SOCIOECONOMIC INEQUALITIES IN CANCER INCIDENCE, SURVIVAL, AND MORTALITY IN BELGIUM

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1. INTRODUCTION

A great deal of research has been done investigating the association between socioeconomic position and various causes of morbidity and mortality. Since the mid-1990s much of this work has been empirically testing the Fundamental Cause of Disease Theory (FCT) put forth by Bruce Link and Jo Phelan which argues that, "socioeconomic status is a 'fundamental cause' of mortality disparities - that socioeconomic disparities endure despite changing mechanisms because socioeconomic status embodies an array of resources, such as money, knowledge, prestige, power, and beneficial social connections, that protect health no matter what mechanisms are relevant at any given time[1]." For nearly all indicators of morbidity and mortality there has been shown to be a consistent negative relationship that supports FCT. However, findings for cancer have been much more heterogeneous, with its social patterning ranging from negative over non-existent, to positive[2-9]. Much of this variation depends upon the site of the cancer and/or the indicator (i.e. incidence, survival, or mortality) used as an outcome.

Cancer mortality is a function of both cancer incidence and survival, implying that the chances of dying from a disease depend on the chances of getting the disease and then on the chances of surviving the disease. There has been quite a bit of confusion and misunderstanding, however concerning the estimation and interpretation of these three indicators in cancer research. As a 2014 article from Ellis et al. explains, "Incidence, survival and mortality are summary measures that provide snapshots of a long-term process that is time-dependent. When we interpret these statistics, it is crucial to account for the dynamic [and interactive] nature of this process[10]." Given that socioeconomic inequalities in cancer mortality are similarly a function of socioeconomic inequalities in both cancer incidence and cancer survival it is important for our understanding of cancer morbidity and mortality to examine these three components at the same time.

Additionally, different types of cancer have different etiologies and therefore the classical patterning of FCT (a negative association between socioeconomic status and morbidity/mortality) may not be evident or operating through the same mechanisms depending upon the site of the cancer. Furthermore, in order to garner accurate survival estimates it's important to have access to data with information on cause of death. Therefore, we hope our study will contribute to a better understanding of the ways socioeconomic status affects cancer by utilizing all three indicators (incidence, survival, and mortality) while also being able to account for competing risks of death.

2. MATERIALS AND METHODS

Data on cancer come from the Belgian Cancer registry, a national population based cancer registry which has been collecting data since 2004. A 2006 Belgian law requires compulsory cancer registration for the oncological care programs and laboratories for pathological anatomy using national Social Security IDs to enable linkages with other medical and/or administrative data. As such the BCR collects data on all new cancer diagnoses at the population level, and is considered to be complete for more than 95% of cases. We have chosen to focus on 12 different sites of cancer that include those types that have the heaviest burden on the Belgian population, have the largest socioeconomic disparities, and/or are the most preventable. These include breast, cervical, colon, head and neck, liver, lung, pancreatic,

rectal, stomach, and thyroid cancers as well as Hodgkin's Lymphoma and malignant melanoma.

This cancer incidence data has been linked to the 2001 Belgian Census which has information on various socioeconomic indicators at the individual and household level. To gain clear insight into SES inequalities in cancer we plan to use different measures of SES to capture the different forms of capital, since they represent different forms of advantage and disadvantage, and additionally are formed during different phases of the life course. These include educational attainment to represent cultural capital, homeownership, housing comfort, household income type, employment status, professional status, and activity sector for economic capital, and marital status and household composition for social capital.

The last data source is the National Mortality Database which was constructed in Belgium at the end of the 1990s and allows us to assign primary cause of death to all deceased individuals in our study, thereby giving us a more accurate picture of net survival in order to calculate cause-specific survival rates in addition to crude ones.

The period of our study covers 2004 - 2013 and contains a little over 7.2 million observations on a little over 7.1 individuals.

There are significant differences between the association of socioeconomic status and cancer incidence, survival, and mortality depending on gender and age. Therefore, analyses were conducted separately for men and women and for different age groups.

Inequalities in cancer mortality and incidence were investigated using direct standardization and log linear Poisson regression models with the SE dimensions as covariates. To assess site-specific cancer survival, cox proportional hazard models were used to calculate both crude (all-cause) and cause-specific survival.

3. PRELIMINARY RESULTS

Thus far we have carried out basic models for each cancer outcome (incidence, survival, and mortality) and all of our socioeconomic indicators separately. These preliminary results suggest a consistent and clear classical patterning of cancer for those sites with the highest rates of incidence and mortality in Belgium, notably colon and lung cancer. The clear exception is breast cancer which, in line with previous research, displays a reverse classical pattern. The mechanism behind this is likely due to the postponement of childbearing if not outright nulliparity, which has been shown to increase the risk for breast cancer incidence[11]. Less common cancers either show no classical patterning or a classical patterning that fails to reach significance, likely due to low samples sizes and thus reduced statistical power.

4. FUTURE STEPS

We have plans for several additional sets of analysis to further our understanding of the associations between socioeconomic status and incidence, survival, and mortality for each of our cancer sites. Firstly we want to run full models including all socioeconomic indicators in an effort to see the ways in which they inform each other, offering a clearer insight into the comprehensive association between SES and our cancer outcomes. Additionally, including cancer-site specific controls, such as *parity* and *age at first birth* for breast cancer models, will help us further draw out potential mechanisms for the socioeconomic gradients we witness.

Additionally, we would like to carry out an analysis that leverages all three indicators simultaneously by "decomposing" the inequalities in site-specific cancer mortality into

inequalities in cancer incidence and cancer survival. In this way we will be able to quantify if, and to what degree, socioeconomic differences in mortality are a function of higher incidence, lower survival, or a combination of both.

5. CONCLUSION

Cancer is a leading cause of death in Belgium accounting for 28,519 deaths or 27% of total mortality in 2013[12]. In 2014, 67,820 people were diagnosed with cancer, i.e. 186 people a day on average[13]. From a European perspective, Belgium has the second highest all-cancer incidence in Europe, following Norway[14]. Therefore, Belgium constitutes an interesting setting to investigate social differences in cancer.

However, due to a lack of data the social patterning of cancer incidence and cancer survival has not been investigated, let alone an analysis of mortality, incidence and survival simultaneously. This paper seeks to fill this gap by "decomposing" SE inequalities in cancer mortality into its two components. It aims at investigating SE differences in site-specific cancer incidence and survival in relation to site-specific mortality patterns in Belgium during the 2000-2010s. By mapping social inequalities in cancer mortality, incidence and survival simultaneously, this project will allow the identification of cancer sites with the largest inequalities that thus require particular attention. Discrepancies between inequalities in incidence and inequalities in survival will indicate those cancer sites leaving substantial room for policy interventions. Considering these dimensions at once will provide clues of intermediating mechanisms or possible causes of cancer inequalities.

ACKNOWLEDGEMENT

This research is supported by a grant from Research Foundation Flanders (FWO - Fonds voor Wetenschappelijk Onderzoek).

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