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Trends of oral cavity, oropharyngeal and laryngeal cancer incidence in Scotland (1975–2012) – A socioeconomic perspective

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ABSTRACT

Aim: To examine current incidence trends (1975–2012) of oral cavity (OCC), oropharyngeal (OPC) and laryngeal cancer in Scotland by socioeconomic status (SES).
Methods: We included all diagnosed cases of OCC (C00.3-C00.9, C02-C06 excluding C2.4), OPC (C01, C2.4, C09-C10, C14) and laryngeal cancer (C32) on the Scottish Cancer Registry (1975–2012) and annual mid-term population estimates by age, sex, geographic region and SES indices (Carstairs 1991 and Scottish Index of Multiple Deprivation 2009). Age-standardized incidence rates were computed and adjusted Poisson regression rate-ratios (RR) compared subsites by age, sex, region, SES and year of diagnosis.
Results: We found 28,217 individuals (19,755 males and 8462 females) diagnosed with head and neck cancer (HNC) over the study period. Between 1975 and 2012, relative to the least deprived areas, those living in the most deprived areas exhibited the highest RR (>double) of OCC, OPC and laryngeal cancer, and an almost dose-like response was observed between SES and HNC incidence. Between 2001 and 2012, this socioeconomic inequality tended to increase over time for OPC and laryngeal cancer but remained relatively unchanged for OCC. Incidence rates increased markedly for OPC, decreased for laryngeal cancer and remained stable for OCC, particularly in the last decade. Males exhibited significantly higher RRs compared to females, and the peak age of incidence of OPC was slightly lower than the other subsites.
Conclusion: Contrary to reports that OPC exhibits an inverse socioeconomic profile, Scotland country-level data show that those from the most deprived areas consistently have the highest rates of head and neck cancers.

Introduction

Cancers of the oral cavity and oropharynx are amongst the most common cancers worldwide, with approximately 442,760 incident cases and 241,418 deaths reported in 2012 [1]. Collectively, these head and neck cancers are the seventh most common in terms of incidence and the ninth most common cause of death in the world [2].

Global incidence rates of oropharyngeal cancer (OPC) are rising, particularly in economically developed countries such as Canada, United States, Japan, Switzerland, Australia, England and parts of Eastern Europe [3–7]. Rates of oral cavity cancer (OCC) are also rising among men and women in some European countries, stabilising in certain Asian countries and decreasing in Canada and USA [4,8].

Tobacco and alcohol consumption are the dominant risk factors for OCC [9], and are also a part of the aetiology for OPC along with human papillomavirus (HPV) infections [10]. Hashibe and Sturgis have suggested that this changing profile of head and neck cancer incidence can be explained by "controlling a tobacco epidemic while a human papillomavirus epidemic emerges" [11]. Moreover, the clinical perspective, recorded in a US case-series, is that the sociodemographic profile of head and neck cancer patients is also changing, with increasing numbers of patients, particularly with OPC diagnosis, having a younger, more socioeconomically affluent profile [12].

The most recent detailed analysis of incidence trends of oral cancer in Scotland examined rates between 1990 and 1999, and found that Scotland had the highest rates of oral cancer in the UK and also exhibited the greatest lifetime risk of developing oral cancer [13]. Overall, rates increased in both males and females between 1990 and 1999. However, this study combined both

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OCC and OPC into a single oral cancer definition in the trends analysis, reflecting the thinking at the time that these sites had a common aetiology.

The aim of this study was to examine the incidence burden and trends of OCC, OPC and laryngeal cancer in Scotland between 1975 and 2012 by key sociodemographic determinants available in the Scottish Cancer Registry: age, sex, area-based socioeconomic deprivation indices, geographic region and year of diagnosis. Additionally, we aimed to compute future projected rates up to 2025 by the same determinants.

Methods

We collated data on all diagnosed cases of OPC, OCC and laryngeal cancer registered at the Scottish Cancer Registry between 1975 and 2012. Subsites were defined using three-digit ICD-10 codes and were anatomically classified into: oropharynx OPC (base of tongue C01, lingual tonsil C2.4, tonsil C09, oropharynx C10, pharynx C14); oral cavity OCC (inner lip C00.3-C00.9, other and unspecified parts of tongue C02, gum C03, floor of mouth C04, palate C05, other and unspecified parts of mouth C06); and larynx (C32). Additionally, all head and neck cancer (HNC) grouping included all of these subsites along with outer lip (C00.0-C00.2), salivary glands (C07, C08), nasopharynx (C11), piriform sinus (C12), hypopharynx (C13), and other and ill-defined sites of the lip, oral cavity and pharynx (C14). Age was grouped into five-year categories for the purpose of analysis. Based on NHS health board boundaries, the geographic regions were grouped into North (Grampian, Highland, Islands), East (Borders, Fife, Forth Valley, Lothian, Tayside), and West (Ayrshire and Arran, Dumfries & Galloway, Greater Glasgow & Clyde, Lanarkshire). Socioeconomic status was primarily measured using the area-based Carstairs Deprivation index grouped into deciles [14]. This index is measured at the postcode sector level and takes four population census variables into account: male unemployment, households with no car, overcrowded households and the percentage of people in social classes IV and V. We also collated annual mid-year population estimates by age, sex, deprivation indices and geographic regions. Additional analysis was performed on cases diagnosed between 2000 and 2012 in order to utilize the more recently developed small area-based socioeconomic index, the Scottish Index of Multiple Deprivation (SIMD 2009) [15]. This index is calculated taking seven domains of deprivation into consideration: income, employment, education, housing, health, crime and geographical access. It is measured at the data zone (neighbourhood) level (n = x of pop), which is a smaller population than the Carstairs postcode sector (n = x pop) [15].

Statistical analysis

Age-standardized incidence rates and projected rates up to 2025 were calculated for all subsites by age, sex, deprivation, region, and year of diagnosis. Direct standardization was carried out using the European Standard population, to account for changes in the age composition of the population [16]. Adjusted Poisson regression rate-ratios were used to compare the subsites by age, sex, socioeconomic deprivation, geographical region and year of diagnosis. All statistical analyses were performed using SAS V9.3.

Results

Our study comprised of 28,217 individuals, of which 19,755 (70.2%) were males and 8462 (29.9%) were females. The mean age was 63.8 years (standard deviation: ±12.3 years). The age-standardized incidence rates of cancer per 100,000 individuals and the fully adjusted Poisson regression rate-ratios (RR) by sociodemographic characteristics are presented in Tables 1 and 2, respectively.

Peak incidence of OPC was observed in the 61–65 age-group, while that of OCC and laryngeal cancer were in the 71–75 age-group (Table 1). In the model, the 41–45 age-group was chosen as the reference category as the incidence rates in younger groups were very small, suggesting that this was a disease that primarily affected the older population. Regression analysis showed that the rates of OPC were more than double in the 61–65 age-group (RR 2.34, 95% CI 2.08–2.63) compared to the reference category (41–45 age-group), and this was statistically significant (Table 2). The highest rate-ratios for OCC (RR 3.54, 95% CI 3.20–3.91) and laryngeal cancer (RR 4.74, 95% CI 4.30–5.23) were observed in the 76–80 and 71–75 age-groups, respectively, relative to the reference group (Table 2).

Males were found to exhibit higher incidence rates than females in all subsites (Table 1). The rates in males were more than three times that of females (RR 3.10, 95% CI 2.90–3.30) for OPC, more than double for OCC (RR 2.11, 95% CI 2.02–2.20), and 4.77 times for laryngeal cancer (RR 4.77, 95% CI 4.54–5.01) (Table 2).

No major differences in incidence burden were observed between the different geographic regions, with rate-ratios of the North, East and West health board regions being similar irrespective of subsite.

The rate-ratios of OPC (RR 2.49, 95% CI 2.18–2.86) and OCC (RR 2.40, 95% CI 2.18–2.65) in the most deprived (Carstairs 1) areas were significantly higher than those in the least deprived (Carstairs 10) areas across all subsites. Moreover, a dose-like effect was observed, with rates of cancer increasing with increasing deprivation (Table 2). This socioeconomic inequality persisted in the analysis of cases diagnosed between 2001 and 2012 using SIMD (Table 3). Moreover, the socioeconomic gap widened in OPC (RR 3.33, 95% CI 2.72–4.07) and laryngeal cancer (RR 4.98; 95% CI 4.15–5.97), but remained relatively unchanged for OCC (RR 2.69; 95% CI 2.31–3.13) over the past decade (Fig. 2).

Incidence rates of OPC increased by 245% between 1975 and 2012 (RR 3.45, 95% CI 2.66–4.48), while rates of OCC showed a smaller increase of 86% over the same period (RR 1.86, 95% CI 1.53–2.26). Both of these increases were statistically significant (Fig. 1). Rates of laryngeal cancer increased by only 12%, but this was not statistically significant (RR 1.12, 95% CI 0.92–1.35). Between 2001 and 2012, incidence rates of OPC increased by 85% (RR 1.85, 95% CI 1.53–2.25), rates of OCC remained relatively stable (RR 1.10, 95% CI 0.94–1.28), and rates of laryngeal cancer decreased by 23% (RR 0.77, 95% CI 0.65–0.90).

Incidence projections up to 2025 show an expected continuation with increases in the rates of HNC, and this appears to be largely driven by a rapid increase in the rates of OPC. Moreover, OPC is expected to overtake the rates of OCC, which continue to remain relatively stable. Rates of laryngeal cancer were expected to decrease over the projection period (Fig. 3).

Discussion

By 2012, the incidence rates of OPC had overtaken those of laryngeal cancer and were nearly on par with OCC incidence. Moreover, by 2025 the projected incidence rates of OPC are expected to continue to rise rapidly and bypass rates of OCC which are expected to continue to remain relatively stable. Rates of laryngeal cancer are expected to decrease over the same time period. The peak age of incidence of OPC was slightly younger (5–10 years) than for the other subsites, and rates were consistently higher in males compared to females irrespective of subsite (see Tables 2 & 3).