Otolaryngology Articles   Otolaryngology - Head and Neck Surgery

7-1-2021

Does insurance type influence overall survival in patients with laryngeal squamous cell carcinoma?

Jeewanjot S. Grewal

Richard H. Law

Amy M. Williams

Anna G. Wertz

Steven S. Chang

Does insurance type influence overall survival in patients with laryngeal squamous cell carcinoma?☆

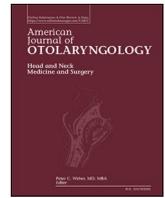Jeewanjot S. Grewal, Richard H. Law, Amy M. Williams, Anna G. Wertz, Steven S. Chang*

Department of Otolaryngology-Head and Neck Surgery, Henry Ford Hospital, Detroit, MI, USA

ABSTRACT

Objective: Patients with head and neck cancer with Medicaid or no insurance present at a more advanced stage and have lower survival. This study is one of the first to examine the relationship between specific insurance types and overall survival for laryngeal squamous cell carcinoma patients.
Study design: Retrospective chart review.
Setting: Henry Ford Cancer Institute.
Subjects and methods: A retrospective database review was performed using the Henry Ford Virtual Data Warehouse Tumor Registry. Six hundred and fifty patients diagnosed with laryngeal squamous cell carcinoma were identified. Insurance groups analyzed were fee for service, health maintenance organization, Henry Ford Medical Group - a managed care type insurance, Medicare and Medicaid/uninsured. Cox proportional hazards and Kaplan-Meier curves were generated to analyze overall survival and display survival differences respectively.
Results: The uninsured group had the lowest median survival time of 29.8 months (95% CI: 20.3–44.8) and the highest HR of 1.85 (95% CI 1.16–2.93) as compared to the HMO group at $p < 0.001$. Patients with fee for service insurance had longer overall survival compared to the other insurance types. Patients with fee for service insurance also had a high proportion of patients with advanced stage disease, but a younger mean age. Henry Ford Medical Group had a higher mean age and no statistically significant difference in survival when compared to fee for service. ($p = 0.999$) After controlling for socioeconomic status, insurance type remains a significant predictor of overall survival.
Conclusions: Fee for service had the highest overall survival of the different insurance types, but it was only statistically significant when compared to the Medicaid/uninsured group.

1. Introduction

The incidence of laryngeal squamous cell carcinoma is estimated at 3.2 cases per 100,000 people with 3710 estimated deaths in 2018 [1]. A key prognostic indicator in survival is early stage at presentation. The 5-year survival for localized laryngeal cancer is 77.5% compared to 33.5% in those who present with lymph node metastases [1]. Early stage disease may be treated conservatively with radiation or organ preservation surgery. At advanced stages, the gold standard treatment is either a total laryngectomy or chemoradiation. Advance stage treatment, however, confers greater morbidity, such as loss of voice and impaired swallowing. Additionally, a significant portion of those undergoing chemo-radiation present with persistent or recurrent disease, requiring salvage laryngectomy [2]. Socioeconomic factors, such as income and insurance

status, play a key role in identifying populations that present with advanced-stage cancers [3–11].

Previous studies have shown that patients with head and neck cancer who are uninsured at diagnosis present at a later stage and with greater tumor burden than those with private insurance [3,6]. These results have been consistent in oral cavity, oropharyngeal, and laryngeal cancers and can also be seen in other cancers, including breast, colorectal, lung, and hematologic malignancies [6–10,12,13]. As expected from presenting with advanced disease, patients with head and neck cancer without insurance have worse overall survival compared to those with private insurance [7,8]. Additionally, they have a higher mortality compared to the insured, even after controlling for stage at presentation [4]. Prior studies have also demonstrated that patients with Medicaid and Medicare diagnosed with cancer often have worse overall survival

compared to those with private insurance [4,9]. As such, insurance status appears to have strong associations with cancer survival, even after controlling for other factors such as race [12,13]. Indeed, research in 2015 using the National Cancer Database examined the relative survival of patients with Medicare, Medicaid, private, uninsured, and unknown insurance in regards to laryngeal squamous cell cancer [5]. This study concluded that patients with Medicaid or without insurance had decreased relative survival compared to those with private insurance [5]. These findings have implications in regard to the state of health care systems in the United States and providing greater access to health care.

To our knowledge, no study has previously compared overall survival of patients with laryngeal cancer among Medicare, Medicaid, and different private insurance types. The current study examines the effect of various private insurance types (health maintenance organization [HMO] managed care insurance, Fee for Service [FFS], and an HMO specific to our institution, Henry Ford Medical Group Confined [HFMG Confined]), in addition to Medicare, Medicaid, and no insurance on laryngeal cancer survival. The study also examined the contributions of markers of socioeconomic status (SES) in the various insurance populations and the interaction of these markers with overall survival.

2. Methods

Henry Ford Health System's Virtual Data Warehouse Tumor Registry was used to identify patients with a diagnosis of laryngeal squamous cell carcinoma from 1990 to 2013. Demographic information, including age, sex, and race/ethnicity, were found within the database. Additionally, disease-specific data such as diagnosis date, treatment dates, follow-up, vital status, and date of death were included. The American Joint Committee on Cancer staging criteria at diagnosis was also available in the database. Socioeconomic markers were included using 2010 US Census block data, which provided median household income, education level, and household status at the level of the patient's census block at time of diagnosis.

The different insurance types evaluated were FFS, HMO managed care insurance, HFMG Confined, Medicare, and Medicaid/uninsured. Medicaid and uninsured patients were grouped together as many patients present as uninsured for their initial cancer diagnosis and treatment only to later apply for and be granted Medicaid insurance after initiation of cancer care. Institutional review board approval from Henry Ford Health System was obtained for the study.

2.1. Statistical analysis

The primary aim of this analysis was to compare overall survival between insurance types. Insurance was grouped into 5 types: FFS, HFMG Confined, HMO, Medicaid/uninsured, and Medicare. Continuous data are described using means and standard deviations, while categorical data are described using counts and percentages. Overall survival time is calculated by taking the difference between diagnosis date and date of death or date of last known contact in those known to be deceased but without a verifiable date of death on record. Patients are considered censored if they were alive at last known contact date or were known to be alive without date of death. Overall survival distributions are compared between groups using a log-rank test, and median survival times with 95% CIs are calculated using the life-test method. Cox proportional hazards models are used to examine the effect of insurance type on survival while controlling for other variables such as stage and SES. Kaplan-Meier curves are produced to visualize survival differences. Stage and site were compared between insurance groups using Fisher's exact tests due to small group sizes, while continuous variables were compared between insurance groups using Wilcoxon signed-rank tests due to non-normal distributions. Statistical significance is set at $p < 0.05$. All analyses are completed using SAS 9.4 (SAS Institute Inc., Cary, NC).

3. Results

Six hundred fifty patients diagnosed with laryngeal squamous cell carcinoma were identified in the tumor registry from 1990 to 2013. In the overall sample, 78% of patients were male, with a mean age of 64 years (SD = 11.2). The overall mean of the median household income in the patient's zip code was \$43,919.60 (SD = \$22,822.30). The largest proportion of patients had FFS type insurance (52.4%), followed by HMO (16.2%), HFMG (14.9%), Uninsured (11.1%) and Medicaid (5.4%).

Table 1A shows the hazard ratios between the different insurance groups stratified by AJCC8 staging criteria for laryngeal squamous cell carcinoma; this was further grouped into two broad categories as early stage and late stage. There was no significant difference in survival probability between the insurance groups for Stage 0/carcinoma in situ ($n = 75$), Stage I ($n = 195$), and Stage II ($n = 112$) cancers ($p = 0.118$,

Table 1A
Survival by insurance type stratified by AJCC stage.

AJCC stage (N)[a]		Insurance group (ref grp = HMO)	HR	95% CI	P-value
Early (N = 382)	0 (N = 75)	FFS	6.60	0.86, 50.73	0.118
		HFMG	2.30	0.26, 20.67	
		Medicaid	14.00	0.83, 237.51	
		Uninsured	2.94	0.27, 32.62	
	I, IA, IB (N = 195)	FFS	1.03	0.62, 1.72	0.073
		HFMG	0.90	0.47, 1.73	
		Medicaid	N/A	N/A	
		Uninsured	2.79	1.26, 6.19	
	II (N = 112)	FFS	1.41	0.66, 3.01	0.220
		HFMG	0.51	0.17, 1.51	
		Medicaid	N/A	N/A	
		Uninsured	1.41	0.50, 3.94	
Late (N = 268)	III (N = 80)	FFS	1.24	0.43, 3.55	**0.017**
		HFMG	0.94	0.26, 3.35	
		Medicaid	3.78	0.81, 17.71	
		Uninsured	4.86	1.36, 17.39	
	IV (N = 50)	FFS	2.95	0.87, 10.05	**0.016**
		HFMG	N/A	N/A	
		Medicaid	None	None	
		Uninsured	6.99	1.88, 25.92	
	IVA (N = 124)	FFS	0.81	0.43, 1.54	0.491
		HFMG	1.10	0.48, 2.52	
		Medicaid	0.52	0.21, 1.31	
		Uninsured	1.40	0.40, 4.95	
	IVB/IVC (N = 14)	FFS	1.15	0.21, 6.33	0.744
		HFMG	1.64	0.21, 12.57	
		Medicaid	0.44	0.04, 5.34	
		Uninsured	0.39	0.03, 4.95	

[a] No patients in the original 650 had Insurance Group = Other.

2

0.073, and 0.220, respectively). There was a significant difference in survival probability overall between the insurance groups for Stage III ($n = 80$) and non-specific Stage IV ($n = 50$) cancers ($p = 0.017$ and $p = 0.016$, respectively); however, there was no statistical difference in HRs for Stage IVA ($n = 124$) and IVB/IVC ($n = 14$) cancers ($p = 0.491$ and $p = 0.744$, respectively). Table 1B shows the sample size for each insurance group stratified by AJCC8 staging.

Analysis of Stage 0 did not include enough data to provide a median survival time as <50% of this cohort died. Stage I had the highest median survival time of 120.6 months (95% CI: 102.1–150.9), followed by Stage II at 91.3 months (95% CI: 64.4–114.7), Stage III at 69.0 months (95% CI: 32.5–87.6), Stage IV at 40.3 months (95% CI: 18.6–58.8), Stage IVA at 29.3 months (95% CI: 17.8–52.2), and Stage IVB/IVC at 4.8 months (95% CI: 1.5–11.0) (Table 2).

The most frequent treatment modality seen in the HMO group was radiotherapy (RT) only at 56.8% (50/88), RT only for FSS at 49.6% (137/276), surgery only for Medicaid at 34.3% (11/32), RT only for HFMG at 51.3% (39/76), and RT only for uninsured at 72.9% (35/48) (Table 3). The overall most frequent modality was RT only at 51.2% (266/520), followed by surgery only at 18.0% (94/520), chemoradiation (CRT) at 11.9% (62/520), surgery & adjuvant RT at 11.9% (62/520), surgery and adjuvant CRT at 4.6% (24/520), salvage surgery at 1.2% (6/520), and chemotherapy only at 1.2% (6/520) (Table 3).

Table 4A shows the effect of primary treatment and stage on survival probability via a multivariable Cox proportional hazards model; however it shows the proportional hazards assumption for a multivariable model using primary treatment and stage as independent variables. Due to this issue, the model was instead stratified by treatment as shown in Table 4B. Table 4B shows the effect of stage on survival probability, stratified by primary treatment. With this adjustment, the adjusted HR was still the highest in the Stage IVB/IVC group as compared to the Stage 0 group with a HR of 21.51 (95% CI: 7.29–63.52) and *p*-value of <0.001.

Table 5 shows the number of patients in each AJCC stage and the modality of treatments they received. For Stage 0 the most common modality of treatment was surgery (50%; 17/34), RT only for Stage I (72.6%; 119/164), RT only for Stage II (74.3%; 75/101), CRT for Stage III (33.3%; 21/63), RT only for Stage IV (72.5%; 29/40), surgery & adjuvant RT for Stage IVA (27.3%; 30/110), and RT only for Stage IVB/IVC (50%; 4/8).

Table 6 shows a multivariable survival model of insurance type when controlling for socioeconomic variables. There was a significant difference in median survival and HRs between the insurance groups overall. The uninsured group had the lowest median survival time of 29.8 months (95% CI: 20.3–44.8) and the highest HR of 1.85 (95% CI 1.16–2.93) as compared to the HMO group at $p < 0.001$. This is reflected in the Kaplan-Meier survival curve as well (Fig. 1). There was also a significant increased risk in death with every 1-year increase in age (HR: 1.06 (95% CI: 1.05–1.08), p < 0.001), being female (HR: 1.34 (95% CI: 1.01–1.76), $p = 0.041$) and with higher stage with Stage IVB/IVC being the highest HR: 28.56 (95% CI: 12.81–63.7), *p*-value of <0.001 (Table 6). The SES markers of education, poverty status, housing status, race and median household income did not significantly affect the risk of death.

Table 1B
Breakdown of AJCC stage by insurance group (counts).

AJCC	Insurance group					
	HMO	FFS	Medicaid	HFMG	Uninsured	Total
0	12	32	4	18	9	75
I, IA, IB	43	101	4	35	12	195
II	17	65	3	15	12	112
III	8	45	4	12	11	80
IV	5	22	0	1	22	50
IVA	18	69	18	14	5	124
IVB/IVC	2	7	2	2	1	14
Total	105	341	35	97	72	650

Table 2
Median survival time by AJCC stage.

AJCC	Median survival time (months)	95% CI
0	N/A[a]	111.7, N/A
I, IA, IB	120.6	102.1, 150.9
II	91.3	64.4, 114.7
III	69.0	35.2, 87.6
IV	40.3	18.6, 58.8
IVA	29.3	17.8, 52.2
IVB/IVC	4.8	1.5, 11.0

[a] Survival probability in this cohort never surpassed 50% so the median survival time and upper limit of the confidence interval are undefined.

Table 3
Insurance group by primary treatment.

Primary Tx	Insurance Group					
	HMO	FFS	Medicaid	HFMG	Uninsured	Total
Surgery only	16	49	11	16	2	94
RT only	50	137	5	39	35	266
Chemo RT	7	36	3	10	6	62
Surgery & adjuvant RT	13	34	5	6	4	62
Surgery & adjuvant chemo RT	1	14	6	2	1	24
Salvage surgery	0	2	2	2	0	6
Chemo only	1	4	0	1	0	6
Total	88	276	32	76	48	520

Table 4A
Effect of primary treatment and stage on survival probability, multivariable model.

Variable	Response	Adj HR	95% CI	P-value
Primary tx	Chemo RT	(ref)		0.170
	Chemo only	1.50	0.51, 4.38	
	RT only	1.06	0.68, 1.66	
	Salvage surgery	2.11	0.81, 5.49	
	Surgery & adjuvant RT	0.90	0.55, 1.46	
	Surgery & adjuvant chemo RT	0.66	0.31, 1.41	
	Surgery only	0.69	0.42, 1.15	
AJCC stage	0	(ref)		<0.001
	I, IA, IB	1.56	0.75, 3.28	
	II	2.15	1.01, 4.56	
	III	3.05	1.37, 6.77	
	IV	4.10	1.86, 9.04	
	IVA	4.44	2.02, 9.74	
	IVB/IVC	24.03	8.45, 68.31	

Table 4B
Effect of stage on survival probability, stratified by primary treatment.

Variable	Response	Adj HR	95% CI	P-value
AJCC stage	0	(ref)		<0.001
	I, IA, IB	1.53	0.73, 3.22	
	II	2.11	0.99, 4.49	
	III	3.16	1.41, 7.05	
	IV	3.92	1.78, 8.64	
	IVA	4.44	2.02, 9.77	
	IVB/IVC	21.51	7.29, 63.51	

4. Discussion

Previous research has demonstrated that Medicaid or uninsured patients with head and neck cancer present at more advanced stage and have worse survival than their counterparts with private insurance [3]. This has been confirmed across many other types of cancers [4,6–10,12,13]. The results of the current study further support these findings and highlight that laryngeal cancer is no exception. Adding to

Table 5
Primary treatment vs stage.

Primary Tx	AJCC Stage							
	0	I, IA, IB	II	III	IV	IVA	IVB/ IVC	Total
Surgery only	17	26	11	14	2	23	1	94
RT only	15	119	75	18	29	6	4	266
Chemo RT	0	0	8	21	6	26	1	62
Surgery & adjuvant RT	2	16	6	5	3	30	0	62
Surgery & adjuvant chemo RT	0	0	0	2	0	21	1	24
Salvage surgery	0	1	0	3	0	2	0	6
Chemo only	0	2	1	0	0	2	1	6
Total	34	164	101	63	40	110	8	520

the current literature, this study demonstrates that patients with managed care insurance presented at earlier stage compared to the other insurance types. Early symptoms of laryngeal cancer often include hoarse voice, odynophagia and dysphagia; there is speculation that patients with Medicaid or those who are uninsured fear the financial demands of pursuing medical treatment when these symptoms present [4]. These Medicaid/uninsured patients also lack easy access to primary care for early detection and appropriate referral [4]. With the aim to better understand the association between insurance status and cancer care outcomes, the current study demonstrates that managed care insurance is associated with improved overall survival. Furthermore, this study reveals that, outside of comparison with Medicaid or uninsured patients, there were no significant differences between Medicare and other managed care insurance products.

The current study further demonstrates that even after controlling for geocoded patient socioeconomic markers, insurance status continues to be associated with overall survival. The higher overall survival seen in the FFS group may be attributed to the younger mean age of this population. The early presentation seen in patients with managed care

insurance is likely due to access to and coordination of care, which is integral to the managed care model. Even within patients presenting at an advanced stage, the patients with FFS or HFMG insurance had the highest median survival and 5-year survival probability among the insurance groups studied. Of note, when stratified by stage of presentation, the overall survival for Stage I and Stage IV was not statistically different when comparing the FFS and HFMG groups to the Medicare group. This may be due to the fact that Stage I laryngeal cancer has high intrinsic cure rates, and thus, high overall survival; hence, differences between the FFS, HFMG and Medicare groups may not be statistically significant. Based on the current study, the same cannot be said for the Medicaid/uninsured population. For advanced stage disease, Stage IV, the overall cure rate is lowest, and thus, survival would be expected to be the lowest as well. There are some studies demonstrating longer cancer survival in patients with Medicare compared to those who were
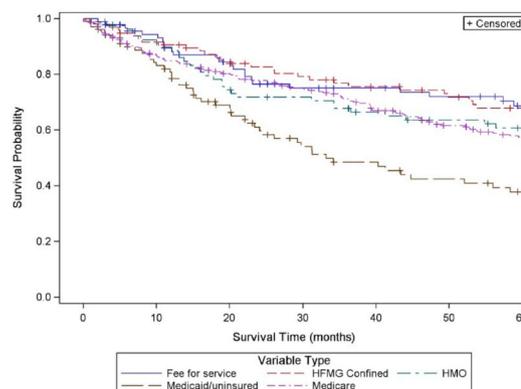
Overall log-rank p-value for equality over strata is statistically significant at <0.001. Abbreviations: HFMG, Henry Ford Medical Group.

Fig. 1. Overall log-rank p-value for equality over strata is statistically significant at <0.001. Abbreviations: HFMG, Henry Ford Medical Group.

Table 6
Multivariable survival model of insurance type when controlling for socioeconomic variables.

Variable	Response	Deaths (N)	Median survival time (months), 95% CI	HR	95% CI	P-value
Insurance group	HMO	52	116.1 (84.3, 167.1)	(ref)		<**0.001**
	FFS	197	81.8 (66.4, 93.1)	0.78	0.55, 1.11	
	HFMG	46	133.9 (97.0, 178.2)	0.57	0.37, 0.88	
	Medicaid	12	135.1 (28.1, N/A)	0.88	0.43, 1.80	
	Uninsured	46	29.8 (20.3, 44.8)	1.85	1.16, 2.93	
Median household income	$2499 - $23,385	76	44.1 (34.2, 62.4)	1.28	0.74, 2.20	0.885
	$23,438 - $35,170	70	80.9 (45.8, 100.7)	1.15	0.72, 1.83	
	$35,250 - $47,574	71	97.5 (66.6, 120.4)	1.19	0.78, 1.81	
	$47,833 - $62,898	68	84.3 (56.0, 124.7)	1.04	0.70, 1.54	
	$62,969 - $187,639	50	133.9 (107.5, 211.2)	(ref)		
Housing	Own	237	100.4 (86.2, 111.7)	(ref)		0.498
	Rent	88	42.5 (30.9, 63.3)	0.91	0.68, 1.21	
Houses in poverty (%)	Every 1% increase			1.61	0.52, 4.98	0.411
Education	<High school	31	46.3 (20.3, 80.7)	1.05	0.66, 1.68	0.711
	High school	140	77.5 (52.7, 90.4)	1.03	0.80, 1.34	
	Bachelor	14	107.5 (31.2, N/A)	1.14	0.64, 2.03	
	Post grad	1	N/A (72.4, N/A)	0.25	0.04, 1.85	
	Some college	145	100.4 (86.3, 120.6)	(ref)		
Age	Every 1-year increase			1.06	1.05, 1.08	<**0.001**
Sex	Male	76	93.1 (80.4, 106.2)	(ref)		**0.041**
	Female	277	64.4 (43.5, 97.5)	1.34	1.01, 1.76	
Race	White	204	97.5 (81.8, 111.3)	(ref)		0.183
	Black	146	66.6 (48.3, 88.0)	0.79	0.59, 1.05	
	Other	1	N/A (15.1, N/A)	0.33	0.04, 2.44	
AJCC stage	0	21	N/A (111.7, N/A)	(ref)		<**0.001**
	I, IA, IB	95	120.6 (102.1, 150.9)	1.56	0.94, 2.59	
	II	65	91.3 (64.4, 114.7)	2.35	1.38, 3.98	
	III	49	69.0 (35.2, 87.6)	3.11	1.78, 5.46	
	IV	41	40.3 (18.6, 58.8)	3.63	2.03, 6.49	
	IVA	69	29.3 (17.8, 52.2)	5.16	3.00, 8.86	
	IVB/IVC	13	4.8 (1.5, 11.0)	28.56	12.81, 63.7	

uninsured [7]. Ellis et al. demonstrated that for certain types of cancers there was no difference in survival between private insurance, Medicaid, and Medicare, specifically for prostate and lung cancer patients; however, for other types of cancers, such as breast, colorectal and melanoma, survival in the private insurance group was much better than Medicaid, Medicare and the uninsured [7]. The associations between cancer-specific survival and insurance status may be explained by cancer-specific biology and the cancer care pathway currently recommended for each type of cancer. This may apply to laryngeal cancer as well; the common symptoms of laryngeal cancer likely prompt patients to seek evaluation by their primary care provider, if they have access, and thus are more likely to receive timely referral to an otolaryngologist for diagnosis. It is interesting that HFMG patients had an older mean age and lower median income, yet they were comparable in survival with the younger FFS patients. The improved survival seen in patients with private insurance may also be secondary to their financial advantage as demonstrated in the analysis of SES markers and survival [4,6–10,12,13].

Whether managed care/HMOs provide better coordination of care compared to private insurances, such as the FFS model, is a point of contention [14]. Managed care in the setting of oncological care has been an area of intense debate and is highlighted in an editorial in 2000 published in the Journal of Clinical Oncology [14]. The editorial stated that managed care, although providing excellent preventative care, falters in providing long-term cancer care and care to the elderly with multiple comorbidities. This is somewhat intuitive as preventative care is geared towards younger patients. This piece also highlighted that the poor and the elderly have worse outcomes in cancer care under managed care compared to FFS care [14]. There was also a call for improvement in coordination for patients with cancer under managed care since many patients with cancer experience delays in proper referral to cancer specialists and access to quality clinical trials. Other research has highlighted the strength of managed care in the ambulatory setting and in preventative care [15,16]. Ayanian et al. did distinguish that although HMOs collectively had a poor performance record even compared to traditional Medicare in the early 2000s, HMOs have since caught up to and even surpassed Medicare on several quality metrics. However, this has only been noted for care in the ambulatory setting. In some ambulatory settings, HMOs provide equal if not better quality of care than the FFS model [16]. It is important to note that not all HMOs are made the same [15]. Larger, more established HMOs have demonstrated robust improvements over time, but smaller and newer ones appear to struggle [15]. Although there is no direct reference to cancer care for the latter two studies, these studies suggest that HMOs have demonstrated improvement in coordination of care over time, and certain factors make some HMOs more reliable in providing better care than others. This is also reflected in the current study where the HFMG cancer patients demonstrated comparable survival despite the older mean age compared to the FFS group. These results may reflect the improving trend in coordination of cancer care under HMOs/managed care.

HPV status has significant influence on overall survival and disease progression in patients with oropharyngeal squamous cell carcinoma [17]. This finding however is not supported in patients with laryngeal squamous cell carcinoma, as disease-specific survival is most impacted by nicotine exposure and tumor staging in laryngeal cancer [21]. Fakhry et al. describes a large institutional study including 140 laryngeal cancer specimens, of which 7 cases (5%) were found to be HPV-positive with no prognostic difference when compared to patients with HPV-negative laryngeal cancer [19]. In this study, HPV testing was not done on the majority of laryngeal cancer specimens in our patient cohort because of the unproven prognostic significance, so this study does not include a sub-analysis between HPV status, insurance status, and overall survival [18–20]. However, the role of HPV status, though strong in oropharyngeal cancers, should be further studied in patients with laryngeal cancer in addition to investigating interactions between insurance and SES with subsequent studies.

The limitations of the current study include the inherent variability within each insurance type and lack of individualized data regarding SES with respect to patient-specific socioeconomic variables. Not all policies within an insurance type offer the same coverage, copays, or deductible, thus access to care can vary widely within any one insurance type. We used census-block level data as proxy for individual level markers of SES. Thus, the SES markers presented in this paper are population level variables for the patient census block, not individual variables. This points to a need for additional research examining individual patient-level socioeconomic variables and the systematic gathering of this data in an electronic medical record. Additional inquiry could also be made with respect to other individual factors that have been shown to influence survival, such as social support, marital status, comorbidity, and health behaviors (i.e., tobacco and alcohol use). These factors, along with insurance type, may prompt patients experiencing symptoms of possible laryngeal cancer to seek treatment earlier rather than later, as well as influencing adherence to treatment and surveillance, and thus, affecting survival probabilities.

5. Conclusion

Contemporary head and neck cancer care is multidisciplinary and requires a significant amount of coordination to provide quality treatment. This study explores the outcome in overall survival with respect to the type of insurance. It also examines the influence of SES for each insurance type and overall survival. The type of insurance or lack of insurance is significantly associated with stage at presentation and survival/treatment outcomes. In this study, HMO and HFMG demonstrated improved overall survival compared to a Medicaid or uninsured group. The FFS group had a higher median survival overall; however, despite differences in mean age and income, HFMG had a similar survival median. These findings may reflect the closing gap in disparities between HMOs and FFS, although further research is needed to explore this topic. This study also lends information for patients and consumers regarding the changing mandate on health insurance. With the introduction and subsequent changes with the Affordable Care Act and resultant insurance marketplaces, different insurance plans are being purchased with decision falling on the individual to determine the type of insurance. Future research should explore different treatment times of patients diagnosed with laryngeal cancer, how it differs with respect to insurance type and how this can influence overall survival. Additional psychosocial variables affecting cancer care and coordination should also be examined, such as social support, individual SES, and education.

CRediT authorship contribution statement

Jeewanjot S. Grewal: Conceptualization, Methodology, Writing-Original Draft Preparation, Editing.
Richard H. Law: Conceptualization, Methodology, Data Curation, Writing-Original Draft Preparation, Editing.
Amy M. Williams: Conceptualization, Methodology, Data Curation, Formal Analysis, Writing-Reviewing and Editing.
Anna G. Wertz: Conceptualization, Methodology, Data Curation, Writing-Original Draft Preparation, Editing.
Steven S. Chang: Conceptualization, Methodology, Supervision, Writing-Reviewing and Editing.

References

[1] Surveillance, Epidemiology and End Results Program, National Cancer Institute. Cancer stat facts: laryngeal cancer. http://seer.cancer.gov/statfacts/html/laryn.html; 2018. August 10, 2018.

[2] Young VN, Mangus BD, Bumpous JM. Salvage laryngectomy for failed conservative treatment of laryngeal cancer. Laryngoscope 2008;118:1561–8.

[3] Chen AY, Schrag NM, Halpern M, Stewart A, Ward EM. Health insurance and stage at diagnosis of laryngeal cancer: does insurance type predict stage at diagnosis? Arch Otolaryngol Head Neck Surg 2007;133:784–90.

[4] Kwok J, Langevin SM, Argiris A, Grandis JR, Gooding WE, Taioli E. The impact of health insurance status on the survival of patients with head and neck cancer. Cancer 2010;116:476–85.

[5] Mehta V, Shi Z, Mills GM, Nathan CA, Shi R. Effect of payer status on relative survival of patients with laryngeal cancer. Anticancer Res 2016;36:327–33.

[6] Cheraghlou S, Kuo P, Mehra S, Yarbrough WG, Judson BL. Untreated oral cavity cancer: long-term survival and factors associated with treatment refusal. Laryngoscope 2018;128:664–9.

[7] Ellis L, Canchola AJ, Spiegel D, Ladabaum U, Haile R, Gomez SL. Trends in cancer survival by health insurance status in California from 1997 to 2014. JAMA Oncol 2018;4:317–23.

[8] Hsu CD, Wang X, Habif Jr DV, Ma CX, Johnson KJ. Breast cancer stage variation and survival in association with insurance status and sociodemographic factors in US women 18 to 64 years old. Cancer 2017;123:3125–31.

[9] Koenig JL, Tsai CJ, Sborov K, Horst KC, Pollom EL. Impact of insurance coverage on outcomes in primary breast sarcoma. Sarcoma 2018;2018(4626):174.

[10] Perry AM, Brunner AM, Zou T, et al. Association between insurance status at diagnosis and overall survival in chronic myeloid leukemia: a population-based study. Cancer 2017;123:2561–9.

[11] Rubin SJ, Kirke DN, Ezzat WH, Truong MT, Salama AR, Jalisi S. Marital status as a predictor of survival in patients with human papilloma virus-positive oropharyngeal cancer. Am J Otolaryngol 2017;38:654–9.

[12] Sineshaw HM, Ng K, Flanders WD, Brawley OW, Jemal A. Factors that contribute to differences in survival of black vs white patients with colorectal cancer. Gastroenterology. 2018;154:906–15. e907.

[13] Tantraworasin A, Taioli E, Liu B, Flores RM, Kaufman AJ. The influence of insurance type on stage at presentation, treatment, and survival between Asian American and non-Hispanic White lung cancer patients. Cancer Med 2018;7: 1612–29.

[14] Bailes J. Managed care and oncology: the quality debate. J Clin Oncol 2000;18: 705–7.

[15] Ayanian JZ, Landon BE, Zaslavsky AM, Saunders RC, Pawlson LG, Newhouse JP. Medicare beneficiaries more likely to receive appropriate ambulatory services in HMOs than in traditional medicare. Health Aff (Millwood) 2013;32:1228–35.

[16] Udvarhelyi IS, Jennison K, Phillips RS, Epstein AM. Comparison of the quality of ambulatory care for fee-for-service and prepaid patients. Ann Intern Med 1991; 115:394–400.

[17] Rettig EM, Zaidi M, Faraji F, et al. Oropharyngeal cancer is no longer a disease of younger patients and the prognostic advantage of human papillomavirus is attenuated among older patients: analysis of the National Cancer Database. Oral Oncol 2018;83:147–53. https://doi.org/10.1016/j.oraloncology.2018.06.013.

[18] Huang CG, Lee LA, Fang TJ, et al. Human papillomavirus infection is not associated with laryngeal squamous cell carcinoma in Taiwan. J Microbiol Immunol Infect 2020;53(1):79–86. https://doi.org/10.1016/j.jmii.2018.02.002.

[19] Fakhry C, Westra WH, Wang SJ, et al. The prognostic role of sex, race, and human papillomavirus in oropharyngeal and nonoropharyngeal head and neck squamous cell cancer. Cancer 2017;123(9):1566–75. https://doi.org/10.1002/cncr.30353.

[20] Young RJ, Urban D, Angel C, et al. Frequency and prognostic significance of p16 (INK4A) protein overexpression and transcriptionally active human papillomavirus infection in laryngeal squamous cell carcinoma. Br J Cancer 2015;112(6): 1098–104. Published 2015 Mar 17, https://doi.org/10.1038/bjc.2015.59.

[21] Dahm V, Haitel A, Kaider A, Stanisz I, Beer A, Lill C. Cancer stage and pack-years, but not p16 or HPV, are relevant for survival in hypopharyngeal and laryngeal squamous cell carcinomas. Eur Arch Otorhinolaryngol 2018;275(7):1837–43. https://doi.org/10.1007/s00405-018-4997-1.