Other	40,461 (20%)	8,021 (25%)
Unknown	87,936	12,525
Facility Region		
Region 1 Northeast	54,682 (19%)	8,206 (21%)
Region 2 Midwest	69,994 (25%)	3,313 (8.6%)
Region 3 South	108,992 (38%)	16,923 (44%)
Region 4 West	49,579 (18%)	10,148 (26%)
Unknown	9,371	5,410
Workday (vs weekend/holiday)		
Weekend/Holiday	9,531 (3.3%)	673 (1.5%)
Workday	283,087 (97%)	43,327 (98%)
Has Tissue Expander	803 (0.3%)	3 (<0.1%)
Year of procedure		
2010	18,689 (6.4%)	3,373 (7.7%)
2011	23,410 (8.0%)	3,906 (8.9%)
2012	29,997 (10%)	3,620 (8.2%)
2013	33,213 (11%)	3,163 (7.2%)
2014	39,823 (14%)	4,645 (11%)
2015	46,196 (16%)	4,765 (11%)
2016	46,673 (16%)	5,756 (13%)
2017	21,248 (7.3%)	7,192 (16%)
2018	33,369 (11%)	7,580 (17%)

¹ Statistics presented: n (%); median (IQR)

ASA PS = American Society of Anesthesiologists Physical Status.

Table 6. Missingness by facility region among all cases.

Missing factor¹	Not Missing, N = 321,837	Missing, N = 14,781
Use of Peripheral Nerve Block	2,423 (0.8%)	42 (0.3%)
Surgical Procedure		
Lumpectomy	27,7387 (86%)	12,279 (83%)
Mastectomy	44,450 (14%)	2,502 (17%)
Age	57 (46, 68)	57 (45, 67)
Unknown	2,075	204
ASA PS		
1	66,807 (24%)	1,104 (12%)
2	136,231 (48%)	4,471 (48%)
3	75,665 (27%)	3,664 (39%)
4	4,469 (1.6%)	130 (1.4%)
5	70 (<0.1%)	2 (<0.1%)
6	5 (<0.1%)	0 (0%)
Unknown	38,590	5,410
Male (vs Female)	7,990 (2.6%)	350 (2.4%)
Unknown	12,138	115
Facility Type		
University Hospital	20,690 (9.2%)	5,838 (54%)
Large Community Hospital (over 500 beds)	42,075 (19%)	856 (8.0%)
Medium Community Hospital (100-500 beds)	93,731 (42%)	2,872 (27%)
Small Community Hospital (less than 100 beds)	15,220 (6.8%)	187 (1.7%)
Specialty Hospital	6,206 (2.8%)	0 (0%)
Other	47,476 (21%)	1,006 (9.4%)
Unknown	96,439	4,022
Facility Region		
Region 1 Northeast	62,888 (20%)	–
Region 2 Midwest	73,307 (23%)	–
Region 3 South	125,915 (39%)	–
Region 4 West	59,727 (19%)	–
Unknown	0	14,781
Workday (vs weekend/holiday)		
Weekend/Holiday	9,957 (3.1%)	247 (1.7%)
Workday	311,880 (97%)	14,534 (98%)
Has Tissue Expander	794 (0.2%)	12 (<0.1%)
Year of Procedure		
2010	20,705 (6.4%)	1,357 (9.2%)
2011	25,809 (8.0%)	1,507 (10%)
2012	31,819 (9.9%)	1,798 (12%)
2013	34,424 (11%)	1,952 (13%)
2014	42,350 (13%)	2,118 (14%)
2015	48,860 (15%)	2,101 (14%)
2016	50,155 (16%)	2,274 (15%)
2017	27,664 (8.6%)	776 (5.2%)
2018	40,051 (12%)	898 (6.1%)

¹ Statistics presented: n (%); median (IQR)

ASA PS = American Society of Anesthesiologists Physical Status.

Table 7. Missingness by facility type among all cases.

Missing factor¹	Not Missing, N = 236,157	Missing, N = 100,461
Use of Peripheral Nerve Block	1,532 (0.6%)	933 (0.9%)
Surgical Procedure		
Lumpectomy	202,791 (86%)	86,875 (86%)
Mastectomy	33,366 (14%)	13,586 (14%)
Age	57 (46, 68)	57 (46, 68)
Unknown	2,096	183
ASA PS		
1	49,099 (24%)	18,812 (21%)
2	96,741 (47%)	43,961 (50%)
3	55,577 (27%)	23,752 (27%)
4	3,232 (1.6%)	1,367 (1.6%)
5	29 (<0.1%)	43 (<0.1%)
6	4 (<0.1%)	1 (<0.1%)
Unknown	3,1475	12,525
Male (vs Female)	5,497 (2.4%)	2,843 (2.9%)
Unknown	9,188	3,065
Facility Type		
University Hospital	26,528 (11%)	-
Large Community Hospital (over 500 beds)	42,931 (18%)	-
Medium Community Hospital (100-500 beds)	96,603 (41%)	-
Small Community Hospital (less than 100 beds)	15,407 (6.5%)	-
Specialty Hospital	6,206 (2.6%)	-
Other	48,482 (21%)	-
Unknown	0	100,461
Facility Region		
Region 1 Northeast	50,058 (22%)	12,830 (13%)
Region 2 Midwest	54,499 (24%)	18,808 (20%)
Region 3 South	77,995 (35%)	47,920 (50%)
Region 4 West	42,846 (19%)	16,881 (18%)
Unknown	10,759	4,022
Workday (vs weekend/holiday)		
Weekend/Holiday	7,137 (3.0%)	3,067 (3.1%)
Workday	229,020 (97%)	97,394 (97%)
Has Tissue Expander	535 (0.2%)	271 (0.3%)
Year of Procedure		
2010	20,720 (8.8%)	1,342 (1.3%)
2011	25,697 (11%)	1,619 (1.6%)
2012	30,204 (13%)	3,413 (3.4%)
2013	29,004 (12%)	7,372 (7.3%)
2014	33,203 (14%)	11,265 (11%)
2015	38,132 (16%)	12,829 (13%)
2016	26,355 (11%)	26,074 (26%)
2017	16,371 (6.9%)	12,069 (12%)
2018	16,471 (7.0%)	24,478 (24%)

¹ Statistics presented: n (%); median (IQR)

ASA PS = American Society of Anesthesiologists Physical Status.