

## ORIGINAL RESEARCH

# Discharge destination and readmissions among patients with head and neck cancer

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## Abstract

**Objective:** Lowering hospital readmission rates is a national goal, and presents an opportunity to lower health care costs, improve quality, and increase patient satisfaction. We aim to assess whether discharge disposition is associated with readmission.

**Methods:** A retrospective cohort study using logistic regression to quantify risk factors of hospital readmission in patients with confirmed head and neck cancer (HNC) who underwent surgery from 2010 to 2018 contained in the Pennsylvania Health Care Cost Containment Council database, which includes patients treated in Pennsylvania hospitals.

**Results:** The readmission rate in this study was 18.1%. Cancers of the hypopharynx had the highest rates of readmission (29.2%). Male sex (odds ratio [OR]: 0.87, 95% CI: 0.75–1.00), emergent admission (vs. elective admission: OR = 1.33, 95% CI: 1.02–1.74), discharge to home health (vs. home: OR = 1.85, 95% CI: 1.59–2.16), discharge to skilled nursing facility (SNF) (vs. home: OR = 2.21, 95% CI: 1.80–2.72), and having 4+ comorbidities (vs. 0–1: OR = 1.39, 95% CI: 1.09–1.76) were significant risk factors for hospital readmission.

**Conclusion:** It is necessary to consider the readmission risk associated with HNC patients. Reasons for readmission are multifactorial and can be related to demographics, hospital course, comorbidities, or discharge disposition—this requires further assessment. There is importance in increasing HNC awareness and staff education about the unique needs of this population.

**Level of Evidence:** 4.

## KEYWORDS

clinical research, head and neck, otolaryngology, readmissions, skilled nursing facilities

## 1 | INTRODUCTION

Unplanned hospital readmissions are a concern due to the costly impact on the patient and the hospital, as well as their negative impact

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on patient outcomes. Accordingly, hospital readmission rates have become a focal point in the assessment of the quality and cost effectiveness of hospital care delivery. Policies have been implemented to limit the number of hospital readmissions. This is true even at the federal level with the establishment of the Hospital Readmissions Reduction Program (HRRP) by the Affordable Healthcare Act. The HRRP reduces reimbursements for hospitals with excess patient readmissions. Initially the HRRP focused on three conditions: myocardial infarction, heart failure, and pneumonia, but has now broadened its scope to include surgical patients (i.e., hip and knee arthroplasty patients).<sup>1,2</sup> Continued expansion of this program to include further conditions and procedures is anticipated.

Head and neck cancer (HNC) patients are seen as a high-risk population for readmissions, with reported readmission rates ranging from 5.1% to 19.8%<sup>1,3-9</sup> and the majority occurring within the first ten days following discharge.<sup>3,5-9</sup> Predictors of readmission in this population include various comorbidities, length of stay, wound infections or dehiscence, lower socioeconomic status (SES), inclusion of a reconstructive procedure, and the presence of a total laryngectomy.<sup>1,3-7</sup> The cancer site also influences 30-day readmission rates with cancers of the oropharynx, hypopharynx or larynx associated with higher rates of readmission.<sup>1,7,8,10</sup> Several studies have shown that these readmissions occur due to an unmet need for increased supportive care at discharge.<sup>4,5,7</sup>

Rehabilitation facilities and skilled nursing facilities (SNFs) are a frequently utilized resource when patients require increased supportive care following a hospital admission. While these facilities are well equipped to provide general rehabilitation for various conditions, HNC patients have unique rehabilitation needs. Specifically, HNC and its treatment can cause significant deficits in a patient's ability to speak and swallow, putting the patient at risk for various related complications if therapy to address these issues is not made a priority during rehabilitation.

Previous literature from other surgical fields has identified discharge to SNF as a risk factor for hospital readmission. One study noted that those who were discharged to SNFs after colectomy were found to have higher rates of readmission compared to patients discharged elsewhere even after controlling for illness severity.<sup>11</sup> Another study found that patients who underwent total knee arthroplasty and were discharged to a postacute care facility, including SNFs and inpatient rehabilitation facilities, had higher rates of unplanned readmissions and infectious complications than patients discharged to home.<sup>12</sup>

The objective of the present study is to investigate the relationship between patient discharge disposition following HNC surgery and risk of readmission. Additionally, this study investigated the association between readmission rate and timing of discharge (weekday vs. weekend). In order to identify the most appropriate discharge disposition for each individual patient, physicians must take several factors into consideration including medical complexity, insurance, social needs, and patient preference. This study will ultimately clarify the influence of the discharge disposition of HNC patients on the rate of hospital readmission.

## 2 | MATERIALS AND METHODS

### 2.1 | Data source

Data for this analysis were from the Pennsylvania Health Care Cost Containment Council (PHC4).<sup>13</sup> PHC4 is an independent state agency that was established to address increasing health care costs and to engage in public reporting of hospital and healthcare provider performance in Pennsylvania. Hospitals and freestanding surgical facilities are required to submit administrative discharge data for all inpatient and ambulatory surgery procedures to PHC4, who then makes this data available for research (<https://www.phc4.org/services/datarequests/data.htm>). The data used are publicly available and de-identified. As such, this study was deemed exempt from the Penn State College of Medicine Institutional Review Board review (STUDY00017831).

### 2.2 | Study cohort

Our study cohort included all patients admitted to a hospital in Pennsylvania between 2010 and 2018 contained in the PHC4 database who underwent a procedure for HNC. HNC procedures were defined using a primary or secondary International Classification of Disease-9th Revision-Clinical Modification (ICD-9-CM) or International Classification of Disease-10th Revision-Clinical Modification (ICD-10-CM) diagnosis codes (Appendix A) (Table A1). In addition, participants were required to have a primary procedure as defined by ICD-9-CM procedure or International Classification of Diseases 10th Revision Procedure Coding System (ICD-10-PCS) codes (Appendix B) (Table B1). Because the focus of this study was unplanned readmissions, we excluded all patients with a discharge status that included a planned readmission. The final sample included 7020 unique admissions.

### 2.3 | Outcome measures

Our primary outcome of interest was inpatient readmission within 30 days of discharge for any reason. PHC4 data include all readmissions to other Pennsylvania hospitals, even if the readmission hospital differed from the index hospital. However, readmissions to hospitals outside of Pennsylvania were not included secondary to the database being limited to Pennsylvania hospitals. Readmissions included all-cause readmissions, and the reasons for readmissions were categorized by primary diagnosis at the time of readmission.

### 2.4 | Covariates

There were two covariates of primary interest: whether the patient was discharged to a SNF, and whether the patient was discharged during a weekend. Weekend discharge was defined as Friday through Sunday. In addition, we controlled for several other patient, disease,

**TABLE 1** Patient characteristics stratified by discharge destination

Variable	Discharged elsewhere (N = 6027)	Discharged to SNF (N = 1013)	Difference	95% Confidence Lower	Upper
Age	62.4	68.9	-6.50	-7.33	-5.67
18-54	25.9%	11.6%	14.3%	12.0%	16.6%
55-64	32.3%	28.1%	4.2%	1.2%	7.2%
65-74	26.5%	29.7%	-3.3%	-6.3%	-0.2%
75+	17.4%	32.8%	-15.3%	-18.4%	-12.3%
Sex					
Male	68.8%	65.0%	3.8%	0.7%	7.0%
Female	31.2%	35.0%	-3.8%	-7.0%	-0.7%
Race/ethnicity					
White non-Hispanic	86.9%	82.0%	4.8%	2.3%	7.3%
Black non-Hispanic	6.7%	10.2%	-3.4%	-5.4%	-1.5%
Hispanic and other	6.4%	7.8%	-1.4%	-3.2%	0.4%
Payer					
Medicare	44.5%	63.4%	-18.9%	-22.1%	-15.6%
Medicaid	11.6%	17.2%	-5.6%	-8.1%	-3.1%
Commercial	42.2%	18.0%	24.3%	21.6%	26.9%
Other	1.6%	1.3%	0.4%	-0.4%	1.1%
Admission type					
Elective	89.3%	80.3%	9.0%	6.5%	11.6%
Urgent	6.8%	9.5%	-2.7%	-4.6%	-0.8%
Emergent	3.9%	10.3%	-6.3%	-8.3%	-4.4%
Transfer					
No	99.2%	96.9%	2.3%	1.2%	3.4%
Yes	0.8%	3.1%	-2.3%	-3.4%	-1.2%
Discharge Destination					
Home	55.8%	0.0%	55.8%	54.5%	57.0%
Home health	43.2%	0.0%	43.2%	41.9%	44.4%
SNF	0.0%	100.0%	-100.0%	-100.0%	-100.0%
Other	1.0%	0.0%	1.0%	0.8%	1.3%
Admission timing					
Weekday	81.5%	81.9%	-0.5%	-3.0%	2.1%
Weekend	18.5%	18.1%	0.5%	-2.1%	3.0%
Discharge timing					
Weekday	42.0%	28.0%	13.9%	17.0%	10.9%
Weekend	58.0%	72.0%	-13.9%	-17.0%	-10.9%
Charlson Comorbidity Index	1.9	2.3	-0.38	-0.45	-0.32
0-1	37.3%	24.0%	13.3%	10.4%	16.2%
2-3	56.5%	61.8%	-5.3%	-8.5%	-2.0%
4+	6.2%	14.2%	-8.0%	-10.3%	-5.8%
Flap reconstruction					
No	81.6%	71.2%	10.4%	7.5%	13.4%
Yes	18.4%	28.8%	-10.4%	-13.4%	-7.5%
Tracheostomy					
No	78.4%	44.2%	34.2%	31.0%	37.4%
Yes	21.6%	55.8%	-34.2%	-37.4%	-31.0%

(Continues)

TABLE 1 (Continued)

Variable	Discharged elsewhere (N = 6027)	Discharged to SNF (N = 1013)	Difference	95% Confidence Lower	Upper
Gastrostomy tube					
No	92.7%	80.8%	11.9%	9.4%	14.4%
Yes	7.3%	19.2%	-11.9%	-14.4%	-9.4%
Site					
Hypopharynx	2.1%	5.1%	-3.0%	-4.4%	-1.6%
Larynx	16.2%	26.9%	-10.7%	-13.6%	-7.8%
Nasal/ME/Acc sinus	1.0%	0.6%	0.5%	-0.1%	1.0%
Nasopharynx	0.8%	0.6%	0.2%	-0.3%	0.7%
Oral cavity	15.9%	22.8%	-6.9%	-9.6%	-4.1%
Oropharynx	23.8%	12.4%	11.3%	9.0%	13.6%
Salivary	9.6%	3.5%	6.2%	4.8%	7.5%
Skin	5.1%	6.0%	-0.9%	-2.5%	0.6%
Tongue	18.6%	12.0%	6.6%	4.3%	8.8%
Other	6.8%	10.0%	-3.1%	-5.1%	-1.2%

and hospital characteristics that may confound the relationship between discharge location and destination and readmission risk. We also considered length of stay. Patient characteristics that were controlled in multivariable analyses included age, sex, race/ethnicity, and primary payer. Patient comorbidities were controlled using the Deyo adaptation of the Charlson comorbidity index (CCI).<sup>14,15</sup> We controlled for urgency of the admission (elective, urgent, emergent), and whether the patient was transferred from another hospital. Flap reconstruction was identified using ICD-9-CM procedure codes and ICD-10-PCD codes; details are contained in Appendix C (Table C1). Finally, we controlled for site of disease. Postoperative complications were not included in this analysis.

## 2.5 | Statistical analysis

The statistical analysis was designed to estimate the association between both discharge destination—discharge to a SNF and discharge timing (weekend vs. midweek discharge) in particular—on readmission. Comparisons were made between patients who were readmitted and those who were not using Student's *t* test for continuous variables and chi-square tests for binary and categorical variables. A multivariable model of readmission was fit using logistic regression with readmission as the dependent variable and independent variables consisting of the patient and disease characteristics described above. Results are presented as odds ratios, along with 95% confidence intervals and associated *p*-values. Because univariate comparisons suggested some covariate imbalance between patients discharged to a SNF and patients discharged elsewhere, we performed a propensity score matching analysis to control for the imbalanced covariates. This technique controls for observable potential confounders by selecting controls from among patients not discharged to a SNF who have the

same distribution of characteristics as patients discharged to a SNF. Therefore, this should control for differences between groups observed in Table 1. The propensity score was estimated from fitted values of a logistic regression of SNF discharge on patient and disease characteristics, and matching was performed on the propensity score 1:1 without replacement using a *k*-nearest neighbor approach and the usual (i.e., 0.2 SD) caliper restriction. The primary outcome of the propensity score analysis was the average effect of treatment on the treated (ATT), which represents the difference in outcome (readmission rate and length of stay) had patients discharged to a SNF been discharged elsewhere.

As a sensitivity analysis, we repeated the propensity score analysis for stratifications on two variables: urgency of admission and site of disease. The ATT was computed for patients admitted on an elective, urgent, and emergent bases, as well as for patients with disease of the oropharynx, oral cavity, larynx, and other sites. All analyses were performed using Stata software (version 14, College Station, TX).

## 3 | RESULTS

Among the 7020 patients identified in this study, the overall readmission rate was 18.1%. Trending over time, patients discharged to a SNF had consistently higher rates of readmission than patients discharged elsewhere, though the increase for both groups was not statistically significant. When assessing trends in rates of discharge to SNF between 2010 and 2018 a statistically significant increase was observed. Characteristics of patients, stratified by readmission, are presented in Table 2. As compared to patients who were not readmitted, patients who were readmitted were of similar age but were significantly more likely to be male (73.1% vs. 67.2%, *p* < .001).

**TABLE 2** Characteristics of patients with head and neck cancer admitted to hospitals in Pennsylvania from 2010 to 2018, stratified by 30-day readmission

Variable	Not readmitted (N = 5747)	Readmitted (N = 1273)	Difference	95% confidence	
				Lower	Upper
Age	63.4	63.3	11.7%	-0.65	0.89
18-54	24.1%	23.0%	1.0%	-1.5%	3.6%
55-64	31.5%	32.8%	-1.3%	-4.2%	1.5%
65-74	26.5%	28.7%	-2.1%	-4.9%	0.6%
75+	20.1%	17.4%	2.7%	0.4%	5.0%
Sex					
Male	67.2%	73.1%	-5.9%	-8.6%	-3.2%
Female	32.8%	26.9%	5.9%	3.2%	8.6%
Race/ethnicity					
White non-Hispanic	86.2%	85.9%	0.3%	-1.8%	2.4%
Black non-Hispanic	7.0%	8.2%	-1.2%	-2.8%	0.5%
Hispanic and other	6.8%	5.9%	0.9%	-0.6%	2.3%
Payer					
Medicare	47.0%	48.4%	-1.4%	-4.4%	1.6%
Medicaid	12.2%	13.4%	-1.2%	-3.2%	0.9%
Commercial	39.1%	36.9%	2.2%	-0.7%	5.1%
Other	1.7%	1.3%	0.3%	-0.4%	1.0%
Admission type					
Elective	88.8%	84.4%	4.4%	2.3%	6.6%
Urgent	7.1%	7.4%	-0.3%	-1.9%	1.3%
Emergent	4.1%	8.2%	-4.2%	-5.8%	-2.6%
Transfer					
No	99.1%	98.0%	1.1%	2.0%	0.3%
Yes	0.9%	2.0%	-1.1%	-2.0%	-0.3%
Discharge destination					
Home	51.3%	31.5%	19.8%	17.0%	22.7%
Home health	34.8%	46.7%	-11.9%	-14.9%	-8.9%
SNF	12.9%	21.2%	-8.3%	-10.7%	-5.9%
Other	0.9%	0.6%	0.3%	-0.2%	0.8%
Admission timing					
Weekday	82.8%	75.6%	7.2%	9.7%	4.6%
Weekend	17.2%	24.4%	-7.2%	-9.7%	-4.6%
Discharge timing					
Weekend	41.4%	33.5%	7.9%	10.8%	5.0%
Weekday	58.6%	66.5%	-7.9%	-10.8%	-5.0%
Charlson Comorbidity Index					
0-1	1.9	2.1	-0.19	-0.25	-0.13
2-3	36.5%	30.1%	6.5%	3.6%	9.3%
4+	56.8%	59.5%	-2.7%	-5.7%	0.2%
4+	6.7%	10.4%	-3.7%	-5.5%	-1.9%
Flap reconstruction					
No	79.5%	82.8%	-3.3%	-1.0%	-5.6%
Yes	20.5%	17.2%	3.3%	1.0%	5.6%
Tracheostomy					
No	75.0%	66.8%	8.1%	10.9%	5.3%

(Continues)

TABLE 2 (Continued)

Variable	Not readmitted (N = 5747)	Readmitted (N = 1273)	Difference	95% confidence	
				Lower	Upper
Yes	25.0%	33.2%	-8.1%	-10.9%	-5.3%
Gastrostomy tube					
No	92.0%	86.7%	5.3%	7.2%	3.3%
Yes	8.0%	13.3%	-5.3%	-7.2%	-3.3%
Site					
Hypopharynx	2.2%	4.1%	-1.9%	-3.0%	-0.7%
Larynx	15.7%	27.5%	-11.6%	-14.2%	-9.0%
Nasal/ME/Acc sinus	1.1%	0.5%	0.6%	0.2%	1.1%
Nasopharynx	0.8%	0.6%	0.1%	-0.4%	0.6%
Oral cavity	17.7%	13.6%	4.0%	1.8%	6.1%
Oropharynx	20.5%	29.5%	-8.9%	-11.7%	-6.2%
Salivary	10.0%	3.0%	7.0%	5.8%	8.3%
Skin	5.7%	3.1%	2.5%	1.4%	3.7%
Tongue	19.1%	11.0%	7.9%	5.9%	9.9%
Other	7.3%	7.1%	0.2%	-1.4%	1.7%

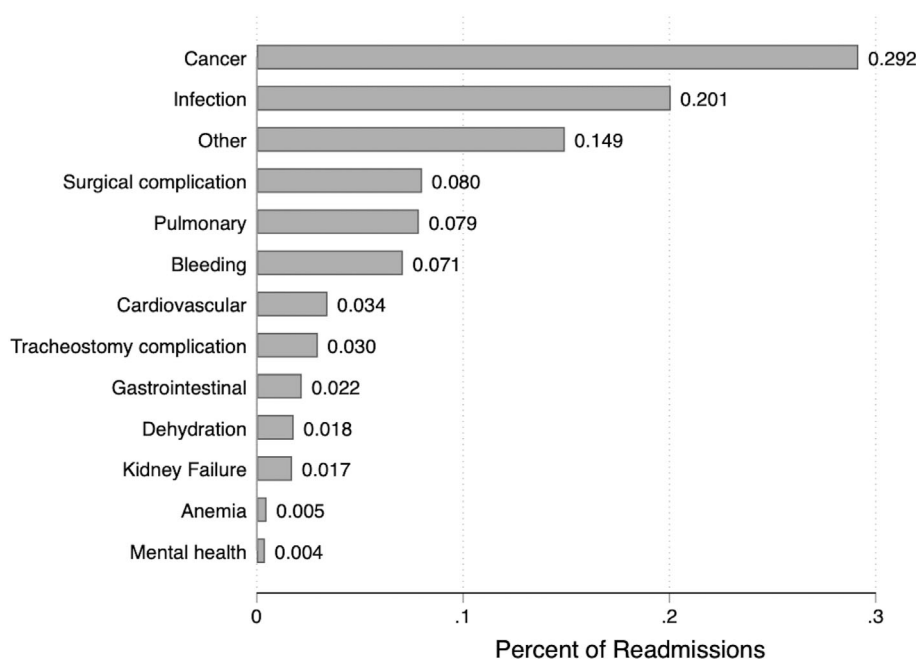


FIGURE 1 Primary diagnosis for 30-day readmission

Patients who were readmitted were more likely to have been discharged to a SNF or with home health (21.2% vs. 12.9%,  $p < .001$  and 46.7% vs. 34.8%,  $p < .001$ , respectively), less likely to have undergone flap reconstruction (17.2% vs. 20.5%,  $p = .004$ ), and more likely to have received a tracheotomy (33.2% vs. 25.0%,  $p < .001$ ) or gastrostomy tube (13.3% vs. 8.0%,  $p < .001$ ). Table 2 also presents site of disease stratified by readmission with noted differences. Overall, there were more cases of cancer of the oropharynx (1439; 20.5%), larynx (1102; 15.7%), oral cavity (1190; 16.9%), and tongue (1237; 17.6%). The highest rates of readmission were among patients with

cancers of the hypopharynx (29.2%), while patients with disease of the nasal cavity/middle ear/accessory sinus and salivary gland had the lowest readmission rates.

As seen in Figure 1, most patients were readmitted with a primary diagnosis code for cancer, referred to as cancer care (29.2%). Specifically, cancer care was counted if the principal ICD-9 diagnosis was 140.XX-149.XX (malignant neoplasm of lip, oral cavity, and pharynx) or 161.XX (malignant neoplasm of larynx), or an equivalent ICD-10 diagnosis according to medicare's general equivalence mapping of ICD-9 to ICD-10 codes. Readmissions were also common for infection

**TABLE 3** Results of multivariable model predicting 30-day readmission for patients with head and neck cancer

Variable	Odds Ratio	95% Confidence		p value
		Lower	Upper	
<b>Age</b>				
18–49	Reference			
50–59	0.944	0.800	1.115	.498
60–69	0.996	0.801	1.238	.972
70+	0.931	0.731	1.185	.561
<b>Sex</b>				
Male	Reference			
Female	0.866	0.750	1.000	.05
<b>Race/ethnicity</b>				
White non-Hispanic	Reference			
Black non-Hispanic	1.022	0.804	1.299	.859
Hispanic and other	0.854	0.655	1.113	.243
<b>Payer</b>				
Medicare	Reference			
Medicaid	0.866	0.682	1.100	.239
Commercial	0.938	0.781	1.127	.494
Other	0.744	0.427	1.297	.297
<b>Admission type</b>				
Elective	Reference			
Urgent	0.990	0.772	1.268	.934
Emergent	1.334	1.021	1.743	<.0001
<b>Transfer</b>				
No	Reference			
Yes	1.513	0.906	2.528	.114
<b>Discharge destination</b>				
Home	Reference			
Home health	1.850	1.586	2.158	<.0001
SNF	2.213	1.800	2.720	<.0001
Other	0.886	0.411	1.907	.756
<b>Admission timing</b>				
Weekday	Reference			
Weekend	1.420	1.219	1.655	0
<b>Discharge timing</b>				
Weekday	Reference			
Weekend	0.785	0.687	0.897	0
<b>Charlson comorbidity index</b>				
0–1	Reference			
2–3	1.075	0.934	1.238	.312
4+	1.385	1.087	1.763	.008
<b>Site</b>				
Oropharynx	Reference			
Hypopharynx	1.001	0.701	1.430	.995

(Continues)

**TABLE 3** (Continued)

Variable	Odds Ratio	95% Confidence		p value
		Lower	Upper	
Larynx	0.974	0.811	1.170	.778
Nasal cavity	0.306	0.130	0.719	.007
Nasopharynx	0.573	0.264	1.244	.159
Oral cavity	0.544	0.440	0.673	<.0001
Salivary gland	0.246	0.172	0.352	<.0001
Skin	0.409	0.282	0.595	<.0001
Tongue	0.461	0.370	0.573	<.0001
Other	0.699	0.536	0.913	.008
<b>Flap reconstruction</b>				
No	Reference			
Yes	0.867	0.729	1.031	.106
<b>Tracheostomy</b>				
No	Reference			
Yes	0.975	0.834	1.140	.754
<b>Gastrostomy tube</b>				
No	Reference			
Yes	1.130	0.921	1.386	.24

(20.1%), surgical complications (8.0%), pulmonary issues (7.9%), and bleeding (7.1%).

Table 3 presents a multivariable model of variables associated with 30-day readmission. After controlling for potential confounders, patients discharged to a SNF had 2.2 times greater odds of being readmitted, and patients discharged with home health had 1.9 times greater odds of being readmitted relative to patients discharged to home (95% CI: 1.80–2.72 and 95% CI: 1.59–2.16). Also, patients who were discharged during the weekend had 21% lower odds of readmission (OR = 0.79; 95% CI: 0.69–0.90). Additional analyses on length of stay and time of hospital discharge determined discharged on a weekend had an average length of stay of 5.59 days, while patients discharged during the week had an average length of stay of 6.81 days ( $p < .001$ ). There were several other patient characteristics that were associated with risk of readmission. Women had 14% lower odds of readmission (OR = 0.86; 95% CI: 0.75–1.00) relative to men, and patients admitted on an emergent basis had 33% greater odds of readmission (OR = 1.33; 95% CI: 1.02–1.74) relative to patients admitted on an elective basis.

Factors associated with length of hospital stay are presented in Table 4. Black patients had a longer length of stay of approximately half a day (0.58 days,  $p = .024$ ). Patients with an urgent admission stayed on average 1.1 days longer ( $p < .001$ ), and with an emergent admission stayed on average 1.6 days longer ( $p < .001$ ). Patients with a CCI of 2 or three stayed on average 1.2 days longer ( $p < .001$ ), and patients with a CCI of 4 or more stayed on average 2.1 days longer ( $p < .001$ ). Flap reconstruction was associated with 1.4 additional days

**TABLE 4** Results of multivariable analysis of length of stay for patients with head and neck cancer

Variable	Coefficient	95% Confidence		p value
		Lower	Upper	
<b>Age</b>				
18–49	Reference			
50–59	0.233	–0.103	0.569	.175
60–69	0.149	–0.298	0.595	.514
70+	–0.306	–0.788	0.176	.214
<b>Sex</b>				
Male	Reference			
Female	–0.035	–0.316	0.246	.808
<b>Race/ethnicity</b>				
White non-Hispanic	Reference			
Black non-Hispanic	0.581	0.077	1.086	.024
Hispanic and other	0.177	–0.339	0.693	.501
<b>Payer</b>				
Medicare	Reference			
Medicaid	1.137	0.639	1.635	.501
Commercial	–0.148	–0.524	0.227	.44
Other	2.201	1.147	3.256	<.0001
<b>Admission Type</b>				
Elective	Reference			
Urgent	1.048	0.545	1.550	<.0001
Emergent	1.613	0.982	2.245	<.0001
<b>Transfer</b>				
No	Reference			
Yes	–0.075	–1.323	1.173	.906
<b>Discharge destination</b>				
Home	Reference			
Home Health	1.729	1.423	2.036	<.0001
SNF	5.534	5.095	5.974	<.0001
Other	3.286	1.912	4.661	0
<b>Admission timing</b>				
Weekday	Reference			
Weekend	–0.125	–0.457	0.206	.458
<b>Discharge timing</b>				
Weekday	Reference			
Weekend	–0.252	–0.515	0.011	.06
<b>Charlson comorbidity index</b>				
0–1	Reference			
2–3	1.217	0.939	1.494	<.0001
4+	2.053	1.521	2.584	<.0001
<b>Site</b>				
Oropharynx	Reference			
Hypopharynx	2.839	1.987	3.692	<.0001

**TABLE 4** (Continued)

Variable	Coefficient	95% Confidence		p value
		Lower	Upper	
Larynx	2.534	2.110	2.957	<.0001
Nasal cavity	0.364	–0.950	1.678	.588
Nasopharynx	1.188	–0.313	2.688	.121
Oral cavity	1.254	0.823	1.685	<.0001
Salivary gland	–0.634	–1.159	–0.108	.018
Skin	–0.167	–0.830	0.496	.622
Tongue	0.369	–0.049	0.786	.084
Other	0.629	0.073	1.185	.027
<b>Flap reconstruction</b>				
No	Reference			
Yes	1.417	1.079	1.754	<.0001
<b>Tracheostomy</b>				
No	Reference			
Yes	3.259	2.922	3.597	<.0001
<b>Gastrostomy tube</b>				
No	Reference			
Yes	1.289	0.822	1.756	<.0001
Intercept	1.723	1.192	2.253	<.0001

( $p < .001$ ), tracheotomy placement was associated with 3.3 ( $p < .001$ ) additional days, and gastrostomy tube was associated with 1.3 ( $p < .001$ ) additional days of hospitalization. The largest association with length of stay was discharge to SNF, which was associated with over five days longer length of stay ( $p < .001$ ).

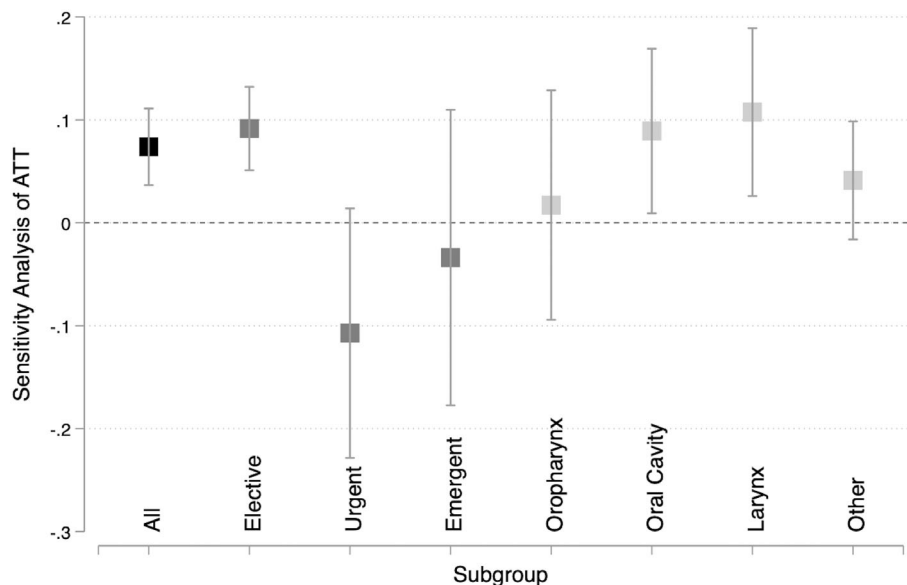
Propensity score matching found adequate matches for 979 out of the total 1013 patients discharged to SNF, yielding a matched sample of 1958 patients in the propensity score analysis. After matching, readmission rates were 26.5% for patients discharged to a SNF compared to 19.1% for patients discharged elsewhere, yielding a difference (i.e., ATT) of 7.4% ( $p < .001$ ). A sensitivity analysis is presented in Figure 2, which shows that the ATT was similar to the overall estimate for patients admitted on an elective basis, but patients admitted on an urgent or emergent basis had lower risk of readmission after matching on propensity to be discharged to a SNF. There was also some variability in ATT across disease site, with highest rates of readmission among patients with disease of the oral cavity and larynx, while patients with disease of the oropharynx and other sites were readmitted at rates that were not significant after matching on propensity to be discharged to a SNF.

## 4 | DISCUSSION

In recent years, there have been widespread efforts to reduce unplanned hospital readmissions throughout the United States. Hospital readmission rates have been recognized as a readily measurable



**FIGURE 2** Sensitivity analysis of propensity score analysis, with stratification by urgency of admission and site of disease.



and standardized metric for quality of healthcare delivery. As such, rates can be tracked nationally to identify system deficiencies and enact financial penalties to incentivize quality improvement. Prior studies investigating readmission rates in HNC patients report a wide range of 5.1% to 19.8%.<sup>1,3-9</sup> The variability of readmission rates is likely due to the heterogeneity of HNC patients including variation in cancer location, disease severity, and selection of treatment. Differences in research methodology such as definition of readmission or data collection techniques may also increase variability in reported readmission rates.<sup>7</sup> The rate of readmission for the present study was 18.1%, which is higher than most previous studies. While other studies define readmission as a patient returning to the index institution, our statewide data set is able to identify readmission to any institution within the state. This provides a more accurate picture when using readmission rate to identify gaps in quality of care and explains why the rate in this study is higher than previously reported.

It has been shown that site of the cancer influences the 30-day unplanned readmission rate. Prior studies showed that cancers in the oropharynx, hypopharynx or larynx are more likely to result in readmission.<sup>1,7,8,10</sup> The present study found similar results, with the highest rate of readmission in the hypopharynx, followed by the larynx and oropharynx. This likely reflects the more complex surgery required for patients with disease of the hypopharynx and larynx as well as the anticipated functional deficits associated with surgery in this area.

Timing of hospital discharge may also affect the likelihood of readmission. In the hospital setting, Friday is the most common day for discharge.<sup>16</sup> This may be due to patient preference of being home on weekends, or shortage of hospital staff on the weekends. It has been hypothesized that the quantity of discharges on Fridays may lead to less detailed discharge instructions from hospital staff.<sup>17</sup> Other studies have found that discharge on a weekend was not associated with an increased readmission rate in medical illnesses or after major surgeries.<sup>18,19</sup> In the current study, patients who were discharged on

the weekend were less likely to be readmitted compared to those discharged on a weekday. Although staff may be limited on weekends, this appears not to correlate with an increased rate of readmission. It is possible that increased family member availability may be an important factor in the reduced readmission rate on weekends. With greater support during the transition, communication regarding patient education and follow up care may be more effective.

The HNC population has unique care needs including airway management, nutritional needs, speech, and swallowing therapy, and wound care. Rehabilitation complications depend upon the extent of the treatment and severity of dysfunction.<sup>20</sup> In addition, if a flap is used, it is insensate and immobile on its own, which can further contribute to dysphagia issues. These difficulties are unique from dysphagia secondary to stroke or a neurological disease and as such, require different treatment. This study found that patients who were readmitted were less likely to have undergone flap reconstruction. Although it may be expected that case complexity would show a positive correlation with complication and readmission rates, other factors such as length of stay and timing of complications may substantially influence this relationship. The inclusion of flap reconstruction in a patient's surgical care is associated with an increased length of stay. Additionally, previous literature has shown that the majority of complications occur during a patient's hospitalization including flap failures that require a return to the OR.<sup>21,22</sup> It should be noted that there is a limitation in using ICD10 for delineating free flap from local skin graft. This could have influenced the reported findings.

One study in Portugal found a prevalence of only 3.36% of patients in SNFs with a tracheotomy, suggesting that SNFs may not be accustomed to managing these patients.<sup>23</sup> The current study showed patients who were readmitted were more likely to have received a tracheotomy or gastrostomy tube. Tracheotomy and gastrostomy tubes are also associated with a longer length of stay due to the amount of planning involved, and they continue to require increased levels of care after discharge. In fact, the outpatient

complication rate for patients with tracheotomies is reported to be 15%, with 13% of patients being readmitted for tracheotomy care.<sup>24</sup> Increased length of stay for patients with a tracheotomy or gastrostomy is likely multifactorial as placement of these devices requires multidisciplinary coordination, postprocedure monitoring, thorough education of patients and caregivers, and may complicate discharge planning.

Because of their unique needs, HNC patients are discharged to SNFs at a higher rate than other patients.<sup>25</sup> In accordance with other studies, we found that each year more patients are discharged to a SNF.<sup>26</sup> In the United States, about 3% of all cancers are HNCs.<sup>27</sup> Because of this relatively low prevalence, nurses and caretakers are likely to have less experience in taking care of these patients. This unfamiliarity could possibly lead to readmissions. Goel et al. assessed discharge locations for HNC patients who specifically underwent flap reconstructions. It was discovered that patients who were discharged to home with home health or discharged to a nursing facility had higher rates of readmission when compared to a routine discharge.<sup>6</sup> The present study shows that patients discharged to SNFs are also more likely to be readmitted than patients who are discharged directly home, regardless of preexisting comorbidities. This is in accordance with previous literature from other surgical specialties.<sup>11,12</sup> However, it should be noted that the use of CCI to control for comorbidities is limited in that it utilizes only four categories and while it is still a useful tool for assessing preexisting comorbidities, it does not account for surgical or medical complications that arise during a patient's hospitalization. This limits the accuracy of propensity score matching.

However, another study that investigated the impact of discharge location in an orthopedic patient population, found different results. For patients undergoing elective spinal surgery, the readmission rate was lower after discharge to a rehabilitation facility.<sup>28</sup> The differences between studies could be related to the fact that patients in the spinal surgery study underwent elective surgery rather than mandatory surgery. In addition, this study controlled for 19 separate variables, including lifestyle factors such as BMI, smoking status, and alcohol use, as well as in-hospital factors such as transfusion <72 h prior to surgery, American Society of Anesthesiologists classification, length of operation, total hospital length of stay, history of previous operation within 30 days of the surgery, and overall 30-day morbidity, in addition to classic comorbid conditions like cardiovascular, neurological, renal conditions. Differences observed between studies may also be due to the fact that rehabilitation facilities are more likely to see orthopedic/neurosurgical patients as compared to HNC patients.<sup>29</sup> Specifically, one study found that 32.4% of patients discharged to a SNF had orthopedic procedures, whereas 2.6% of patients had head and neck procedures.<sup>29</sup> If staff at the rehabilitation centers are more familiar with the needs of orthopedic patients this could in part explain the differences seen between studies.

In addition to SNFs, patients with advanced needs are often discharged home with home health. While not as high risk as discharge to SNF, this study reports increased rates of readmission with discharge to home health compared to routine discharge home. There are several factors that may have led to this observation. First,

readmission avoidance may not be a priority for home health care organizations, as the current payment structure does not award these agencies for avoiding readmissions.<sup>30</sup> Additionally, home health care nurses must make quick decisions for patients at the time of a visit, which may even hasten returns to the hospital due to early detection of issues. Patients are more likely to visit the emergency department on the day of a home health care visit.<sup>31</sup> Readmissions could also be affected by the skill level of health care nurses and legal concerns, which may influence nurses to favor a cautious approach, recommending returns to the hospital in order to avoid negative outcomes at home.<sup>32</sup>

Future studies should investigate the implementation of educational programs in hospitals to provide increased supportive care and education. In a pilot study, Graboyes et al. started an informational program for patients who had HNC, to educate the patient and the caregiver. It included a hands-on class with a nurse educator, prehospital discharge competency assessment, and speech-language pathology counseling. This could increase discharges to home with family support and potentially decrease readmission rates because it leaves patients and caregivers more knowledgeable and prepared.<sup>33</sup> Additionally, another study found that implementing a quality care plan that focused on improving communication, education, and discharge planning resulted in 2% fewer readmissions among HNC patients.<sup>34</sup>

While the present study had many strengths, there were also some limitations. Because of the retrospective nature of the study, it was difficult to assess whether the readmissions were planned or unexpected. Due to this limitation, all readmissions were included and although it is probable that some readmissions were for planned secondary procedures, we would not expect these to systematically differ between groups. Additionally, it is not possible to assess the quality of the skilled nursing facility, and the training of the staff at the locations where patients were discharged. While our analyses were designed to maximize the available data to ensure the same distribution of characteristics for our cohorts, we recognize some unobservable variables could not be captured. Uncaptured variables that may influence the risk of readmission and length of stay with discharge to SNF include: unreported comorbidities, frailty, poor healing, surgical complications, and stage of disease. The data set is from a single state and results may not generalize to other states.

## 5 | CONCLUSION

There are many variables that factor into a physician's decision of discharge location. HNC patients are at high risk for hospital readmission and require unique rehabilitative care with which certain facilities or caregivers may have minimal experience. Variables associated with readmission include male sex, emergent admission, discharge to home health or SNF, and having four or more comorbidities. The increased readmission rate with discharge to SNF is especially important to note as trends show an increase over time in discharges to these facilities. The influence of discharge destination on readmission rate is likely

multifactorial with factors such as underlying patient characteristics, facility resources, personnel experience, facility policies, discharge education, and family support playing a role. This association must be further assessed to identify areas where patient safety can be improved. It is possible that there is a knowledge gap or other concerns that may be prompting a cautious approach and contributing to the higher readmission rates from SNF. For complicated HNC patients that require additional care, it is important to send them to a facility that is equipped with educated staff and resources for these patients. Therefore, we must continue to increase HNC awareness and emphasize the importance of having educated staff knowledgeable about unique HNC conditions. Consideration should be given to implementing patient, caregiver, and nursing staff education programs to improve familiarity with postoperative care and encourage discharge to home when indicated.

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## CONFLICT OF INTEREST

The authors have no relevant conflicts of interest or financial disclosures

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## APPENDIX A

TABLE A1 Diagnosis codes used to identify head and neck cancer

Site	ICD-9-CM diagnosis codes	ICD-10-CM diagnosis codes
Hypopharynx	148.0: mal neo postcricoid	C12: malignant neoplasm of pyriform sinus
	148.1: mal neo pyriform sinus	C130: malignant neoplasm of postcricoid region
	148.2: mal neo aryepiglott fold	C131: malignant neoplasm of aryepiglottic fold, hypopharyngeal aspect
	148.3: mal neo post hypopharynx	C132: malignant neoplasm of posterior wall of hypopharynx
	148.8: mal neo hypopharynx NEC	C138: malignant neoplasm of overlapping sites of hypopharynx
	148.9: mal neo hypopharynx NOS	C139: malignant neoplasm of hypopharynx, unspecified
Larynx	161.0: malignant neo glottis	C320: malignant neoplasm of glottis
	161.1: malig neo supraglottis	C321: malignant neoplasm of supraglottis
	161.2: malig neo subglottis	C322: malignant neoplasm of subglottis
	161.3: mal neo cartilage larynx	C323: malignant neoplasm of laryngeal cartilage
	161.8: malignant neo larynx NEC	C328: malignant neoplasm of overlapping sites of larynx
	161.9: malignant neo larynx NOS	C329: malignant neoplasm of larynx, unspecified
Nasal cavity/Middle ear/ accessory sinus	160.0: mal neo nasal cavities	C300: malignant neoplasm of nasal cavity
	160.2: mal neo maxillary sinus	C310: malignant neoplasm of maxillary sinus
	160.3: mal neo ethmoidal sinus	C311: malignant neoplasm of ethmoidal sinus
	160.4: malig neo frontal sinus	C312: malignant neoplasm of frontal sinus
	160.5: mal neo sphenoid sinus	C313: malignant neoplasm of sphenoid sinus
	160.8: mal neo access sinus NEC	C318: malignant neoplasm of overlapping sites of accessory sinuses
160.9: mal neo access sinus NOS	C319: malignant neoplasm of accessory sinus, unspecified	
Nasopharynx	147.1: mal neo post nasopharynx	C111: malignant neoplasm of posterior wall of nasopharynx
	147.2: mal neo lat nasopharynx	C112: malignant neoplasm of lateral wall of nasopharynx
	147.3: mal neo ant nasopharynx	C113: malignant neoplasm of anterior wall of nasopharynx
	147.8: mal neo nasopharynx NEC	C118: malignant neoplasm of overlapping sites of nasopharynx
	147.9: mal neo nasopharynx NOS	C119: malignant neoplasm of nasopharynx, unspecified
Oral Cavity	140.3: mal neo upper lip, inner	C003: malignant neoplasm of upper lip, inner aspect
	140.4: mal neo lower lip, inner	C004: malignant neoplasm of lower lip, inner aspect
	140.6: mal neo lip, commissure	C006: malignant neoplasm of commissure of lip, unspecified
	140.8: mal neo lip NEC	C008: malignant neoplasm of overlapping sites of lip
	140.9: mal neo lip/vermil NOS	C030: malignant neoplasm of upper gum
	143.0: malig neo upper gum	C031: malignant neoplasm of lower gum
	143.1: malig neo lower gum	C039: malignant neoplasm of gum, unspecified
	143.8: malig neo gum NEC	C040: malignant neoplasm of anterior floor of mouth
	143.9: Malig neo gum NOS	C041: malignant neoplasm of lateral floor of mouth
	144.0: mal neo ant floor mouth	C048: malignant neoplasm of overlapping sites of floor of mouth
	144.1: mal neo lat floor mouth	C049: malignant neoplasm of floor of mouth, unspecified
	144.8: mal neo mouth floor NEC	C050: malignant neoplasm of hard palate
	144.9: mal neo mouth floor NOS	C060: malignant neoplasm of cheek mucosa
	145.0: mal neo cheek mucosa	C061: malignant neoplasm of vestibule of mouth
	145.1: mal neo mouth vestibule	C062: malignant neoplasm of retromolar area
	145.2: malig neo hard palate	C0689: malignant neoplasm of overlapping sites of other parts of mouth
	145.6: malig neo retromolar	C069: malignant neoplasm of mouth, unspecified
	145.8: malig neoplasm mouth NEC	
	145.9: malig neoplasm mouth NOS	

(Continues)

TABLE A1 (Continued)

Site	ICD-9-CM diagnosis codes	ICD-10-CM diagnosis codes
Oropharynx	141.0: mal neo tongue base	C01: malignant neoplasm of base of tongue
	141.6: mal neo lingual tonsil	C024: malignant neoplasm of lingual tonsil
	145.3: malig neo soft palate	C051: malignant neoplasm of soft palate
	145.4: malignant neoplasm uvula	C052: malignant neoplasm of uvula
	145.5: malignant neo palate NOS	C059: malignant neoplasm of palate, unspecified
	146.0: malignant neopl tonsil	C090: malignant neoplasm of tonsillar fossa
	146.1: mal neo tonsillar fossa	C091: malignant neoplasm of tonsillar pillar (anterior) (posterior)
	146.2: mal neo tonsil pillars	C099: malignant neoplasm of tonsil, unspecified
	146.3: malig neopl vallecula	C100: malignant neoplasm of vallecula
	146.4: mal neo ant epiglottis	C101: malignant neoplasm of anterior surface of epiglottis
	146.6: mal neo lat oropharynx	C102: malignant neoplasm of lateral wall of oropharynx
	146.7: mal neo post oropharynx	C103: malignant neoplasm of posterior wall of oropharynx
	146.8: mal neo oropharynx NEC	C108: malignant neoplasm of overlapping sites of oropharynx
	146.9: malig neo oropharynx NOS	C109: malignant neoplasm of oropharynx, unspecified
Other	149.0: mal neo pharynx NOS	C140: malignant neoplasm of pharynx, unspecified
	149.8: mal neo oral/pharynx NEC	C148: malignant neoplasm of overlapping sites of lip, oral cavity and pharynx
	149.9: mal neo orophryn ill-def	C410: malignant neoplasm of bones of skull and face
	170.0: mal neo skull/face bone	C411: malignant neoplasm of mandible
	170.1: malignant neo mandible	C490: malignant neoplasm of connective and soft tissue of head, face and neck
	171.0: mal neo soft tissue head	C760: malignant neoplasm of head, face and neck
Salivary	142.0: malig neo parotid	C07: malignant neoplasm of parotid gland
	142.1: malig neo submandibular	C080: malignant neoplasm of submandibular gland
	142.2: malig neo sublingual	C089: malignant neoplasm of major salivary gland, unspecified
	142.8: mal neo maj salivary NEC	
	142.9: mal neo salivary NOS	
Skin	140.0: mal neo upper vermilion	C001: malignant neoplasm of external lower lip
	140.1: mal neo lower vermilion	C4401: basal cell carcinoma of skin of lip
	173.00: malig neopl skin lip NOS	C4402: squamous cell carcinoma of skin of lip
	173.01: basal cell ca skin lip	C44309: unspecified malignant neoplasm of skin of other parts of face
	173.02: squamous cell ca skn lip	C44310: basal cell carcinoma of skin of unspecified parts of face
	173.10: mal neo eyelid/canth NOS	C44311: basal cell carcinoma of skin of nose
	173.11: basal cell ca lid/canth	C44319: basal cell carcinoma of skin of other parts of face
	173.12: squam cell ca lid/canth	C44320: squamous cell carcinoma of skin of unspecified parts of face
	173.19: mal neo eyelid/canth NEC	C44321: squamous cell carcinoma of skin of nose
	173.20: malig neo skin ear NOS	C44329: squamous cell carcinoma of skin of other parts of face
	173.20: malig neo skin ear NOS	C44390: other specified malignant neoplasm of skin of unspecified parts of face
	173.21: basal cell ca skin ear	C44399: other specified malignant neoplasm of skin of other parts of face
	173.22: squam cell ca skin ear	C4440: unspecified malignant neoplasm of skin of scalp and neck
	173.29: neo skin ear/ex canl NEC	C4441: basal cell carcinoma of skin of scalp and neck
	173.30: mal neo skn face NEC/NOS	C4442: squamous cell carcinoma of skin of scalp and neck
	173.30: mal neo skn face NEC/NOS	C4449: other specified malignant neoplasm of skin of scalp and neck
	173.31: Bsl cel skn face NEC/NOS	
	173.32: Sqm cel skn face NEC/NOS	
	173.39: mal neo skn face NEC/NOS	
	173.40: mal neo sclp/skn nck NOS	

TABLE A1 (Continued)

Site	ICD-9-CM diagnosis codes	ICD-10-CM diagnosis codes
	173.40: mal neo sclp/skn nck NOS	
	173.41: Bsl cell ca scalp/skn nk	
	173.42: sqam cell ca sclp/skn nk	
	173.49: mal neo sclp/skn nck NEC	
Tongue	141.1: mal neo dorsal tongue	C020: malignant neoplasm of dorsal surface of tongue
	141.2: mal neo tip/lat tongue	C021: malignant neoplasm of border of tongue
	141.3: mal neo ventral tongue	C022: malignant neoplasm of ventral surface of tongue
	141.4: mal neo ant 2/3	C023: malignant neoplasm of anterior two-thirds of tongue, part unspecified
	141.5: mal neo tongue junction	C028: malignant neoplasm of overlapping sites of tongue
	141.8: malig neo tongue NEC	C029: malignant neoplasm of tongue, unspecified
	141.9: malig neo tongue NOS	

## APPENDIX B

TABLE B1 Procedure codes used to identify cohort

ICD-9-CM procedure code	ICD-9-CM procedure codes
16.59: Other exenteration of orbit	08T0XZZ: resection of right eye, external approach
	08T1XZZ: resection of left eye, external approach
	0KX10ZZ: transfer facial muscle, open approach
	0KX14ZZ: transfer facial muscle, percutaneous endoscopic approach
18.39: Other excision of external ear	09T00ZZ: resection of right external ear, open approach
	09T04ZZ: resection of right external ear, percutaneous endoscopic approach
	09T0XZZ: resection of right external ear, external approach
	09T10ZZ: resection of left external ear, open approach
	09T14ZZ: resection of left external ear, percutaneous endoscopic approach
	09T1XZZ: resection of left external ear, external approach
25.1: Excision or destruction of lesion or tissue of tongue	0C570ZZ: destruction of tongue, open approach
	0C573ZZ: destruction of tongue, percutaneous approach
	0C57XZZ: destruction of tongue, external approach
25.2: Partial glossectomy	0CB70ZZ: excision of tongue, open approach
	0CB73ZZ: excision of tongue, percutaneous approach
	0CB7XZZ: excision of tongue, external approach
25.3: Complete glossectomy	0CT70ZZ: resection of tongue, open approach
	0CT7XZZ: resection of tongue, external approach
25.4: Radical glossectomy	0CT70ZZ: resection of tongue, open approach
	0CT7XZZ: resection of tongue, external approach
26.29: Other excision of salivary gland lesion	0C580ZZ: destruction of right parotid gland, open approach
	0C583ZZ: destruction of right parotid gland, percutaneous approach
	0C590ZZ: destruction of left parotid gland, open approach
	0C593ZZ: destruction of left parotid gland, percutaneous approach
	0C5B0ZZ: destruction of right parotid duct, open approach
	0C5B3ZZ: destruction of right parotid duct, percutaneous approach
	0C5C0ZZ: destruction of left parotid duct, open approach
	0C5C3ZZ: destruction of left parotid duct, percutaneous approach
	0C5D0ZZ: destruction of right sublingual gland, open approach
	0C5D3ZZ: destruction of right sublingual gland, percutaneous approach
	0C5F0ZZ: destruction of left sublingual gland, open approach
	0C5F3ZZ: destruction of left sublingual gland, percutaneous approach
	0C5G0ZZ: destruction of right submaxillary gland, open approach
	0C5G3ZZ: destruction of right submaxillary gland, percutaneous approach
	0C5H0ZZ: destruction of left submaxillary gland, open approach
	0C5H3ZZ: destruction of left submaxillary gland, percutaneous approach
	0C5J0ZZ: destruction of minor salivary gland, open approach
	0C5J3ZZ: destruction of minor salivary gland, percutaneous approach
	0CB80ZZ: excision of right parotid gland, open approach
	0CB83ZZ: Excision of Right Parotid Gland, Percutaneous Approach
	0CB90ZZ: excision of left parotid gland, open approach
	0CB93ZZ: excision of left parotid gland, percutaneous approach
0CBB0ZZ: excision of right parotid duct, open approach	



TABLE B1 (Continued)

ICD-9-CM procedure code	ICD-9-CM procedure codes
	0CBB3ZZ: excision of right parotid duct, percutaneous approach
	0CBC0ZZ: excision of left parotid duct, open approach
	0CBC3ZZ: excision of left parotid duct, percutaneous approach
	0CBD0ZZ: excision of right sublingual gland, open approach
	0CBD3ZZ: excision of right sublingual gland, percutaneous approach
	0CBF0ZZ: excision of left sublingual gland, open approach
	0CBF3ZZ: excision of left sublingual gland, percutaneous approach
	0CBG0ZZ: excision of right submaxillary gland, open approach
	0CBG3ZZ: excision of right submaxillary gland, percutaneous approach
	0CBH0ZZ: excision of left submaxillary gland, open approach
	0CBH3ZZ: excision of left submaxillary gland, percutaneous approach
	0CBJ0ZZ: excision of minor salivary gland, open approach
	0CBJ3ZZ: excision of minor salivary gland, percutaneous approach
26.30: Sialoadenectomy, not otherwise specified	0CB83ZZ: excision of right parotid gland, percutaneous approach
	0CB90ZZ: excision of left parotid gland, open approach
	0CB93ZZ: excision of left parotid gland, percutaneous approach
	0CBB0ZZ: excision of right parotid duct, open approach
	0CBB3ZZ: excision of right parotid duct, percutaneous approach
	0CBC0ZZ: excision of left parotid duct, open approach
	0CBC3ZZ: excision of left parotid duct, percutaneous approach
	0CBD0ZZ: excision of right sublingual gland, open approach
	0CBD3ZZ: excision of right sublingual gland, percutaneous approach
	0CBF0ZZ: excision of left sublingual gland, open approach
	0CBF3ZZ: excision of left sublingual gland, percutaneous approach
	0CBG0ZZ: excision of right submaxillary gland, open approach
	0CBG3ZZ: excision of right submaxillary gland, percutaneous approach
	0CBH0ZZ: excision of left submaxillary gland, open approach
	0CBH3ZZ: excision of left submaxillary gland, percutaneous approach
	0CBJ0ZZ: excision of minor salivary gland, open approach
	0CBJ3ZZ: excision of minor salivary gland, percutaneous approach
26.31: Partial sialoadenectomy	0CB80ZZ: excision of right parotid gland, open approach
	0CB83ZZ: excision of right parotid gland, percutaneous approach
	0CB90ZZ: excision of left parotid gland, open approach
	0CB93ZZ: excision of left parotid gland, percutaneous approach
	0CBB0ZZ: excision of right parotid duct, open approach
	0CBB3ZZ: excision of right parotid duct, percutaneous approach
	0CBC0ZZ: excision of left parotid duct, open approach
	0CBC3ZZ: excision of left parotid duct, percutaneous approach
	0CBD0ZZ: excision of right sublingual gland, open approach
	0CBD3ZZ: excision of right sublingual gland, percutaneous approach
	0CBF0ZZ: excision of left sublingual gland, open approach
	0CBF3ZZ: excision of left sublingual gland, percutaneous approach
	0CBG0ZZ: excision of right submaxillary gland, open approach
	0CBG3ZZ: excision of right submaxillary gland, percutaneous approach
	0CBH0ZZ: excision of left submaxillary gland, open approach
	0CBH3ZZ: excision of left submaxillary gland, percutaneous approach

(Continues)

TABLE B1 (Continued)

ICD-9-CM procedure code	ICD-9-CM procedure codes
	0CBJ0ZZ: excision of minor salivary gland, open approach
	0CBJ3ZZ: excision of minor salivary gland, percutaneous approach
26.32: Complete sialoadenectomy	OCT80ZZ: resection of right parotid gland, open approach
	OCT90ZZ: resection of left parotid gland, open approach
	OCTB0ZZ: resection of right parotid duct, open approach
	OCTC0ZZ: resection of left parotid duct, open approach
	OCTD0ZZ: resection of right sublingual gland, open approach
	OCTF0ZZ: resection of left sublingual gland, open approach
	OCTG0ZZ: resection of right submaxillary gland, open approach
	OCTH0ZZ: resection of left submaxillary gland, open approach
	OCTJ0ZZ: resection of minor salivary gland, open approach
27.31: Local excision or destruction of lesion or tissue of bony palate	0C520ZZ: destruction of hard palate, open approach
	0C523ZZ: destruction of hard palate, percutaneous approach
	0C52XZZ: destruction of hard palate, external approach
	0CB20ZZ: excision of hard palate, open approach
	0CB23ZZ: excision of hard palate, percutaneous approach
	0CB2XZZ: excision of hard palate, external approach
27.32: Wide excision or destruction of lesion or tissue of bony palate	0CB20ZZ: excision of hard palate, open approach
	0CB23ZZ: excision of hard palate, percutaneous approach
	0CB2XZZ: excision of hard palate, external approach
	OCT20ZZ: resection of hard palate, open approach
	OCT2XZZ: resection of hard palate, external approach
	0NBR0ZZ: excision of maxilla, open approach
	0NBR3ZZ: excision of maxilla, percutaneous approach
	0NBR4ZZ: excision of maxilla, percutaneous endoscopic approach
27.42: Wide excision of lesion of lip	0CB00ZZ: excision of upper lip, open approach
	0CB03ZZ: excision of upper lip, percutaneous approach
	0CB0XZZ: excision of upper lip, external approach
	0CB10ZZ: excision of lower lip, open approach
	0CB13ZZ: excision of lower lip, percutaneous approach
	0CB1XZZ: excision of lower lip, external approach
27.49: Other excision of mouth	0CB33ZZ: excision of soft palate, percutaneous approach
	0CB3XZZ: excision of soft palate, external approach
	0CB40ZZ: excision of buccal mucosa, open approach
	0CB43ZZ: excision of buccal mucosa, percutaneous approach
	0CB4XZZ: excision of buccal mucosa, external approach
29.33: Pharyngectomy (partial)	09BN0ZZ: excision of nasopharynx, open approach
	09BN3ZZ: excision of nasopharynx, percutaneous approach
	09BN4ZZ: excision of nasopharynx, percutaneous endoscopic approach
	09BN7ZZ: excision of nasopharynx, via natural or artificial opening
	09BN8ZZ: excision of nasopharynx, via natural or artificial opening endoscopic
	09TN0ZZ: resection of nasopharynx, open approach
	09TN4ZZ: resection of nasopharynx, percutaneous endoscopic approach
	09TN7ZZ: resection of nasopharynx, via natural or artificial opening
	09TN8ZZ: resection of nasopharynx, via natural or artificial opening endoscopic

TABLE B1 (Continued)

ICD-9-CM procedure code	ICD-9-CM procedure codes
	0CBM0ZZ: excision of pharynx, open approach
	0CBM3ZZ: excision of pharynx, percutaneous approach
	0CBM4ZZ: excision of pharynx, percutaneous endoscopic approach
	0CBM7ZZ: excision of pharynx, via natural or artificial opening
	0CBM8ZZ: excision of pharynx, via natural or artificial opening endoscopic
	0CTM0ZZ: resection of pharynx, open approach
	0CTM4ZZ: resection of pharynx, percutaneous endoscopic approach
	0CTM7ZZ: resection of pharynx, via natural or artificial opening
	0CTM8ZZ: resection of pharynx, via natural or artificial opening endoscopic
29.39: Other excision or destruction of lesion or tissue of pharynx	095N0ZZ: destruction of nasopharynx, open approach
	095N3ZZ: destruction of nasopharynx, percutaneous approach
	095N4ZZ: destruction of nasopharynx, percutaneous endoscopic approach
	095N7ZZ: destruction of nasopharynx, via natural or artificial opening
	095N8ZZ: destruction of nasopharynx, via natural or artificial opening endoscopic
	09BN0ZZ: excision of nasopharynx, open approach
	09BN3ZZ: excision of nasopharynx, percutaneous approach
	09BN4ZZ: excision of nasopharynx, percutaneous endoscopic approach
	09BN7ZZ: excision of nasopharynx, via natural or artificial opening
	09BN8ZZ: excision of nasopharynx, via natural or artificial opening endoscopic
	0C5M0ZZ: destruction of pharynx, open approach
	0C5M3ZZ: destruction of pharynx, percutaneous approach
	0C5M4ZZ: destruction of pharynx, percutaneous endoscopic approach
	0C5M7ZZ: destruction of pharynx, via natural or artificial opening
	0C5M8ZZ: destruction of pharynx, via natural or artificial opening endoscopic
	0CBM0ZZ: excision of pharynx, open approach
	0CBM3ZZ: excision of pharynx, percutaneous approach
	0CBM4ZZ: excision of pharynx, percutaneous endoscopic approach
	0CBM7ZZ: excision of pharynx, via natural or artificial opening
	0CBM8ZZ: excision of pharynx, via natural or artificial opening endoscopic
30.09: Other excision or destruction of lesion or tissue of larynx	0C5S0ZZ: destruction of larynx, open approach
	0C5S3ZZ: destruction of larynx, percutaneous approach
	0C5S4ZZ: destruction of larynx, percutaneous endoscopic approach
	0C5S7ZZ: destruction of larynx, via natural or artificial opening
	0C5S8ZZ: destruction of larynx, via natural or artificial opening endoscopic
	0C5T0ZZ: destruction of right vocal cord, open approach
	0C5T3ZZ: destruction of right vocal cord, percutaneous approach
	0C5T4ZZ: destruction of right vocal cord, percutaneous endoscopic approach
	0C5T7ZZ: destruction of right vocal cord, via natural or artificial opening
	0C5T8ZZ: destruction of right vocal cord, via natural or artificial opening endoscopic
	0C5V0ZZ: destruction of left vocal cord, open approach
	0C5V3ZZ: destruction of left vocal cord, percutaneous approach
	0C5V4ZZ: destruction of left vocal cord, percutaneous endoscopic approach
	0C5V7ZZ: destruction of left vocal cord, via natural or artificial opening
	0C5V8ZZ: destruction of left vocal cord, via natural or artificial opening endoscopic
	0CBR0ZZ: excision of epiglottis, open approach

(Continues)

TABLE B1 (Continued)

ICD-9-CM procedure code	ICD-9-CM procedure codes
	0CBR3ZZ: excision of epiglottis, percutaneous approach
	0CBR4ZZ: excision of epiglottis, percutaneous endoscopic approach
	0CBR7ZZ: excision of epiglottis, via natural or artificial opening
	0CBR8ZZ: excision of epiglottis, via natural or artificial opening endoscopic
	0CBS0ZZ: excision of larynx, open approach
	0CBS3ZZ: excision of larynx, percutaneous approach
	0CBS4ZZ: excision of larynx, percutaneous endoscopic approach
	0CBS7ZZ: excision of larynx, via natural or artificial opening
	0CBS8ZZ: excision of larynx, via natural or artificial opening endoscopic
	0CBT0ZZ: excision of right vocal cord, open approach
	0CBT3ZZ: excision of right vocal cord, percutaneous approach
	0CBT4ZZ: excision of right vocal cord, percutaneous endoscopic approach
	0CBT7ZZ: excision of right vocal cord, via natural or artificial opening
	0CBT8ZZ: excision of right vocal cord, via natural or artificial opening endoscopic
	0CBV0ZZ: excision of left vocal cord, open approach
	0CBV3ZZ: excision of left vocal cord, percutaneous approach
	0CBV4ZZ: excision of left vocal cord, percutaneous endoscopic approach
	0CBV7ZZ: excision of left vocal cord, via natural or artificial opening
	0CBV8ZZ: excision of left vocal cord, via natural or artificial opening endoscopic
	0CDT0ZZ: extraction of right vocal cord, open approach
	0CDT3ZZ: extraction of right vocal cord, percutaneous approach
	0CDT4ZZ: extraction of right vocal cord, percutaneous endoscopic approach
	0CDT7ZZ: extraction of right vocal cord, via natural or artificial opening
	0CDT8ZZ: extraction of right vocal cord, via natural or artificial opening endoscopic
	0CDV0ZZ: extraction of left vocal cord, open approach
	0CDV3ZZ: extraction of left vocal cord, percutaneous approach
	0CDV4ZZ: extraction of left vocal cord, percutaneous endoscopic approach
	0CDV7ZZ: extraction of left vocal cord, via natural or artificial opening
	0CDV8ZZ: extraction of left vocal cord, via natural or artificial opening endoscopic
30.21: Epiglottidectomy	0C5R0ZZ: destruction of epiglottis, open approach
	0C5R3ZZ: destruction of epiglottis, percutaneous approach
	0C5R4ZZ: destruction of epiglottis, percutaneous endoscopic approach
	0C5R7ZZ: destruction of epiglottis, via natural or artificial opening
	0C5R8ZZ: destruction of epiglottis, via natural or artificial opening endoscopic
	0CBR0ZZ: excision of epiglottis, open approach
	0CBR3ZZ: excision of epiglottis, percutaneous approach
	0CBR4ZZ: excision of epiglottis, percutaneous endoscopic approach
	0CBR7ZZ: excision of epiglottis, via natural or artificial opening
	0CBR8ZZ: excision of epiglottis, via natural or artificial opening endoscopic
	0CTR0ZZ: resection of epiglottis, open approach
	0CTR4ZZ: resection of epiglottis, percutaneous endoscopic approach
	0CTR7ZZ: resection of epiglottis, via natural or artificial opening
	0CTR8ZZ: resection of epiglottis, via natural or artificial opening endoscopic
30.22: Vocal cordectomy	0CBT0ZZ: excision of right vocal cord, open approach
	0CBT3ZZ: excision of right vocal cord, percutaneous approach
	0CBT4ZZ: excision of right vocal cord, percutaneous endoscopic approach

TABLE B1 (Continued)

ICD-9-CM procedure code	ICD-9-CM procedure codes
	0CBT7ZZ: excision of right vocal cord, via natural or artificial opening
	0CBT8ZZ: excision of right vocal cord, via natural or artificial opening endoscopic
	0CBV0ZZ: excision of left vocal cord, open approach
	0CBV3ZZ: excision of left vocal cord, percutaneous approach
	0CBV4ZZ: excision of left vocal cord, percutaneous endoscopic approach
	0CBV7ZZ: excision of left vocal cord, via natural or artificial opening
	0CBV8ZZ: excision of left vocal cord, via natural or artificial opening endoscopic
	0CTT0ZZ: Resection of Right Vocal Cord, Open Approach
	0CTT4ZZ: resection of right vocal cord, percutaneous endoscopic approach
	0CTT7ZZ: resection of right vocal cord, via natural or artificial opening
	0CTT8ZZ: resection of right vocal cord, via natural or artificial opening endoscopic
	0CTV0ZZ: resection of left vocal cord, open approach
	0CTV4ZZ: resection of left vocal cord, percutaneous endoscopic approach
	0CTV7ZZ: resection of left vocal cord, via natural or artificial opening
	0CTV8ZZ: resection of left vocal cord, via natural or artificial opening endoscopic
30.29: Other partial laryngectomy	0CBS0ZZ: excision of larynx, open approach
	0CBS3ZZ: excision of larynx, percutaneous approach
	0CBS4ZZ: excision of larynx, percutaneous endoscopic approach
	0CBS7ZZ: excision of larynx, via natural or artificial opening
	0CBS8ZZ: excision of larynx, via natural or artificial opening endoscopic
30.3: Complete laryngectomy	0B110F4: bypass trachea to cutaneous with tracheostomy device, open approach
	0B110Z4: bypass trachea to cutaneous, open approach
	0B113F4: bypass trachea to cutaneous with tracheostomy device, percutaneous approach
	0B113Z4: bypass trachea to cutaneous, percutaneous approach
	0B114F4: Bypass Trachea to Cutaneous with Tracheostomy Device, Percutaneous Endoscopic Approach
	0B114Z4: Bypass Trachea to Cutaneous, Percutaneous Endoscopic Approach
	0CTS0ZZ: resection of larynx, open approach
	0CTS4ZZ: resection of larynx, percutaneous endoscopic approach
	0CTS7ZZ: resection of larynx, via natural or artificial opening
	0CTS8ZZ: resection of larynx, via natural or artificial opening endoscopic
30.4: Radical laryngectomy	07T10ZZ: resection of right neck lymphatic, open approach
	07T14ZZ: resection of right neck lymphatic, percutaneous endoscopic approach
	07T20ZZ: resection of left neck lymphatic, open approach
	07T24ZZ: resection of left neck lymphatic, percutaneous endoscopic approach
	0B110F4: bypass trachea to cutaneous with tracheostomy device, open approach
	0B110Z4: bypass trachea to cutaneous, open approach
	0B113F4: bypass trachea to cutaneous with tracheostomy device, percutaneous approach
	0B113Z4: bypass trachea to cutaneous, percutaneous approach
	0B114F4: bypass trachea to cutaneous with tracheostomy device, percutaneous endoscopic approach
	0B114Z4: bypass trachea to cutaneous, percutaneous endoscopic approach
	0CTS0ZZ: resection of larynx, open approach
	0CTS4ZZ: resection of larynx, percutaneous endoscopic approach
	0CTS7ZZ: resection of larynx, via natural or artificial opening
	0CTS8ZZ: resection of larynx, via natural or artificial opening endoscopic
	0GTG0ZZ: resection of left thyroid gland lobe, open approach
	0GTG4ZZ: resection of left thyroid gland lobe, percutaneous endoscopic approach
	0GTH0ZZ: resection of right thyroid gland lobe, open approach

(Continues)

TABLE B1 (Continued)

ICD-9-CM procedure code	ICD-9-CM procedure codes
40.40: Radical neck dissection, not otherwise specified	0GTH4ZZ: resection of right thyroid gland lobe, percutaneous endoscopic approach
	0GTK0ZZ: resection of thyroid gland, open approach
	0GTK4ZZ: resection of thyroid gland, percutaneous endoscopic approach
	07T10ZZ: resection of right neck lymphatic, open approach
	07T14ZZ: resection of right neck lymphatic, percutaneous endoscopic approach
	07T20ZZ: resection of left neck lymphatic, open approach
	07T24ZZ: resection of left neck lymphatic, percutaneous endoscopic approach
40.41: Radical neck dissection, unilateral	07T10ZZ: resection of right neck lymphatic, open approach
	07T14ZZ: resection of right neck lymphatic, percutaneous endoscopic approach
	07T20ZZ: resection of left neck lymphatic, open approach
40.42: Radical neck dissection, bilateral	07T24ZZ: resection of left neck lymphatic, percutaneous endoscopic approach
	07T10ZZ: resection of right neck lymphatic, open approach
	07T14ZZ: resection of right neck lymphatic, percutaneous endoscopic approach
76.31: Partial mandibulectomy	07T20ZZ: resection of left neck lymphatic, open approach
	07T24ZZ: resection of left neck lymphatic, percutaneous endoscopic approach
	0NBT0ZZ: excision of right mandible, open approach
	0NBT3ZZ: excision of right mandible, percutaneous approach
76.41: Total mandibulectomy with synchronous reconstruction	0NBT4ZZ: excision of right mandible, percutaneous endoscopic approach
	0NBV0ZZ: excision of left mandible, open approach
	0NBV3ZZ: excision of left mandible, percutaneous approach
	0NBV4ZZ: excision of left mandible, percutaneous endoscopic approach
	0NRT07Z: replacement of right mandible with autologous tissue substitute, open approach
	0NRT0JZ: replacement of right mandible with synthetic substitute, open approach
	0NRT0KZ: replacement of right mandible with nonautologous tissue substitute, open approach
	0NRT37Z: replacement of right mandible with autologous tissue substitute, percutaneous approach
	0NRT3JZ: replacement of right mandible with synthetic substitute, percutaneous approach
	0NRT3KZ: replacement of right mandible with nonautologous tissue substitute, percutaneous approach
	0NRT47Z: replacement of right mandible with autologous tissue substitute, percutaneous endoscopic approach
	0NRT4JZ: replacement of right mandible with synthetic substitute, percutaneous endoscopic approach
	0NRT4KZ: replacement of right mandible with nonautologous tissue substitute, percutaneous endoscopic approach
	0NRV07Z: replacement of left mandible with autologous tissue substitute, open approach
	0NRV0JZ: replacement of left mandible with synthetic substitute, open approach
	0NRV0KZ: replacement of left mandible with nonautologous tissue substitute, open approach
0NRV37Z: replacement of left mandible with autologous tissue substitute, percutaneous approach	
0NRV3JZ: replacement of left mandible with synthetic substitute, percutaneous approach	
0NRV3KZ: replacement of left mandible with nonautologous tissue substitute, percutaneous approach	
0NRV47Z: replacement of left mandible with autologous tissue substitute, percutaneous endoscopic approach	
0NRV4JZ: replacement of left mandible with synthetic substitute, percutaneous endoscopic approach	
0NRV4KZ: replacement of left mandible with nonautologous tissue substitute, percutaneous endoscopic approach	

## APPENDIX C

TABLE C1 ICD-9-CM and ICD-10-PCS codes used to identify flap reconstruction

ICD-9-CM procedure codes for flap reconstruction	ICD-10-PCD codes for flap reconstruction
86.60	OHR0X73, OHR0X74, OHR0XK3, OHR0XK4, OHR1X73, OHR1X74, OHR1XK3, OHR1XK4, OHR4X73, OHR4X74, OHR4XK3, OHR4XK4, OHR5X73, OHR5X74, OHR5XK3, OHR5XK4, OHR6X73, OHR6X74, OHR6XK3, OHR6XK4, OHR7X73, OHR7X74, OHR7XK3, OHR7XK4, OHR8X73, OHR8X74, OHR8XK3, OHR8XK4, OHRAX73, OHRAX74, OHRAXK3, OHRAXK4, OHRBX73, OHRBX74, OHRBXK3, OHRBXK4, OHRCX73, OHRCX74, OHRCKX3, OHRCKX4, OHRDX73, OHRDX74, OHRDXK3, OHRDXK4, OHREX73, OHREX74, OHREXK3, OHREXK4, OHRHX73, OHRHX74, OHRHXK3, OHRHXK4, OHRJX73, OHRJX74, OHRJXK3, OHRJXK4, OHRKX73, OHRKX74, OHRKXK3, OHRKXK4, OHRXL73, OHRXL74, OHRXLK3, OHRXLK4, OHRMX73, OHRMX74, OHRMXK3, OHRMXK4, OHRNX73, OHRNX74, OHRNXK3, OHRNXK4
86.63	OHB0XZZ, OHB1XZZ, OHB4XZZ, OHB5XZZ, OHB6XZZ, OHB7XZZ, OHB8XZZ, OHBAXZZ, OHBBXZZ, OHBCXZZ, OHBDXZZ, OHBEXZZ, OHBFXZZ, OHBGXZZ, OHBHZZ, OHBJZZ, OHBKZZ, OHBLZZ, OHBMXZZ, OHBNXZZ, OHR0X73, OHR0X74, OHR1X73, OHR1X74, OHR4X73, OHR4X74, OHR5X73, OHR5X74, OHR6X73, OHR6X74, OHR7X73, OHR7X74, OHR8X73, OHR8X74, OHRAX73, OHRAX74, OHRBX73, OHRBX74, OHRCX73, OHRCX74, OHRDX73, OHRDX74, OHREX73, OHREX74, OHRHX73, OHRHX74, OHRJX73, OHRJX74, OHRKX73, OHRKX74, OHRKXK3, OHRKXK4, OHRXL73, OHRXL74, OHRXLK3, OHRXLK4, OHRMX73, OHRMX74, OHRMXK3, OHRMXK4, OHRNX73, OHRNX74
86.65	OHR0XK3, OHR0XK4, OHR1XK3, OHR1XK4, OHR4XK3, OHR4XK4, OHR5XK3, OHR5XK4, OHR6XK3, OHR6XK4, OHR7XK3, OHR7XK4, OHR8XK3, OHR8XK4, OHRAXK3, OHRAXK4, OHRBXK3, OHRBXK4, OHRCKX3, OHRCKX4, OHRDXK3, OHRDXK4, OHREXK3, OHREXK4, OHRHXK3, OHRHXK4, OHRJXK3, OHRJXK4, OHRKXK3, OHRKXK4, OHRXLK3, OHRXLK4, OHRMXK3, OHRMXK4, OHRNXK3, OHRNXK4
86.66	OHR0XK3, OHR0XK4, OHR1XK3, OHR1XK4, OHR4XK3, OHR4XK4, OHR5XK3, OHR5XK4, OHR6XK3, OHR6XK4, OHR7XK3, OHR7XK4, OHR8XK3, OHR8XK4, OHRAXK3, OHRAXK4, OHRBXK3, OHRBXK4, OHRCKX3, OHRCKX4, OHRDXK3, OHRDXK4, OHREXK3, OHREXK4, OHRFXK3, OHRFXK4, OHRGXK3, OHRGXK4, OHRHXK3, OHRHXK4, OHRJXK3, OHRJXK4, OHRKXK3, OHRKXK4, OHRXLK3, OHRXLK4, OHRMXK3, OHRMXK4, OHRNXK3, OHRNXK4
86.67	OHR0XJ3, OHR0XJ4, OHR0XJZ, OHR0XK3, OHR0XK4, OHR1XJ3, OHR1XJ4, OHR1XJZ, OHR1XK3, OHR1XK4, OHR4XJ3, OHR4XJ4, OHR4XJZ, OHR4XK3, OHR4XK4, OHR5XJ3, OHR5XJ4, OHR5XJZ, OHR5XK3, OHR5XK4, OHR6XJ3, OHR6XJ4, OHR6XJZ, OHR6XK3, OHR6XK4, OHR7XJ3, OHR7XJ4, OHR7XJZ, OHR7XK3, OHR7XK4, OHR8XJ3, OHR8XJ4, OHR8XJZ, OHR8XK3, OHR8XK4, OHRAXJ3, OHRAXJ4, OHRAXJZ, OHRAXK3, OHRAXK4, OHRBXJ3, OHRBXJ4, OHRBXJZ, OHRBXK3, OHRBXK4, OHRCXJ3, OHRCXJ4, OHRCXJZ, OHRCKX3, OHRCKX4, OHRDXJ3, OHRDXJ4, OHRDXJZ, OHRDXK3, OHRDXK4, OHREXJ3, OHREXJ4, OHREXJZ, OHREXK3, OHREXK4, OHRFXJ3, OHRFXJ4, OHRFXJZ, OHRFXK3, OHRFXK4, OHRGXJ3, OHRGXJ4, OHRGXJZ, OHRGXK3, OHRGXK4, OHRHXJ3, OHRHXJ4, OHRHXJZ, OHRHXK3, OHRHXK4, OHRJXJ3, OHRJXJ4, OHRJXJZ, OHRJXK3, OHRJXK4, OHRKXJ3, OHRKXJ4, OHRKXJZ, OHRKXK3, OHRKXK4, OHRXLJ3, OHRXLJ4, OHRXLJZ, OHRXLK3, OHRXLK4, OHRMXJ3, OHRMXJ4, OHRMXJZ, OHRMXK3, OHRMXK4, OHRNXJ3, OHRNXJ4, OHRNXJZ, OHRNXK3, OHRNXK4
86.69	OHR0X74, OHR1X74, OHR4X74, OHR5X74, OHR6X74, OHR7X74, OHR8X74, OHRAX74, OHRBX74, OHRCX74, OHRDX74, OHREX74, OHRHX74, OHRJX74, OHRKX74, OHRXL74, OHRMX74, OHRNX74
86.70	OHX0XZZ, OHX1XZZ, OHX4XZZ, OHX5XZZ, OHX6XZZ, OHX7XZZ, OHX8XZZ, OHXAXZZ, OHXBZZ, OHXCXZZ, OHXDZZ, OHXEXZZ, OHXFXZZ, OHXGXZZ, OHXHZZ, OHXJZZ, OHXKZZ, OHXLZZ, OHXMXZZ, OHXNXZZ
86.71	OH80XZZ, OH81XZZ, OH84XZZ, OH85XZZ, OH86XZZ, OH87XZZ, OH88XZZ, OH8AXZZ, OH8BXZZ, OH8CXZZ, OH8DXZZ, OH8EXZZ, OH8FXZZ, OH8GXZZ, OH8HXZZ, OH8JZZ, OH8KZZ, OH8LZZ, OH8MXZZ, OH8NXZZ
86.72	OHX0XZZ, OHX1XZZ, OHX4XZZ, OHX5XZZ, OHX6XZZ, OHX7XZZ, OHX8XZZ, OHX9XZZ, OHXAXZZ, OHXBZZ, OHXCXZZ, OHXDZZ, OHXEXZZ, OHXFXZZ, OHXGXZZ, OHXHZZ, OHXJZZ, OHXKZZ, OHXLZZ, OHXMXZZ, OHXNXZZ
86.74	OHX0XZZ, OHX1XZZ, OHX4XZZ, OHX5XZZ, OHX6XZZ, OHX7XZZ, OHX8XZZ, OHXAXZZ, OHXBZZ, OHXCXZZ, OHXDZZ, OHXEXZZ, OHXHZZ, OHXJZZ, OHXKZZ, OHXLZZ, OHXMXZZ, OHXNXZZ, OJX00ZB, OJX00ZC, OJX03ZB, OJX03ZC, OJX10ZB, OJX10ZC, OJX13ZB, OJX13ZC, OJX40ZB, OJX40ZC, OJX43ZB, OJX43ZC, OJX50ZB, OJX50ZC, OJX53ZB, OJX53ZC, OJX60ZB, OJX60ZC, OJX63ZB, OJX63ZC, OJX70ZB, OJX70ZC, OJX73ZB, OJX73ZC, OJX80ZB, OJX80ZC, OJX83ZB, OJX83ZC, OJX90ZB, OJX90ZC, OJX93ZB, OJX93ZC, OJXB0ZB, OJXB0ZC, OJXB3ZB, OJXB3ZC, OJXC0ZB, OJXC0ZC, OJXC3ZB, OJXC3ZC, OJXD0ZB, OJXD0ZC, OJXD3ZB, OJXD3ZC, OJXF0ZB, OJXF0ZC, OJXF3ZB, OJXF3ZC, OJXG0ZB, OJXG0ZC, OJXG3ZB, OJXG3ZC, OJXH0ZB, OJXH0ZC, OJXH3ZB, OJXH3ZC, OJXL0ZB, OJXL0ZC, OJXL3ZB, OJXL3ZC, OJXM0ZB, OJXM0ZC, OJXM3ZB, OJXM3ZC, OJXN0ZB, OJXN0ZC, OJXN3ZB, OJXN3ZC, OJXP0ZB, OJXP0ZC, OJXP3ZB, OJXP3ZC, OJXQ0ZB, OJXQ0ZC, OJXQ3ZB, OJXQ3ZC, OJXR0ZB, OJXR0ZC, OJXR3ZB, OJXR3ZC
86.75	OHB0XZZ, OHB1XZZ, OHB4XZZ, OHB5XZZ, OHB6XZZ, OHB7XZZ, OHB8XZZ, OHBAXZZ, OHBBXZZ, OHBCXZZ, OHBDXZZ, OHBEXZZ, OHBFXZZ, OHBGXZZ, OHBHZZ, OHBJZZ, OHBKZZ, OHBLZZ, OHBMXZZ, OHBNXZZ