Extended abstract

The association between individual and area-level socioeconomic status and mortality from cancer of the head and neck, Belgium 2001-2011

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Introduction

Head and neck cancer (HNC) is a cancer type consisting of several cancer subtypes with different etiologies and risk factors. The main risk factors are tobacco and alcohol consumption and human papillomavirus (HPV) infection, although unhealthy diet, high body mass index, poor oral and dental health and certain occupational exposures are associated with an increased HNC risk as well [1,2]. Previous studies in Belgium have observed substantial regional differences in incidence and premature mortality from HNC. High levels of premature mortality and incidence from HNC were observed in the south of Belgium, while premature mortality and incidence were relatively low in the north [3–5]. These studies name regional deprivation as a factor for the excess risk in these areas; yet, the role of deprivation has not been studied so far. Several studies have observed higher HNC incidence and mortality rates among low-SES individuals [6–8]. Ecological studies have associated area deprivation with higher incidence and lower survival of HNC as well [9,10]. Only a handful of studies were conducted on both individual and area-level SES combined, with varying outcomes. Low-SES individuals were found to have elevated incidence rates when they were living in deprived areas [11–13], although others found no area-effects independent from individual characteristics [14,15]. Yet, the association between area deprivation and HNC remains understudied, especially within a European context. The aim of this study is *(i)* to assess the association between HNC mortality and both individual and area-level SES, *(ii)* to estimate interaction between the individual and area-level SES variables, and *(iii)* to study to what extent individual and area-level SES contribute to geographic differences in HNC mortality in Belgium.

Data and methods

This study uses data from the 2001 census, which is linked to data from the Belgian population register on cause-specific mortality and emigration covering the period 2001-2011. The study population consists of men aged 40-64 years. HNC mortality is defined according to the International Classification of Disease 10 (ICD-10) codes C01-C06; C09-C10; C12-C14; C32. To study potential differences in etiological groups, a further subdivision is made into subtypes strongly related to HPV, and subtypes mainly related to tobacco and alcohol consumption. HPV-subtypes include cancer of the oropharynx and tonsils (ICD-10 C09-C10); non-HPV subtypes including cancer of the oral cavity, pharynx and larynx (ICD-10 C01-C06; C12-C14; C32).

Individual SES is measured using education, employment status, and housing conditions. Deprivation at municipality level is measured by a deprivation index composed of the percentage unemployed men aged 18-64; the percentage of household without a car; and

the percentage inhabitants aged 25-64 who are lower educated, within each municipality. The deprivation index is divided into quintiles, with Q1 being the least deprived and Q5 the most deprived.

The association between HNC mortality and individual and area-level SES is estimated using age standardized mortality rates (ASMR) and multilevel Poisson models. ASMRs are calculated using the Belgian male population in 2001 as standard population. Multilevel Poisson models are used to accommodate the nested data structure (individuals within municipalities). Cross-level interactions are included to study the interaction between individual and area-level SES. Multilevel models allow for estimation of variation in HNC mortality at both the individual and the municipality level. This enables us to study regional variation in HNC mortality and changes to this variation when accounting for individual and area-level SES. The average relative deviation (ARD) is used to express regional variation, and indicates the percentage deviation of HNC mortality rates at municipality-level compared to the total Belgian mortality rate.

Preliminary results

The ASMR for HNC is 20 deaths per 100,000 person years (95% CI 19.4-21.0), of which the majority are non-HPV related subtypes (ASMR=17.7; 95% CI 17.0-18.4), and the minority HPV-related (ASMR = 2.5; 95% CI 2.5-2.8). Figure 1 shows the HNC mortality rate ratios (MRR) and their 95 % confidence intervals by individual SES and area deprivation. HNC mortality for men who are unemployed, nonworking or living in rental housing is substantially higher compared to men who are employed or live in high-quality owner-occupied housing. The largest SES inequalities are observed for employment status. With a MRR of 3.64 (95% CI 3.28-4.04) nonworking men have a HNC mortality risk that is almost four times that of men who are employed. Similar outcomes are observed for both non-HPV and HPV subtypes. After controlling for individual SES, HNC mortality is 1.23 (95%CI 1.04-1.45) and 1.36 (95%CI 1.15-1.62) times higher for men living in the 4^{th} and 5^{th} deprivation quartiles respectively, compared to those living in the least deprived municipalities (Q1).

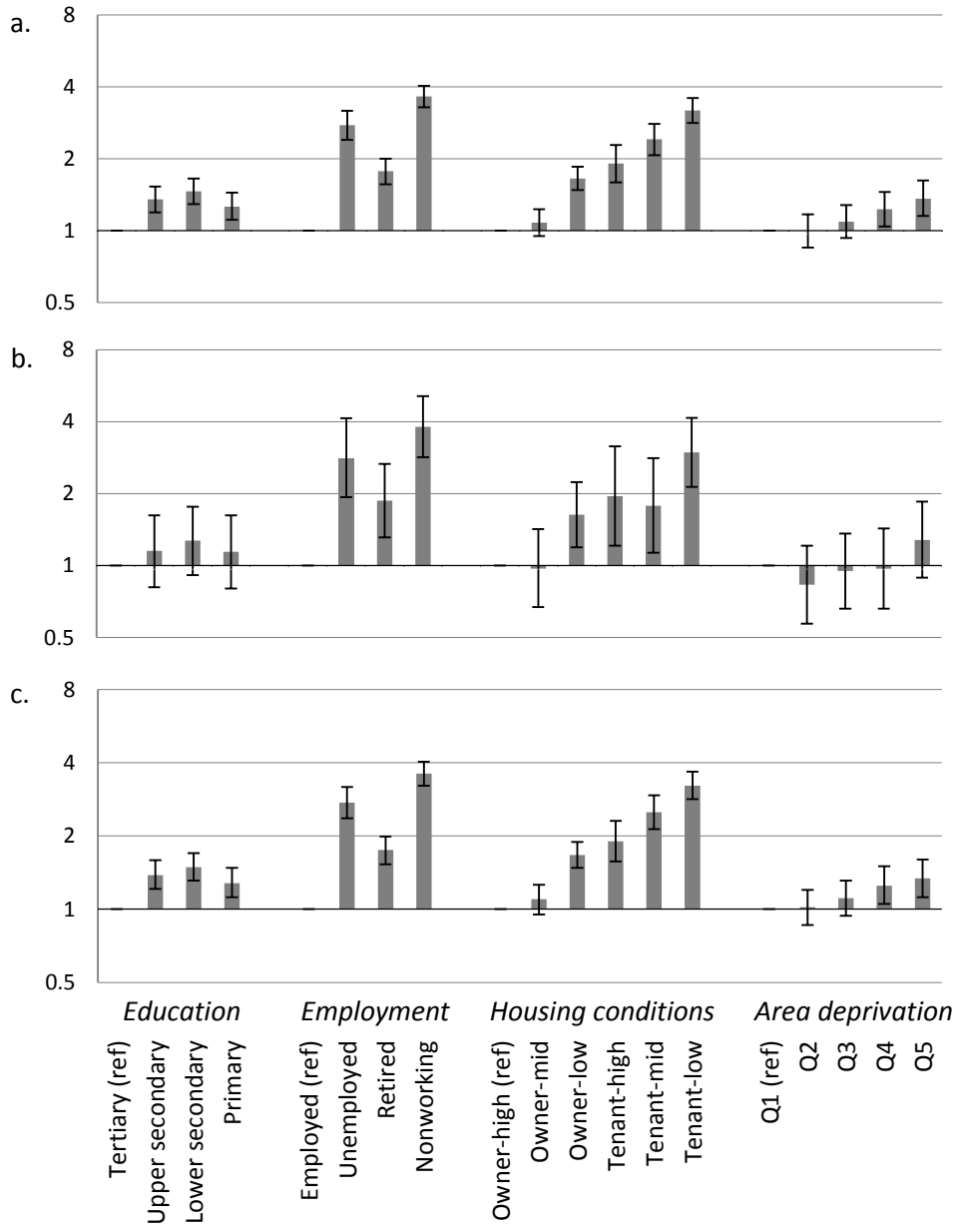
The cross-level interactions show that men with a high or average SES experience significantly higher HNC mortality rates in deprived areas compared to men with a similar SES living in the least deprived areas. However, for men who are primary educated, unemployed, nonworking, or living in rental housing of poor quality, HNC mortality rates are elevated regardless of area-level SES. As a result, HNC mortality differences between men with a low vs. men with a high SES tend to be smaller in the most deprived quartile (Q5).

The regional variation in HNC mortality, expressed by the ARD, indicates that there are significant and substantial spatial differences for total HNC and for both subgroups. The ARD for total HNC is 25.8%, and 25% for non-HPV subtypes. Regional variation for HPV-related subtypes is slightly smaller: 15%. Controlling for individual SES reduces regional variation in HNC mortality to 22%, while additionally controlling for area-level SES or cross-level interaction effects resulted in little additional reductions in regional variation. After controlling for both individual and area-level SES regional variation remains significant.

Conclusion

There has been little research on the association between HNC mortality and both individual and area deprivation. The outcomes from this study indicate that men who are low educated, non-working or unemployed, or living in poor quality rental housing have significantly higher risk of HNC mortality. The outcomes also suggest that men living in deprived municipalities experience significantly higher HNC mortality rates. Cross-level interactions show that especially men with a high or average SES experience elevated mortality rates in deprived areas compared to men living in affluent municipalities. Men with a low SES, on the other hand, have a relatively high HNC mortality risk regardless of area deprivation. Significant variations in HNC mortality are observed between municipalities, which persist after controlling for individual SES and area deprivation. Future studies should investigate other possible factors that might explain geographic disparities in HNC mortality, including regional differences in risk behavior such as smoking and tobacco use.

Figure 1. Mortality Rate Ratios and 95% Confidence Intervals by individual and area-level SES for men aged 40-64; a. total head and neck cancer; b. HPV-related subtypes; c. other subtypes.



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