characteristics included anatomic cancer site, anatomic cancer subsite, stage, grade, histology and p16 staining (the most commonly used surrogate marker for HPV status) [23]. Testing for p16 was performed routinely on primaries of the base of tongue and tonsillar region and at the surgeon/pathologist's discretion otherwise. Primary treatment details (treatment within the first 5 months of therapy initiation) and outcomes, including recurrence rates and survival within the follow- up period were also collected, with follow-up defined as the last clinical encounter prior to September 2013. Patients were de-identified and data was entered into a database on a password-protected computer.

Statistical analysis

The two types of HNC were compared using chi-square tests for dichotomous categorical variables or Fishers exact test where appropriate. Wald test was used to compare variables with 3 categories. Continuous variables were compared using the non-parametric Wilcoxon test. The primary outcome was disease-free survival defined as survival free of relapse. Death was treated as a competing risk and reported as relapse-free mortality. Data was censored on date of last known follow-up. Overall survival was analyzed as a secondary outcome. All events were measured from the date of diagnosis. Gray's test for equality of cumulative incidence functions was used to assess differences between types of HNC. The cumulative incidence of mortality in the presence of relapse was also modeled. Cumulative incidence looks at the probability of relapse conditional on relapse free survival and competing risk for survival adjusting for the risk of death.

The proportional hazards model for subdistribution was used to model the cumulative incidence of relapse and relapse-free mortality [25]. Univariate competing risk regression models were performed to look at type of HNC. Multivariate models were used adjusting for COPD, age, overall stage, treatment and previous malignancy. Linearity of continuous variables and proportional hazards assumption of categorical variables was tested. Age violated assumptions of linearity and was therefore modeled as age < 55 vs. age ≥ 55. Overall survival was characterized using Kaplan-Meier plots and the Log-rank test was used to compare type of HNC. Cox-proportional hazards model was used to estimate hazard ratios. Level of significance was set at $\alpha = 0.05$. SAS STAT software v9.3 (Cary, NC: SAS Institute Inc.) was used for all analyses.

Results

Primary subsite distribution

There were 582 charts reviewed with 318 (55 %) patients meeting the inclusion criteria. Of those analyzed, 122 (38 %) had been diagnosed with OPSCC and 196 (62 %) patients had other HNSCC primaries (Table 1). Analysis was performed on all available data. However, there were varying levels of availability in patient charts as demonstrated by the variability in sample sizes for specific comparisons.

Demographics, risk factors and comorbidities

Patients' demographics, risk factors and comorbidities are reported in Table 2. There were no significant differences in smoking history between patients with OPSCC and other types of HNC ($n = 312$, never smoked 21(17 %) vs 25(13 %), current smoker 48(39 %) vs 91(46 %) and quit smoking 53(43 %) vs 74(38 %), $p = 0.3002$). The same was shown when pack year history was analyzed (Current smokers: 41.5 % vs 44.09 % $p = 0.9891$; Quit smoking: 27.79 % vs 32.18 %, $p = 0.2969$). Those with OPSCC, however, were significantly less likely to have COPD as a co-morbidity ($n = 318$, 19(16 %) vs 53(27 %), $p = 0.0175$). Particularly of note there were no significant differences in patients diagnosed at age <55 years ($n = 316$, 91(75 %)) compared to those age 55 years and older (147(75 %), $p = 0.8123$), in patient gender ($n = 318$, males: 97(80 %) vs. 140(71 %), $p = 0.1078$), in marijuana use ($n = 128$, 10(8 %) vs 17(9 %), $p = 0.8267$) or in drinking status ($n = 267$, never drank 4(3 %) vs 8(4 %), current drinker 84(69 %) vs 126(64 %) and quit drinking 20(16 %) vs 25(13 %), $p = 0.7538$). Finally, the Charlson probability for 10 year survival demonstrated no significant difference ($n = 318$, >50 % 89(28 %) vs 140(44 %), $p = 0.7984$).

Treatment and weight loss

Treatment and weight loss data is summarized in Table 3. These comparisons demonstrated that OPSCCs were more likely to be given combination therapy, including "surgery and radiation therapy" (S-RT), "surgery

Table 1 Anatomical subsite distribution of HNSCC primary tumours

Site	Frequency (n)	Percent
Oropharynx	122	38.4 %
Lip & Oral Cavity	86	27.0 %
Larynx	72	22.6 %
Hypopharynx	15	4.7 %
Nasopharynx	10	3.1 %
Nasal Cavity	8	2.5 %
Paranasal Sinuses	4	1.3 %
Salivary Glands	1	0.3 %