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Life expectancy and expected years of life lost to oral cancer in Taiwan: A nation-wide analysis of 22,024 cases followed for 10 years

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SUMMARY

Objectives: This analysis examined the life expectancies (LE) and expected years of life lost (EYLL) in relation to oral cancer in Taiwan.
Materials and methods: A semi-parametric extrapolation method was applied to estimate gender, age, histology, subsite, and stage stratified LE, EYLL of 22,024 pathologically verified oral cancer patients retrospectively recruited from the National Cancer Registry of Taiwan during 2002–2009, who were followed up to 2011.
Results: The patients were predominantly male 20,101, (91.3%), and over 80% were less than 65 years old. The mean age at diagnosis of males was younger than that of females (52.73 years vs. 60.76 years). The LE after diagnosis was longer among females than males (15.26 years vs. 12.73 years), with a smaller loss of the corresponding EYLL (8.88 years vs. 14.05 years), which prevails after stratification by age and stage. More than half of the oral cancer cases were diagnosed at a later stage, with 2921 cases (13.3%) of stage III and 8488 (38.5%) of stage IV. The five-year overall survival rate of oral cancer for stages I, II, III, and IV were 78.98%, 69.38%, 54.62%, and 36.17%, respectively. The earlier the diagnosis, the longer the life expectancy and the smaller the EYLL.
Conclusions: We concluded that early detection and early intervention of oral cancer can prolong life expectancy and reduce the years of life lost, indicating the importance of proactive screening and oral hygiene.

Introduction

Head and neck cancer is the sixth most common cancer worldwide, accounting for an estimated 4% of all cancers, with about 40% of such cases being oral cancer [1,2]. Oral cancer is much more common in males than females, and is the leading cause of death from cancer in men between the ages of 25 and 44 in Taiwan [3].

The prognosis of oral cancer depends on its specific site, but is moderately good in the early stage. The overall five-year survival rate for oral cancer patients is 55–60%. This low survival rate is probably due to diagnosis at late stage, field cancerization, second primary tumors, a high incidence of locoregional recurrence and distant metastasis, for which the five-year survival rate is <28% [4,5]. Therefore, early detection of potentially malignant disorders by oral mucosa screening among high risk groups who engage in cigarette smoking, alcohol drinking and betel quid chewing may improve the outcomes of oral cancer [6].

There are several methods to estimate the impact of premature mortality, with the person-years of life lost being one of the most widely used, and this is the summation of the difference between the expected age of death and actual age at death over the population of interest [7,8]. However, it would be more accurate to estimate how many years a patient's life expectancy would be cut short by some diseases beginning at the date of diagnosis [9,10]. Hwang et al. [11] developed a novel semi-parametric method to extrapolate the survival function beyond the end of follow-up,

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Table 1
The life expectancy (LE) and expected years of life lost (EYLL) of oral cancer, stratified by genders, ages and stages.

		No. of cases	Mean age at diagnosis (SD)	Mean LE (SE)	EYLL (SE)
Total cases		22,024	53.43 (12.09)	12.7 (0.03)	13.85 (0.04)
	F:M	1923:20,101	60.76 (14.93):52.73 (11.54)	15.26 (0.09):12.73 (0.03)	8.88 (0.1):14.05 (0.04)
Age (years)					
0–49		8921	42.26 (5.37)	15.87 (0.03)	19.58 (0.04)
	F:M	438:8483	40.68 (7.61):42.35 (5.21)	27.76 (0.18):15.7 (0.04)	13.81 (0.18):19.41 (0.05)
	Stage I	2348	41.94 (5.62)	26.82 (0.07)	9.05 (0.06)
	Stage II	1801	42.12 (5.47)	19.38 (0.06)	16.07 (0.07)
	Stage III	1325	42.1 (5.21)	18.78 (0.11)	16.66 (0.11)
	Stage IV	3447	42.62 (5.18)	10.29 (0.07)	24.7 (0.07)
	Stage IVc[b]	96	43.15 (4.91)	3.57 (0.15)	31.14 (0.15)
50–64		8986	55.83 (4.13)	12.8 (0.05)	11.36 (0.05)
	F:M	664:8322	56.62 (4.31):55.76 (4.11)	18.54 (0.17):12.38 (0.05)	8.41 (0.18):11.5 (0.05)
	Stage I	2521	55.85 (4.08)	18.22 (0.09)	5.96 (0.09)
	Stage II	1865	55.92 (4.19)	16.42 (0.1)	7.63 (0.1)
	Stage III	1112	55.91 (4.21)	13.62 (0.12)	10.42 (0.13)
	Stage IV	3488	55.74 (4.11)	7.92 (0.07)	16.2 (0.07)
	Stage IVc[b]	103	56.27 (4.38)	2.82 (0.13)	20.88 (0.13)
≧65		4117	72.41 (6.21)	7.3 (0.08)	5.33 (0.08)
	F:M	821:3296	74.82 (7.02):71.81 (5.84)	7.18 (0.19):7.38 (0.06)	5.49 (0.19):5.22 (0.07)
	Stage I	1100	72.06 (5.92)	10.72 (0.11)	2.14 (0.1)
	Stage II	980	72.45 (6.36)	7.97 (0.14)	4.66 (0.14)
	Stage III	484	72.25 (6.2)	7.26 (0.18)	5.44 (0.19)
	Stage IV	1553	72.69 (6.32)	4.53 (0.12)	7.89 (0.12)
	Stage IVc[b]	74	73.49 (6.2)	2.47 (0.19)	9.41 (0.2)
Stage					
I		5969	53.37 (12.01)	20.5 (0.05)[a]	6.2 (0.04)[a]
	F:M	663:5306	58.15 (14.75):52.77 (11.49)	22.51 (0.14):20.31 (0.04)	3.78 (0.14):6.37 (0.04)
II		4646	54.06 (12.46)	14.84 (0.07)	11.21 (0.06)[a]
	F:M	380:4266	62.67 (14.94):53.29 (11.92)	15.55 (0.23):14.1 (0.06)	7.06 (0.22):12.24 (0.07)
III		2921	52.35 (11.98)	14.63 (0.08)	12.71 (0.09)[a]
	F:M	239:2682	60.49 (14.52):51.63 (11.45)	8.24 (0.32):15.39 (0.08)	16.06 (0.31):12.23 (0.08)
IV		8488	53.51 (11.95)	8.38 (0.04)[a]	18.02 (0.05)[a]
	F:M	641:7847	62.43 (14.89):52.78 (11.37)	9.68 (0.2):8.41 (0.05)	13.12 (0.2):18.33 (0.05)

[a] *P* value < 0.001 between stage I *vs.* stage II, stage II *vs.* stage III, stage III *vs.* stage IV, and stage I + II *vs.* stage III + IV of mean LE and EYLL.
[b] The numbers of stage IV includes those of stage IVc.

which has improved the ability to estimate the mean life expectancy (LE) and the expected years of life lost (EYLL) for a cohort since the date of diagnosis. The general idea of this approach is to use information from an age- and sex-matched reference population, whose lifetime survival function can be derived from life tables. If the disease generally causes premature mortality, it can be assumed that the disease-associated excess hazard would become stabilized before the end of follow-up, and this can then be used for extrapolation after the end of follow-up. The aim of this study was thus to estimate the LE and EYLL for patients with oral cancer in Taiwan based on linkages among nation-wide databases and the application of this novel method.

Materials and methods

The study protocol was approved by the Institutional Human Experiment and Ethics Committee of National Cheng Kung University Hospital (B-ER-I 02-034).

Oral cancer cohort and the reference population

Following the third edition of the International Classification of Diseases for Oncology (ICD-O-3), we included oral cavity cancers coded as C00.0-C06.9 and excluded oropharyngeal cancers coded as C01.9 (base of tongue, NOS), C02.4 (lingual tonsil), C05.1 (soft palate, NOS), and C05.2 (uvula). Nonepithelial tumors, such as those of lymphoid tissue, soft tissue, bone and cartilage, were also excluded. The histology types were classified into squamous cell carcinoma (coded as 8070-8084) and non-squamous cell carcinoma (coded as 8010-8050 and 8090-8941). Oral cavity subsites were divided into tongue (C02 and C04), buccal (C06.0 and C06.1), palate (C05.0 and C05.9) and others, while age groups were stratified into 0–49, 50–64, and ≧65 years old to be comparable with our previous study [12] for estimations of LE and EYLL. In total, we included 22,024 pathologically verified oral cancer patients registered in the National Cancer Registry of Taiwan from 2002 to 2009. The gender, age at diagnosis, histology, oral cavity subsite and stage were obtained from the database. All data were first linked with the National Mortality Registry to determine if a patient was still alive by the end of 2011. The patients were then linked to the National Health Insurance's reimbursement database to obtain the treatment modalities. All patients were classified by pathological staging based on the American Joint Committee on Cancer staging system. If the pathological staging was absent, the clinical staging was used. Since all pathologically validated oral cancers can be registered as a catastrophic illness, and all co-payments are waived, the patients generally underwent comprehensive examinations using computed tomography (CT), magnetic resonance imaging (MRI), bone scan, and/or positron emission tomography (PET) for staging and further management. The data used in this work is thus comprehensive and accurate.

Estimation of long-term survival for oral cancer: extrapolation beyond follow-up limit

The survival functions of patients with different ages, genders, histologies, oral cavity subsites and stages of oral cancer were estimated using the Kaplan–Meier method up to the end of follow-up